CUBE HIGHWAYS TRUST

(Settled in the Republic of India as an irrevocable trust by way of a trust deed dated December 7, 2021 (as amended and restated on July 8, 2022) under the Indian Trusts Act, 1882, and registered as an infrastructure investment trust under the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, on April 5, 2022 having registration number IN/InvIT/22-23/0022)

Principal place of business: B-376, UGF, Nirman Vihar, New Delhi 110 092, India
Tel: +91 01204 868300; **Fax**: N.A.; **Compliance Officer**: Mridul Gupta
E-mail: compliance.officer@cubehighways.com; **Website**: www.cubehighwaystrust.com

Sponsor 1 **Cube Highways and Infrastructure Pte. Ltd.**	**Sponsor 2** **Cube Highways and Infrastructure III Pte. Ltd.**	**Investment Manager** **Cube Highways Fund Advisors Private Limited**	**Trustee** **Axis Trustee Services Limited**

Initial offer by Cube Highways Trust (the "**Trust**") of 522,582,727 Ordinary Units through a private placement at a price of ₹ 100 per Ordinary Unit (the "**Offer Price**"), aggregating to ₹ 52,258.27 million (the "**Offer**").* The Offer comprises a fresh issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million by the Trust (the "**Fresh Issue**") and an offer for sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million by the Selling Unitholders comprising of: (i) 59,690,223 Ordinary Units aggregating to ₹ 5,969.02 million by CH-I; (ii) 16,526,666 Ordinary Units aggregating to ₹ 1,652.67 million by CH-II; and (iii) 66,106,666 Ordinary Units aggregating to ₹ 6,610.67 million by CH-III (the "**Offer for Sale**"). The Offer Price is ₹ 100 per Ordinary Unit.

**Subject to Allotment of Ordinary Units by the board of directors of the Investment Manager*

THIS OFFER IS BEING MADE ONLY TO THE ELIGIBLE INVESTORS IN RELIANCE UPON REGULATION 14(2) OF THE SECURITIES AND EXCHANGE BOARD OF INDIA (INFRASTRUCTURE INVESTMENT TRUSTS) REGULATIONS, 2014

The Ordinary Units are proposed to be listed on BSE Limited (the "**BSE**") and National Stock Exchange of India Limited (the "**NSE**") (BSE and NSE, collectively referred to as "**Stock Exchanges**"). The Trust has received in-principle approvals from BSE and NSE for listing of the Ordinary Units pursuant to the letters dated August 3, 2022 and September 2, 2022. The validity of the in-principle approval from BSE has been extended by way of letters dated December 1, 2022 and March 10, 2023. The validity of the in-principle approval from NSE has been extended by way of letters dated November 3, 2022 and February 2, 2023. BSE is the Designated Stock Exchange. Applications shall be made to the Stock Exchanges for obtaining the final listing and trading approval for the Ordinary Units to be Allotted pursuant to the Offer. The Trust has also issued Subordinate Units which shall not be listed, except if mandated under applicable law or if required to be by any regulatory or statutory authority. The Stock Exchanges assume no responsibility for the correctness of any statements made, opinions expressed or reports contained herein. Admission of the Ordinary Units to be Allotted pursuant to the Offer for trading on the Stock Exchanges should not be taken as an indication of the merits of the Trust or of the Ordinary Units.

This being an initial offer by the Trust, there has been no formal market for the Units. The Offer Price (determined and justified by the Investment Manager in consultation with the Placement Agents), should not be taken to be indicative of the market price of the Units after the Ordinary Units are listed. No assurance can be given regarding an active or sustained market for trading in the Ordinary Units or regarding the price at which the Ordinary Units will be traded after listing. The Offer is meant only for Eligible Investors on a private placement basis and is not an offer to the public or to any other class of investors to purchase the Ordinary Units.

A copy of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum has been filed with the Securities and Exchange Board of India ("**SEBI**") and delivered to the Stock Exchanges. This Final Placement Memorandum has not been, and will not be, registered as a prospectus, will not be circulated or distributed to the public at large in India or any other jurisdiction, and will not constitute a public offer in India or any other jurisdiction. This Final Placement Memorandum is not an offer to sell any Units and is not soliciting an offer to subscribe or buy the Units in any jurisdiction where such offer or sale is not permitted.

The Investment Manager, having made all reasonable inquiries confirms that this Final Placement Memorandum contains all information with regard to the Trust, the Units and the Offer, which is material in the context of the Offer, that the information contained in this Final Placement Memorandum is true, correct and adequate in all material aspects and is not misleading in any material respect, that the opinions and intentions expressed herein are honestly held and have been reached after considering all relevant circumstances and are based on reasonable assumptions and information presently available with the Investment Manager and that there are no other facts, the omission of which makes this Final Placement Memorandum as a whole or any of such information or the expression of any such opinions or intentions misleading in any material respect.

The Units have not been and will not be registered under the United States Securities Act of 1933, as amended (the "**Securities Act**") and may not be offered or sold within the United States except pursuant to an exemption from, or in a transaction not subject to, the registration requirements of the Securities Act and applicable U.S. state securities laws. Accordingly, the Units are only being offered and sold outside the United States in "offshore transactions" as defined in, and in reliance on, Regulation S under the Securities Act ("**Regulation S**") and the applicable law of the jurisdictions where such offers and sales occur. The Units are transferable only in accordance with the restrictions described under the section titled "*Selling and Transfer Restrictions*" on page 309 of this Final Placement Memorandum.

THIS FINAL PLACEMENT MEMORANDUM IS PERSONAL TO EACH BIDDER. THIS FINAL PLACEMENT MEMORANDUM HAS BEEN PREPARED BY THE TRUST SOLELY FOR PROVIDING INFORMATION IN CONNECTION WITH THE OFFER. YOU MAY NOT, AND ARE NOT AUTHORIZED TO, (1) DELIVER THIS FINAL PLACEMENT MEMORANDUM TO ANY OTHER PERSON; OR (2) REPRODUCE THIS FINAL PLACEMENT MEMORANDUM IN ANY MANNER WHATSOEVER. ANY DISTRIBUTION OR REPRODUCTION OF THIS FINAL PLACEMENT MEMORANDUM, IN WHOLE OR IN PART, IS UNAUTHORIZED. FAILURE TO COMPLY WITH THIS INSTRUCTION MAY RESULT IN A VIOLATION OF THE SECURITIES AND EXCHANGE BOARD OF INDIA (INFRASTRUCTURE INVESTMENT TRUSTS) REGULATIONS, 2014 OR OTHER APPLICABLE LAWS OF INDIA AND OF OTHER JURISDICTIONS.

INVESTMENTS IN THE ORDINARY UNITS INVOLVE RISKS AND PROSPECTIVE INVESTORS SHOULD NOT INVEST ANY FUNDS IN THE OFFER UNLESS THEY CAN AFFORD TO TAKE THE RISK OF LOSING THEIR ENTIRE INVESTMENT. FOR MAKING AN INVESTMENT DECISION, INVESTORS MUST RELY ON THEIR OWN EXAMINATION OF THE TRUST, THE UNITS, THE OFFER, THE PLACEMENT MEMORANDUM AND THIS FINAL PLACEMENT MEMORANDUM, INCLUDING THE RISKS INVOLVED. INVESTORS ARE ADVISED TO CAREFULLY READ THE PLACEMENT MEMORANDUM AND THIS FINAL PLACEMENT MEMORANDUM, INCLUDING THE SECTIONS ENTITLED "RISK FACTORS" AND "RIGHTS OF UNITHOLDERS" ON PAGES 63 AND 317, RESPECTIVELY, BEFORE MAKING AN INVESTMENT DECISION. INVESTORS SHOULD NOT RELY ON THE DRAFT PLACEMENT MEMORANDUM FOR ANY DECISION TO INVEST IN THE OFFER.

THE ORDINARY UNITS HAVE NOT BEEN RECOMMENDED BY SEBI NOR DOES SEBI GUARANTEE ACCURACY OR ADEQUACY OF THE CONTENTS OF THIS FINAL PLACEMENT MEMORANDUM. EACH ELIGIBLE INVESTOR IS ADVISED TO CONSULT ITS OWN ADVISORS, ABOUT THE CONSEQUENCES OF AN INVESTMENT IN THE ORDINARY UNITS BEING OFFERED PURSUANT TO THE PLACEMENT MEMORANDUM AND THIS FINAL PLACEMENT MEMORANDUM.

Unless a serially numbered Placement Memorandum along with an Application Form was addressed to a particular Eligible Investor, no invitation to offer shall be deemed to have been made to such Eligible Investor to make an offer to subscribe to the Ordinary Units on private placement basis pursuant to the Offer. For further details, please see the section entitled "*Offer Information*" on page 322. The distribution of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum or the disclosure of its contents without the Trustee's or Investment Manager's prior consent, to any person, other than to the addressees, shall be unauthorized and prohibited. Each addressee, by accepting delivery of this Final Placement Memorandum, shall agree to observe the foregoing restrictions and to make no copies of this Final Placement Memorandum or any documents referred to in this Final Placement Memorandum.

The information on the websites of the Sponsors, the Investment Manager, the Project Manager, the Trust or the Placement Agents, as applicable, any website directly or indirectly linked to such websites, or the website of the Trustee, does not form part of this Final Placement Memorandum and prospective investors should not rely on such information contained in, or available through, any such websites.

PLACEMENT AGENTS		**REGISTRAR AND UNIT TRANSFER AGENT**
Citigroup Global Markets India Private Limited 1202, 12th Floor First International Financial Centre G Block, Bandra Kurla Complex Bandra – East Mumbai 400 098 Tel: +91 22 6175 9999 E-mail: cubehighways.invit@citi.com Investor grievance E-mail: investors.cgmib@citi.com Website: www.online.citibank.co.in/rhtm/citigroupglobalscreen1.htm Contact Person: Abhishek Mawandiya SEBI Registration No.: INM000010718	**J. P. Morgan India Private Limited** J.P. Morgan Tower Off C.S.T. Road, Kalina Santacruz (East) Mumbai 400 098 Maharashtra, India Tel: +91 22 6157 3000 E-mail: cubehighways_invit@jpmorgan.com Investor grievance E-mail: investorsmb.jpmipl@jpmorgan.com Website: www.jpmipl.com Contact Person: Aanchal Mittal SEBI Registration No.: INM000002970	**KFin Technologies Limited** Selenium, Tower B Plot No- 31 and 32, Financial District Nanakramguda, Serilingampally Hyderabad, Rangareddi 500 032 Telangana, India Tel.: +91 40 6716 2222 Toll free number: 1800 309 4001 E-mail: cube.invit@kfintech.com Investor Grievance E-mail: einward.ris@kfintech.com Website: www.kfintech.com Contact Person: M Murali Krishna SEBI Registration No.: INR000000221 CIN: U72400TG2017PLC117649

This Final Placement Memorandum is dated April 17, 2023

TABLE OF CONTENTS

NOTICE TO INVESTORS **1**
DEFINITIONS AND ABBREVIATIONS **6**
PRESENTATION OF FINANCIAL DATA AND OTHER INFORMATION **14**
FORWARD-LOOKING STATEMENTS **18**
THE OFFER **20**
OVERVIEW OF THE TRUST **22**
FORMATION TRANSACTIONS IN RELATION TO THE TRUST **25**
SUMMARY OF COMBINED FINANCIAL STATEMENTS **33**
SUMMARY FINANCIAL INFORMATION OF THE SPONSORS **39**
SUMMARY FINANCIAL INFORMATION OF THE INVESTMENT MANAGER **46**
SUMMARY OF INDUSTRY **50**
SUMMARY OF BUSINESS **56**
RISK FACTORS **63**
GENERAL INFORMATION **102**
PARTIES TO THE TRUST **107**
OTHER PARTIES INVOLVED IN THE TRUST **139**
CORPORATE GOVERNANCE **144**
INDUSTRY OVERVIEW **158**
BUSINESS **172**
SUMMARY OF KEY AGREEMENTS **216**
INFORMATION CONCERNING THE UNITS **226**
USE OF PROCEEDS **229**
FINANCIAL INDEBTEDNESS AND DEFERRED PAYMENTS **232**
DISTRIBUTION **243**
DISCUSSION AND ANALYSIS BY THE DIRECTORS OF THE INVESTMENT MANAGER OF THE FINANCIAL CONDITION, RESULTS OF OPERATIONS AND CASH FLOWS OF THE INITIAL PORTFOLIO ASSETS OF THE TRUST **246**
RELATED PARTY TRANSACTIONS **275**
REGULATIONS AND POLICIES **285**
REGULATORY APPROVALS **294**
LEGAL AND OTHER INFORMATION **301**
SECURITIES MARKET OF INDIA **307**
SELLING AND TRANSFER RESTRICTIONS **309**
RIGHTS OF UNITHOLDERS **317**
DILUTION **320**
OFFER STRUCTURE **321**
OFFER INFORMATION **322**
STATEMENT OF TAX BENEFITS **331**
LEGAL MATTERS **343**
INDEPENDENT ACCOUNTANTS **344**
AUDITED SPECIAL PURPOSE COMBINED FINANCIAL STATEMENTS **345**
PROJECTIONS OF REVENUE FROM OPERATIONS AND CASH FLOW FROM OPERATING ACTIVITIES **347**
MATERIAL CONTRACTS AND DOCUMENTS FOR INSPECTION **475**
DECLARATION **479**
ANNEXURE A
ANNEXURE B
ANNEXURE C

NOTICE TO INVESTORS

The statements contained in this Final Placement Memorandum relating to the Trust and the Units are, in all material respects, true and accurate and not misleading, to enable the investors to make an informed decision. The opinions and intentions expressed in this Final Placement Memorandum with regard to the Trust and the Ordinary Units are honestly held, have been reached after considering all relevant circumstances and are based on reasonable assumptions and information presently available with the Investment Manager, the Sponsors or both, as applicable. There are no other facts in relation to the Trust and the Ordinary Units, the omission of which would, in the context of the Offer, make any statement in this Final Placement Memorandum misleading in any material respect. Further, each of the Investment Manager and the Sponsors has made all reasonable enquiries to ascertain such facts and to verify the accuracy of all such information and statements disclosed in this Final Placement Memorandum.

The Placement Agents have not separately verified any information (financial, legal or otherwise) contained in this Final Placement Memorandum. Accordingly, the Placement Agents or any of its shareholders, employees, counsel, officers, directors, representatives, agents, associates or affiliates make any express or implied representation, warranty or undertaking, and accept no responsibility or liability as to the accuracy or completeness of the information contained in this Final Placement Memorandum or any other information supplied in connection with the Offer or the distribution of the Ordinary Units, other than in relation to themselves. Each Eligible Investor receiving this Final Placement Memorandum acknowledges that such person has neither relied on the Placement Agents nor any of their shareholders, employees, counsel, officers, directors, representatives, agents, associates or affiliates in connection with their investigation of the accuracy of such information or such person's investment decision. Each Eligible Investor must rely on its own examination of the Trust and the merits and risks involved in investing in the Ordinary Units. Eligible Investors should not construe the contents of this Final Placement Memorandum as legal, tax, accounting or investment advice. Each Eligible Investor acknowledges that in making an investment decision, such investor has relied solely on the information contained in the Placement Memorandum and this Final Placement Memorandum and not on any other disclosure or representation by the Investment Manager, the Project Manager, the Trustee, the Sponsors, the Placement Agents or any other party. Nothing contained herein is, or may be relied upon as, a promise or representation as to the future performance of the Trust.

No person is authorized to give any information or to make any representation not contained in this Final Placement Memorandum and any information or representation not so contained must not be relied upon as having been authorized by or on behalf of the Trust or by, or on behalf, of the Sponsors, the Investment Manager or the Placement Agents. The delivery of this Final Placement Memorandum, at any time, does not imply that the information contained in it is correct as of any time subsequent to its date. This Final Placement Memorandum shall not be relied upon by, and the Investment Manager, the Trustee, the Sponsors, the Project Manager and/or the Placement Agents shall not be liable to, any subsequent acquirer, transferee or investor of the Ordinary Units.

This Final Placement Memorandum is personal to each Bidder.

The distribution of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum or the disclosure of its contents to any person, other than the Eligible Investors to whom it is addressed and those retained by such Eligible Investors to enable them to make a decision with respect to their purchase of the Ordinary Units, is unauthorized and prohibited. Each Eligible Investor, by accepting delivery of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum, agrees to observe the foregoing restrictions and make no copies of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum or any other material in connection with the Offer or the Ordinary Units.

Certain U.S. Matters

The Ordinary Units to be offered pursuant to the Offer have not been approved, disapproved or recommended by any regulatory authority in any jurisdiction, including the United States Securities and Exchange Commission ("**SEC**"), any other federal or state authorities in the United States, the securities authorities of any non-United States jurisdiction or any other United States or non-United States regulatory authority. No authority has passed on or endorsed the merits of the Offer or the accuracy or adequacy of this Final Placement Memorandum. Any representation to the contrary is a criminal offence in the United States and may be a criminal offence in other jurisdictions.

The Units have not been and will not be registered under the Securities Act and may not be offered or sold within the United States except pursuant to an exemption from, or in a transaction not subject to, the registration requirements of the Securities Act and applicable state securities laws. Accordingly, the Units are only being offered and sold outside the United States in "offshore transactions" as defined in, and in reliance on, Regulation S and the applicable laws of the jurisdictions where those offers and sales occur. The Units are transferable only in accordance with the restrictions described under the section "*Selling and Transfer Restrictions*" on page 309 of this Final Placement Memorandum.

Each purchaser of the Ordinary Units offered by this Final Placement Memorandum will be deemed to have made the representations, agreements and acknowledgments as described in this section entitled "*Notice to Investors - Representations by Eligible Investors"* on page 2 and in the section entitled "*Selling and Transfer Restrictions*" on page 309.

Notice to Investors in certain other jurisdictions

The distribution of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum and the offer of the Ordinary Units in certain jurisdictions may be restricted by law. As such, the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum do not constitute, and may not be used for, or in connection with, an offer or solicitation by anyone in any jurisdiction in which such offer or solicitation is not authorized or to any person to whom it is unlawful to make such offer or solicitation. In particular, no action has been taken by the Investment Manager or the Placement Agents which would permit an offer of the Ordinary Units or distribution of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum in any jurisdiction, other than India. Accordingly, the Ordinary Units may not be offered or sold, directly or indirectly, and neither the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum nor any Offer materials in connection with the Units be distributed or published in or from any country or jurisdiction that would require registration of the Units in such country or jurisdiction. Please see the section entitled "*Selling and Transfer Restrictions*" on page 309.

THE VALUE OF THE ORDINARY UNITS AND THE INCOME DERIVED FROM THEM MAY FLUCTUATE. THE ORDINARY UNITS ARE NOT OBLIGATIONS OF, DEPOSITS IN, OR GUARANTEED BY THE TRUST, THE TRUSTEE, THE SPONSORS, THE INVESTMENT MANAGER, THE PLACEMENT AGENTS OR ANY OF THEIR RESPECTIVE SHAREHOLDERS, EMPLOYEES, COUNSEL, OFFICERS, DIRECTORS, REPRESENTATIVES, AGENTS, ASSOCIATES OR AFFILIATES. AN INVESTMENT IN THE ORDINARY UNITS IS SUBJECT TO INVESTMENT RISKS, INCLUDING THE POSSIBLE LOSS OF THE PRINCIPAL AMOUNT INVESTED, FURTHER, LISTING OF THE ORDINARY UNITS ON THE STOCK EXCHANGES DOES NOT GUARANTEE A LIQUID MARKET FOR THE ORDINARY UNITS. INVESTORS HAVE NO RIGHT TO REQUEST THE TRUST, THE TRUSTEE, THE SPONSORS OR THE INVESTMENT MANAGER OR ANY OF THEIR RESPECTIVE SHAREHOLDERS, EMPLOYEES, COUNSEL, OFFICERS, DIRECTORS, REPRESENTATIVES, AGENTS, ASSOCIATES OR AFFILIATES TO REDEEM THEIR ORDINARY UNITS WHILE THE ORDINARY UNITS ARE LISTED, UNLESS OTHERWISE PERMITTED BY APPLICABLE LAW. THE PERFORMANCE OF ANY OF THE LISTED ORDINARY UNITS OF THE TRUST IS NOT NECESSARILY INDICATIVE OF THE FUTURE PERFORMANCE OF THE ORDINARY UNITS OF THE TRUST.

Representations by Eligible Investors

References herein to "you" or "your" is to each Eligible Investor in the Offer.

By purchasing, or subscribing to, the Ordinary Units pursuant to the Offer, you are deemed to have represented to the Trustee, the Investment Manager, the Sponsors, the Selling Unitholders and the Placement Agents, and acknowledge and agree as follows:

1. You are an "Institutional Investor" as defined in Regulation 2(1)(ya) of InvIT Regulations or a "Body Corporate" as defined in Regulation 2(1)(d) of InvIT Regulations, and are eligible under applicable laws and regulations of India, and undertake (i) to acquire, hold, manage or dispose of any of the Ordinary Units that are Allotted to you in accordance with InvIT Regulations, other applicable laws and under the laws of all relevant jurisdictions; (ii) that you are entitled to acquire and have all necessary capacity and have obtained all necessary consents, governmental or otherwise and authorisations to enable you to commit to this participation in the Offer and to perform your obligations in relation thereto (including, without limitation, in the case of any person on whose behalf you are acting, all necessary consents and authorisations to agree to the terms set out or referred to in the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum) and will honour such obligations and (iii) to comply with all requirements under applicable laws in relation to filing and reporting obligations, if any, in this relation including making all necessary filings, in relation to the Offer and your investment in the Ordinary Units, with appropriate governmental, statutory or regulatory authorities, including the RBI, as may be required, pursuant to applicable law, rules and regulations in India and in your respective jurisdiction, if applicable;

2. You agree to provide on request in a timely manner, and consent to the use and disclosure of, any information or documentation in relation to yourself and, if and to the extent required, the beneficial ownership of your Ordinary Units (if any), as may be necessary in terms of the applicable law for the Trust (or the Trustee and its agents) and the Investment Manager to comply with any regulatory obligations and/or prevent the withholding of tax or other penalties under FATCA, the CRS or other similar exchange of tax information regimes. You acknowledge and agree that you shall have no claim against the Trust (or the Trustee and its agents) and the Investment Manager for any losses suffered by you (including in relation to the direct or indirect beneficial ownership of your Ordinary Units (if any)) as a result of such use or disclosure of such information or documentation to, any regulatory, governmental or statutory authority.

3. You are aware that the Ordinary Units have not been, and will not be registered through a prospectus under the InvIT Regulations, or under any other law in force in India, and no Ordinary Units will be offered in India or overseas to the public or any members of the public in India or any other class of investors other than Institutional Investors and Bodies Corporate. This Final Placement Memorandum has been filed with the Stock Exchanges and SEBI and would be displayed on the website of the SEBI and the Stock Exchanges;

4. You confirm that if you have participated in or attended any investor meetings or presentations by the Trust or its agents ("**Presentations**") with regard to the Trust, the Units or the Offer, you understand and acknowledge that the Placement Agents or the Trustee may not have knowledge of the statements that the Trust, the Sponsors or their respective agents may have made at such Presentations and are therefore unable to determine whether the information provided to you at such Presentations may have included any material misstatements or omissions, and, accordingly you acknowledge that the Placement Agents, the Trustee (or its agents), the Investment Manager, the Sponsors or the Selling Unitholders have advised you not to rely in any way on any information that was provided to you at such Presentations;

5. None of the Selling Unitholders, Sponsors, the Investment Manager, the Trustee or the Placement Agents or any of their respective shareholders, directors, officers, employees, counsel, representatives, agents or affiliates is making any recommendations to you or advising you regarding the suitability of any transactions it may enter into in connection with the Offer and that participation in the Offer is on the basis that you are not and will not, up to the Allotment, be a client of the Placement Agents. None of the Selling Unitholders, Sponsors, the Trustee, the Investment Manager, the Placement Agents or any of their respective shareholders, employees, counsel, officers, directors, representatives, agents or affiliates have any duties or responsibilities to you for providing the protection afforded to their clients, or for providing advice in relation to the Offer and are in no way acting in a fiduciary capacity towards you;

6. All statements, other than statements of historical fact included in this Final Placement Memorandum, including, without limitation, those regarding the Trust's financial position, business strategy, plans and objectives for future operations, the Investment Objectives, and the Projections of Revenue from Operations and Cash Flow from Operating Activities, are forward-looking statements. Such forward-looking statements involve known and unknown risks, uncertainties and other important factors that could cause actual results to be materially different from the results, performance or achievements expressed or implied by such forward-looking statements. Such forward-looking statements are based on certain assumptions regarding the Trust's present and future business strategies and the environment in which the Trust will operate in the future. You should not place undue reliance on forward-looking statements, which speak only as of the date of this Final Placement Memorandum. The Trust, the Trustee, the Sponsors, the Placement Agents, the Selling Unitholders and the Investment Manager or any of their respective shareholders, directors, officers, employees, counsel, representatives, advisors, agents, associates or affiliates assume no responsibility to update any of the forward-looking statements contained in this Final Placement Memorandum. You are cautioned not to place undue reliance on such forward-looking statements and not to regard such statements to be a guarantee or assurance of our future performance or returns to investors;

7. You have been provided with a serially numbered copy of the Placement Memorandum and have read the Placement Memorandum in its entirety, including, in particular, the section entitled "*Risk Factors*". Further, you have been provided with a serially numbered copy of this Final Placement Memorandum and will be deemed to have read this Final Placement Memorandum in its entirety, including, in particular, the section entitled "*Risk Factors*" on page 63;

8. You are aware and understand that the Ordinary Units are being offered only to Eligible Investors through the Placement Memorandum and this Final Placement Memorandum and are not being offered to the general public and the Allotment shall be on a discretionary basis;

9. You have made, or are deemed to have made, as applicable, the representations provided in the section entitled "*Selling and Transfer Restrictions*" on page 309;

10. You (i) are not acquiring or subscribing for the Units as a result of any "directed selling efforts" (as defined in Regulation S) and (ii) are acquiring or subscribing for the Ordinary Units in an "offshore transaction" as defined in, and in reliance on, Regulation S, and are not an affiliate of the Trust or the Placement Agents or a person acting on behalf of such an affiliate;

11. You understand and agree that the Units are transferable only in accordance with the restrictions described in the section entitled "*Selling and Transfer Restrictions*" on page 309, and you warrant that you will comply with such restrictions;

12. In making your investment decision, you have (i) relied on your own examination of the Trust, the Ordinary Units and the terms of the Offer, including the merits and risks involved, (ii) made and will continue to make your own assessment of the Trust, the Ordinary Units and the terms of the Offer based solely on the information contained in

the Placement Memorandum, (iii) consulted your own independent advisors or otherwise have satisfied yourself concerning, without limitation, the effects of local laws, (iv) relied solely on the information contained in the Placement Memorandum and this Final Placement Memorandum; (v) received all information in the Placement Memorandum and this Final Placement Memorandum that you believe is necessary or appropriate in order to make an investment decision in respect of the Trust and the Ordinary Units, and (vi) relied upon your own investigation in deciding to invest in the Offer;

13. You have such knowledge and experience in financial, business and investment matters as to be capable of evaluating the merits and risks of an investment in the Ordinary Units. You and any accounts for which you are subscribing to the Ordinary Units, (i) are each able to bear the economic risk of the investment in the Ordinary Units; (ii) will not, subject to the terms of the Placement Memorandum and this Final Placement Memorandum, look to any of the Investment Manager, the Trustee, the Sponsors, the Selling Unitholders or the Placement Agents or any of their respective shareholders, employees, counsel, officers, directors, representatives, financial advisors, agents or affiliates for all, or part, of any such loss or losses that may be suffered due to your investment in the Units unless all, or part, of any such loss or losses are on account of the Placement Memorandum and this Final Placement Memorandum being misleading or containing any untrue statements or any misstatements in any material respect such that you are not able to make an informed decision in relation to the Offer; and (iii) are able to sustain a complete loss on the investment in the Units. You acknowledge that an investment in the Ordinary Units involves a high degree of risk and that the Ordinary Units are, therefore, a speculative investment. You are seeking to subscribe to the Ordinary Units in the Offer for your own investment and not with a view to resell or distribute in any manner that could characterise you as an underwriter or similar entity in any jurisdiction;

14. The Trustee, the Sponsors, the Investment Manager, the Placement Agents, the Selling Unitholders or any of their respective shareholders, directors, officers, employees, counsel, representatives, advisors, agents or affiliates have not provided you with any legal, financial or tax advice or otherwise made any representations regarding the tax consequences of the Ordinary Units (including but not limited to the Offer and the use of the proceeds of the Offer), except as provided in third party reports and set out in the Placement Memorandum and this Final Placement Memorandum. You will obtain your own independent legal, financial or tax advice and will not rely on the Investment Manager, the Sponsors, the Trustee, the Placement Agents, the Selling Unitholders or any of their respective shareholders, employees, counsel, officers, directors, representatives, advisors, agents or affiliates when evaluating the tax consequences in relation to the Ordinary Units (including but not limited to the Offer and the use of the proceeds of the Offer). You waive and agree not to assert any claim against the Placement Agents, the Sponsors, the Trustee or the Investment Manager or any of their respective agents or affiliates with respect to the tax aspects of the Ordinary Units or the Offer or as a result of any tax audits by tax authorities, in relation to the Ordinary Units and the Offer, wherever situated, except any claim against the Sponsors, the Selling Unitholders or the Investment Manager resulting from tax audits by the tax authorities, which claim is solely attributable to an act not in compliance with applicable Indian law by the Sponsors, the Selling Unitholders or the Investment Manager, as determined by a non-appealable judgement of a court of competent jurisdiction. Further, it is clarified that the Bidders shall not be liable for any claim or default with respect to any tax, including withholding obligation with respect to consideration payable to the Selling Unitholders in relation to the sale of Ordinary Units forming part of the Offer for Sale and the Selling Unitholders/ Trust will be solely liable for payment of any such tax on the sale of Ordinary Units forming part of the Offer for Sale.

15. You are not the Trustee, or the Valuer or an employee of the Valuer involved in the valuation of the Trust's Initial Portfolio Assets;

16. You are aware that (i) we have received in-principle approval from the Stock Exchanges dated August 3, 2022 and September 2, 2022 from BSE and NSE, respectively. The validity of the in-principle approval from BSE has been extended by way of letters dated December 1, 2022 and March 10, 2023. The validity of the in-principle approval from NSE has been extended by way of letters dated November 3, 2022 and February 2, 2023, and (ii) the application for the final listing and trading approval will be made only after Allotment. There can be no assurance that the final approval for listing and trading of the Ordinary Units will be obtained in a timely manner, or at all. The Trust, the Trustee, the Placement Agents, the Investment Manager, the Sponsors or the Selling Unitholders, shall not be responsible for any delay or non-receipt of such final approval (except to the extent prescribed under the InvIT Regulations) or any loss arising from such delay or non-receipt;

17. You shall not undertake any trade in the Ordinary Units credited to your demat account until such time that the final listing and trading approval for the Ordinary Units have been issued by the Stock Exchanges;

18. The only information you are entitled to rely on, and on which you have relied, in committing yourself to acquire the Ordinary Units is contained in the Placement Memorandum and this Final Placement Memorandum, such information being all that you deem necessary to make an investment decision in respect of the Ordinary Units;

19. You understand that the Ordinary Units to be Allotted in this Offer will, when allotted, be credited as fully paid and will rank *pari passu* in all respect with all other Ordinary Units, including in respect of the right to receive all

distributions declared, made or paid in respect of the Ordinary Units after the Allotment. For details, please see the section entitled "*Distribution*" on page 243. You understand that the Subordinate Units will not rank *pari passu* to the Ordinary Units and will be subject to the terms and conditions set out in the Trust Deed;

20. You agree to indemnify and hold the Trustee, Investment Manager, the Sponsors, the Selling Unitholders and the Placement Agents harmless from any and all actual and direct costs, claims, liabilities and expenses (including legal fee and expenses) arising out of or in connection with any breach of the representations and warranties in this section, unless such breach by you is directly resulting from or in accordance with the Placement Memorandum and this Final Placement Memorandum being misleading or containing any untrue statements or any misstatements in any material respect such that you are not able to make an informed decision in relation to the Offer. Notwithstanding anything contained in this paragraph 20, the liability of each Eligible Investor shall not exceed the respective Bidding Amount of each Eligible Investor;

21. The Trustee, the Investment Manager, the Sponsors, the Placement Agents, the Selling Unitholders, their respective shareholders, employees, counsel, offices, directors, representatives, agents or affiliates, will rely on the truth and accuracy of the foregoing representations, warranties, acknowledgements and undertakings which are given to the Placement Agents on their own behalf and on behalf of the Trust, the Sponsors, the Investment Manager, the Trustee, the Selling Unitholders and the same are irrevocable;

22. You are eligible to invest in India and in the Ordinary Units under applicable law, including the FEMA Rules, and have not been prohibited by SEBI from buying, selling or dealing in securities;

23. You understand that, neither the Placement Agents, the Investment Manager, the Sponsors, the Selling Unitholders nor the Trustee has any obligation to purchase or subscribe to all, or any part, of the Ordinary Units purchased by you in the Offer, or to support any losses directly or indirectly sustained or incurred by you for any reason whatsoever in connection with the Offer. Provided that Unitholders which are sovereign related investors reserve all immunities, defences, rights or actions arising out of its status as sovereign state or entity or otherwise;

24. Any dispute arising in connection with the Offer will be governed by, and construed in accordance with, the laws of the Republic of India and the courts at New Delhi shall have exclusive jurisdiction to settle any disputes which may arise out of or in connection with the Offer;

25. You have made, the representations provided in this section and each of the representations, warranties, acknowledgements and agreements set out above shall continue to be true and accurate at all times, up to and including the Allotment of the Ordinary Units in the Offer; and

26. You are eligible to hold the Ordinary Units, so Allotted. You are aware that your application for Ordinary Units and holding after the Allotment of the Ordinary Units cannot exceed the maximum investment level permissible as per any applicable law and regulations.

Available Information

The Investment Manager agrees to comply with any undertakings given by it from time to time in connection with the Ordinary Units and, without prejudice to the generality of foregoing, shall furnish to the Unitholders all such information as may be required under the InvIT Regulations.

Disclaimer

This Final Placement Memorandum does not, directly or indirectly, relate to any invitation, offer or sale of any securities, instruments or loans (including listed non-convertible debentures, bonds or other debt securities, if any) that may be issued by the Trust after the listing of the Ordinary Units. Any person or entity investing in such issue or transaction by the Trust should consult its own advisors. Neither the Placement Agents, nor their associates or affiliates have any responsibility or liability for such issue or transaction by the Trust.

DEFINITIONS AND ABBREVIATIONS

This Final Placement Memorandum uses the definitions and abbreviations provided below which you should consider when reading the information contained herein.

References to any legislation, act, regulations, rules, guidelines or policies shall be to such legislation, act, regulations, rules, guidelines or policies as amended, supplemented, or re-enacted from time to time and any reference to a statutory provision shall include any subordinate legislation made under that provision.

The words and expressions used in this Final Placement Memorandum, but not defined herein shall have the meaning ascribed to such terms under the InvIT Regulations, the SEBI Act, the SCRA, the Depositories Act, and the rules and regulations made thereunder.

Notwithstanding the foregoing, the terms not defined but used in the sections entitled "Audited Special Purpose Combined Financial Statements", "Projections of Revenue from Operations and Cash Flow from Operating Activities", "Statement of Tax Benefits" and "Legal and Other Information" on pages 345, 461, 331 and 301, respectively, shall have the meanings ascribed to such terms in those respective sections.

In this Final Placement Memorandum, unless the context otherwise requires, a reference to "we", "us" and "our" refers to the Trust and the Initial Portfolio Assets on a consolidated basis. For the sole purpose of the Audited Special Purpose Combined Financial Statements, reference to "we", "us" and "our" refers to the Initial Portfolio Assets on a combined basis.

Trust Related Terms

Term	Description
APEL	Andhra Pradesh Expressway Limited
Associate	Associate shall have the meaning under Regulation 2(1)(b) of the InvIT Regulations
Audited Special Purpose Combined Financial Statements	Audited special purpose combined financial statements of the Trust and the Initial Portfolio Assets, which comprise the combined balance sheets as at October 31, 2022, March 31, 2020, March 31, 2021 and March 31, 2022 and the related combined statements of profit and loss (including other comprehensive income), combined cash flow statements and combined statements of changes in equity for the period ended October 31, 2022 and the financial years ended March 31, 2020, March 31, 2021 and March 31, 2022 and a summary of significant accounting policies and other explanatory information, prepared in accordance with Guidance Note on Reports in Company Prospectuses (Revised 2019), and the Guidance Note on Combined and Carve Out Financial Statements issued by the Institute of Chartered Accountants of India (the "**Guidance Notes**") using the recognition and measurement principles of Indian Accounting Standards as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015 read with Section 133 of the Companies Act, 2013 ("**Ind AS**") and other generally accepted accounting principles and other relevant provisions relating to disclosures required as per the InvIT Regulations
Auditors	S.B. Billimoria & Co. LLP, Chartered Accountants, the statutory auditors of the Trust
BOT/DBFOT SPVs	Initial portfolio assets which hold projects based on build, operate, transfer and design, build, finance, operate, transfer model
Capital Contribution	The total subscription amounts (either by way of cash or share swap or otherwise (including transfer of interest in the InvIT Assets by the Sponsors and any other entities)) received by the Trust from the Unitholders (including the Sponsors), for subscription of Units, in accordance with applicable law and the InvIT Documents
CH-I	Cube Highways and Infrastructure Pte. Ltd.
CH-IB	Cube Infrastructure Investment Company Pte. Ltd.
CH-ID	Cube Highways and Infrastructure I-D Pte. Ltd.
CH-II	Cube Highways and Infrastructure II Pte. Ltd.
CH-III	Cube Highways and Infrastructure III Pte. Ltd.
Claims Management Agreement or CMA	Claims management agreement dated January 2, 2023, as amended and restated on April 1, 2023, entered into between Cube Infrastructure Investment Company Pte. Ltd., Cube Highways and Infrastructure Pte. Ltd., the Investment Manager, the Trustee (acting on behalf of the Trust) and Western UP Tollway Limited
Concession Agreements	Collectively, the concession agreements entered into between the Initial Portfolio Assets and the relevant concessioning authorities. For details, please see the section entitled "*Summary of Key Agreements*" on page 216

Term	Description
Corporate Governance Framework	The corporate governance framework adopted by the Investment Manager in relation to the Trust. For details, please see the section entitled "*Corporate Governance*" on page 144
Cube Group	Collectively, the Sponsors, CH-IB, CH-II, CH-ID and Cube Mobility Investments Pte Ltd.
DATRPL	DA Toll Road Private Limited
Formation Transactions	The formation transactions in relation to the Trust, including the transfer of the Project SPVs to the Trust
FRHL	Farakka - Raiganj Highways Limited
GAEPL	Ghaziabad Aligarh Expressway Private Limited
Holding Company/Holdco	A holding company, as defined under Regulation 2(1)(sa) of the InvIT Regulations
HTL	Hazaribagh Tollway Limited
IM Board	The board of directors of the Investment Manager
Initial Portfolio Assets or Project SPVs or Trust Assets	(i) Andhra Pradesh Expressway Limited, (ii) DA Toll Road Private Limited, (iii) Farakka - Raiganj Highways Limited, (iv) Ghaziabad Aligarh Expressway Private Limited, (v) Hazaribagh Tollway Limited, (vi) Jhansi – Lalitpur Tollway Limited, (vii) Jaipur – Mahua Tollway Limited, (viii) Jhansi – Vigakhet Tollway Limited, (ix) Kanyakumari – Etturavattam Tollway Limited, (x) Kotwa – Muzaffarpur Tollway Limited, (xi) Lucknow – Raebareli Tollway Limited, (xii) Mahua Bharatpur Expressways Limited, (xiii) Madurai – Kanyakumari Tollway Limited, (xiv) Nelamangala Devihalli Expressway Private Limited, (xv) Nanguneri - Kanyakumari Tollway Limited, (xvi) Salaipudhur - Madurai Tollway Limited, (xvii) Western UP Tollway Limited, and (xviii) Walayar Vadakkencherry Expressways Private Limited.
Initial Tranche Subordinate Units	The Subordinate Units issued by the Trust immediately prior to Allotment in the Offer
Investment Committee	The investment committee constituted by the IM Board
Investment Management Agreement	The amended and restated investment management agreement dated December 16, 2022 entered into between the Trustee, the Investment Manager and the Initial Portfolio Assets, as amended.
Investment Manager	Cube Highways Fund Advisors Private Limited
Investment Objectives	The investment objectives of the Trust, as provided under the section entitled "*Overview of the Trust*" on page 22
InvIT Assets	Assets owned by the Trust, whether held directly, or through holding companies or SPVs, and includes all rights, interests and benefits arising from and incidental to ownership of such assets, in accordance with the InvIT Regulations and applicable law
InvIT Documents	The Trust Deed, the Investment Management Agreement, the Project Implementation and Management Agreement, Share Purchase Agreements, policies adopted by the Investment Manager, any other document, letter or agreement entered into by the Investment Manager or Trustee on behalf of the Trust, with respect to the Trust or the Units or executed in connection with the Trust, the offer documents and such other documents in connection therewith, as originally executed and amended, modified, supplemented or restated from time to time, together with the respective annexures, schedules and exhibits, if any
InvIT Loan	The loan proposed to be availed by the Trust after the listing of the Ordinary Units, key terms of which are set out in the section entitled "*Financial Indebtedness and Deferred Payments*" on page 232
InvIT Loan Agreement	The facility agreement entered into by the Trust dated July 30, 2022 in relation to the InvIT Loan, as amended.
JLTL	Jhansi-Lalitpur Tollway Limited
JMTL	Jaipur-Mahua Tollway Limited
JVTL	Jhansi-Vigakhet Tollway Limited
KETL	Kanyakumari-Etturavattam Tollway Limited
KMTL	Kotwa-Muzaffarpur Tollway Limited
LRTL	Lucknow-Raebareli Tollway Limited
MBEL	Mahua Bharatpur Expressways Limited
MKTL	Madurai-Kanyakumari Tollway Limited
NDEPL	Nelamangala Devihalli Expressway Private Limited
NKTL	Nanguneri-Kanyakumari Tollway Limited
Operations Committee	The operations committee constituted by the IM Board
Ordinary Unit Holder or Ordinary Unitholder	Any person who owns any Ordinary Unit of the Trust

Term	Description
Ordinary Units	Units that carry one vote per Unit and full economic benefits and other benefits as prescribed under applicable law, including the right to receive distributions as stipulated under the InvIT Regulations
Original Trust Deed	The trust deed of Cube Highways Trust dated December 7, 2021 entered into between the Settlor, Sponsors and the Trustee
Parties to the Trust	Collectively, the Sponsors, the Trustee, the Investment Manager and the Project Manager
Portfolio Assets	The Initial Portfolio Assets and SPVs and holding companies, as the context may require, which are owned by the Trust from time to time
Project Implementation and Management Agreement	The project implementation and management agreement, dated January 2, 2023 entered into amongst the Trustee, the Project Manager, the Investment Manager and the Initial Portfolio Assets
Project Manager	Cube Highways and Transportation Assets Advisors Private Limited
Projections of Revenue from Operations and Cash Flow from Operating Activities	Statements of projections of revenue from operations and cash flows from operating activities of the Trust and the Initial Portfolio Assets for the years ending March 31, 2024, March 31, 2025 and March 31, 2026 prepared in accordance with accounting principles of Indian Accounting Standards ("**Ind AS**") as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015, as amended prescribed under Section 133 of the Companies Act, 2013 read with InvIT Regulations and the Guidance Note on Combined and Carve- Out Financial Statements issued by the Institute of Chartered Accountants of India. Projected cash flow from operating activities have been calculated using the direct method under Ind AS 7 - Statement of Cash Flows and is computed by deducting the projected operating expenses and income taxes from the projected revenue from operations and adjusted for projected non-cash expenses, if any.
Reimbursement Agreement	The agreement dated September 7, 2022 entered into between the Investment Manager the Sponsors, CH-II, CH-ID and Cube Mobility Investments Pte Ltd. in relation to reimbursement of costs. For details, please see the section entitled "*Related Party Transactions – Reimbursement Agreement*" on page 284
Related Parties	Related parties, as defined under Regulation 2(1)(zv) of the InvIT Regulations.
ROFO Agreement	Right of first offer agreement dated January 2, 2023 between the Trustee (acting on behalf of the Trust), the Investment Manager, CH-I and CH-III
ROFO SPVs or Future Assets	The SPVs proposed to be acquired by the Trust by way of the ROFO Agreement and shall include (i) Borgaon Watambare Highways Private Limited; (ii) Mangalwedha Solapur Highways Private Limited; (iii) Mangloor Highways Private Limited; (iv) KNR Shankarampet Projects Private Limited; (v) KNR Srirangam Infra Private Limited; (vi) KNR Tirumala Infra Private Limited; and (vii) N.A.M. Expressway Limited
Settlor	Cube Highways and Transportation Assets Advisors Private Limited
Share Purchase Agreements or SPAs	Collectively, the share purchase agreements, each dated March 30, 2023, entered amongst the relevant member of the Cube Group, the Trustee (on behalf of the Trust), the Investment Manager, and the relevant Initial Portfolio Assets
Shared Services Agreement or SSA	Shared services agreement, dated September 7, 2022, entered into between the Investment Manager and the Project Manager
SMTL	Salaipudhur-Madurai Tollway Limited
Sponsors	Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd
SPV(s)	Special purpose vehicles, as defined under Regulation 2(l)(zy) of the InvIT Regulations
Subordinate Units	Units issued to the Sponsors or their respective Associates that carry only inferior voting or other rights compared to the Ordinary Units, as set out in the Trust Deed.
TOT SPVs	Initial Portfolio Assets, holding projects based on the toll, operate and transfer model
Trust	Cube Highways Trust
Trust Deed	The amended and restated trust deed of Cube Highways Trust dated July 8, 2022 entered into between the Settlor, Sponsors and the Trustee
Trust Group	Collectively, the Trust, the Project SPVs and the Parties to the Trust
Trust Loan Agreements	Trust loan agreements and ancillary financing documents, amongst the Trustee (acting on behalf of the Trust), the Investment Manager and the Initial Portfolio Assets. For further details, please see the sections entitled "*Financial Indebtedness and Deferred Payments*" and "*Material Contracts and Documents for Inspection*" on pages 232 and 475
Trustee or Axis	Axis Trustee Services Limited
Unit	Collectively, the Ordinary Units and the Subordinate Units representing an undivided beneficial interest in the Trust in accordance with their respective terms specified in the

Term	Description
	Trust Deed, and such Units together represent the entire beneficial interest in the Trust of the respective holders of the Ordinary Units and the Subordinate Units
Unitholder	Any person who owns any Unit of the Trust
Valuation Report	The valuation report dated January 13, 2023 issued by the Valuer, which sets out its opinion as to the fair enterprise value of the Initial Portfolio Assets as on October 31, 2022
Valuer	Ernst & Young Merchant Banking Services LLP
We / us / our	Unless the context otherwise requires or implies, the Trust and the Portfolio Assets
WUPTL	Western UP Tollway Limited
WVEPL	Walayar Vadakkencherry Expressways Private Limited

Offer Related Terms

Term	Description
Allocated/ Allocation	The allocation of the Ordinary Units, to successful Bidders on the basis of the Application Form submitted by them, by the Investment Manager, in consultation with the Placement Agents
Allot/ Allotment/ Allotted	Unless the context otherwise requires, the issue, transfer and allotment, as applicable, of the Ordinary Units to successful Bidders, pursuant to the Offer
Allottees	Bidders to whom Ordinary Units are Allotted pursuant to the Offer
Application Form	The serially numbered form pursuant to which Eligible Investors have submitted a Bid for the Ordinary Units in the Offer
Bid Amount	The amount paid by a Bidder for the number of Ordinary Units Bid for at the Offer Price specified in the Placement Memorandum and this Final Placement Memorandum
Bid Lot	A minimum of such number of Ordinary Units that the Bid Amount is not less than ₹ 260 million, and in multiples of 1 Ordinary Units thereafter
Bid(s)	Indication of interest of an Eligible Investor, as provided in the Application Form, to subscribe for the Ordinary Units at the Offer Price, in terms of the Placement Memorandum and the Application Form
Bid/ Offer Closing Date	April 13, 2023, which is the last date up to which the Application Forms have been accepted
Bid/ Offer Opening Date	April 10, 2023, which is the date on which the Application Forms have been dispatched to Eligible Investors and the date from which Application Forms have been accepted
Bid/ Offer Period	Period between the Bid/ Offer Opening Date and the Bid/ Offer Closing Date, inclusive of both days, during which Eligible Investors could submit their Bids
Bidder	Any Eligible Investor, who made a Bid pursuant to the terms of the Placement Memorandum and the Application Form
Body Corporate / Bodies Corporate	Body Corporate / Bodies corporate as defined in Regulation 2(1)(d) of the InvIT Regulations
Business Day	Any day from Monday to Friday, excluding any public holiday
Cash Escrow Account	'No-lien' and 'non-interest bearing' account opened with the Escrow Collection Bank and in whose favour Bidders should transfer money through direct credit/NEFT/NACH/RTGS in respect of the Bid Amount when submitting a Bid
Cash Escrow Agreement	The cash escrow agreement dated March 29, 2023 entered into amongst the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Investment Manager, the Placement Agents, the Selling Unitholders and the Escrow Collection Bank for, among others, collection of the Bid Amounts and for remitting refunds, if any, of the amounts collected, to the Bidders
Client ID	Client identification number maintained with one of the Depositories in relation to a demat account
Closing Date	The date on which Allotment of the Ordinary Units pursuant to the Offer shall be made, i.e. on or about April 17, 2023
Demographic Details	Details of the Bidders, including the Bidder's address, investor status, occupation and bank account details
Designated Date	The date of credit of Ordinary Units to the successful Bidders' demat accounts
Designated Stock Exchange	BSE Limited
Draft Placement Memorandum	The draft placement memorandum dated July 20, 2022, filed with SEBI and the Stock Exchanges, issued in accordance with the InvIT Regulations, which did not contain the complete particulars of the Offer
Eligible Investors	Institutional Investors and Bodies Corporate, whether Indian or foreign
Escrow Collection Bank	Axis Bank Limited

Term	Description
Final Placement Memorandum	This final placement memorandum dated April 17, 2023, issued in relation to this Offer, in accordance with the InvIT Regulations
Fresh Issue	A fresh issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million by the Trust, on a private placement basis to successful Bidders
Institutional Investors	Institutional investor as defined in Regulation 2(1)(ya) of the InvIT Regulations
Issue Proceeds	The proceeds of the Fresh Issue that are available to the Trust, pursuant to the fresh issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million. The Selling Unitholders are entitled to the proceeds of the Offer for Sale. The Trust will not receive any proceeds from the Offer for Sale
Listing Agreement	The listing agreement to be entered into with the Stock Exchanges by the Trust, in line with the format as specified under the Securities and Exchange Board of India circular number CIR/CFD/CMD/6/2015 dated October 13, 2015 on "Format of uniform Listing Agreement"
Listing Date	The date on which the Ordinary Units will be listed on the Stock Exchanges
Minimum Bid Size	₹ 260 million
Mutual Funds	Mutual funds registered with SEBI under the Securities and Exchange Board of India (Mutual Funds) Regulations, 1996
Offer	Offer of to 522,582,727 Ordinary Units through a private placement to Eligible Investors at a price of ₹ 100 per Ordinary Unit, aggregating to ₹ 52,258.27 million and comprising of a fresh issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million and an offer for sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million by the Selling Unitholders
Offer for Sale	Offer for sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million by the Selling Unitholders comprising of: (i) 59,690,223 Ordinary Units aggregating to ₹ 5,969.02 million by CH-I; (ii) 16,526,666 Ordinary Units aggregating to ₹ 1,652.67 million by CH-II; and (iii) 66,106,666 Ordinary Units aggregating to ₹ 6,610.67 million by CH-III
Offer Price	₹ 100 per Ordinary Unit, being the price at which Ordinary Units will be Allotted to successful Bidders in terms of this Offer
Offer Size	The offer of to 522,582,727 Ordinary Units aggregating to ₹ 52,258.27 million
Placement Agents	Citigroup Global Markets India Private Limited and J.P. Morgan India Private Limited
Placement Agreement	The placement agreement dated July 20, 2022, as amended and restated on March 22, 2023 entered into among the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Investment Manager, the Sponsors, the Project Manager, the Selling Unitholders and the Placement Agents
Placement Memorandum	The placement memorandum dated April 3, 2023 issued in relation to this Offer in accordance with the InvIT Regulations which did not have complete particulars of the Offer Price, the size of the Offer and other related details such as Offer Proceeds which were available only after the Bid/ Offer Closing Date and are included in this Final Placement Memorandum
Qualified Institutional Buyers or QIB(s)	Qualified institutional buyers, as defined under Regulation 2(1)(ss) of the SEBI ICDR Regulations, which currently includes (i) a mutual fund, a VCF, an AIF and an FVCI registered with SEBI, (ii) an FPI, other than individuals, corporate bodies and family offices, (iii) a public financial institution as defined in section 2(72) of the Companies Act, 2013, (iv) a scheduled commercial bank, (v) a multilateral and bilateral development financial institution, (vi) a state industrial development corporation, (vii) an insurance company registered with the IRDAI, (viii) a provident fund with minimum corpus of ₹ 250 million, (ix) a pension fund with minimum corpus of ₹ 250 million, (x) National Investment Fund set up by resolution no. F. No. 2/3/2005-DDII dated November 23, 2005 of the GoI published in the Gazette of India, (xi) insurance funds set up and managed by army, navy or air force of the Union of India, (xii) insurance funds set up and managed by the Department of Posts, India, and (xiii) systemically important non-banking financial companies.
Registrar and Unit Transfer Agent or Registrar	KFin Technologies Limited
Selling Unitholders	CH-I, CH-II and CH-III
Unit Escrow Agreement	The unit escrow agreement dated March 29, 2023 entered into between the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Selling Unitholders, the Investment Manager and the Unit Escrow Agent in relation to the transfer of Ordinary Units under the Offer by the Selling Unitholders and credit of such Ordinary Units to the demat accounts of the Allottees
Unit Escrow Agent	Axis Bank Limited

Term	Description
Working Day	Working Day, with reference to (a) Bid/Offer Period, shall mean all days, excluding Saturdays, Sundays and public holidays, on which commercial banks in Mumbai are open for business; and (b) the time period between the Bid/Offer Closing Date and the listing of the Ordinary Units on the Stock Exchanges, shall mean all trading days of Stock Exchanges, excluding Sundays and bank holidays

Technical and Industry Related Terms

Term	Description
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
AI	Artificial intelligence
BOT	Build, operate and transfer
BTKM	Billion tonne kilometers
CJV	Cars/ Jeeps/ Vans
CRISIL Report	A report entitled "*An assessment of the roads sector in India"* dated June 2022, prepared by CRISIL
DBFOT	Design, build, finance, operate and transfer
ETC	Electronic toll collection
Fee Rules	National Highways Fee (Determination of Rates and Collection) Rules, 2008
FVTPL	Fair value through profit or loss
HAM	Hybrid Annuity Model
LJV/ LCV	Light Goods Vehicle/ Light Commercial Vehicles
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MM	Major maintenance
MMR	Maximum marginal rate
MNC	Multinational company
NCR	National Capital Region
NHDP	National Highways Development Project
NIP	National Infrastructure Pipeline
O&M	Operation and maintenance
OCI	Other comprehensive income
PPP	Public-private partnership
PPPAC	Public Private Partnership Appraisal Committee
RFID	Radio-frequency identification
ROU	Right-of-use
SCA	Service Concession Arrangement
Technical Consultant	AECOM India Private Limited
Technical Reports or Technical Consultant Reports	Collectively the technical reports, prepared by the Technical Consultant, in relation to the Initial Portfolio Assets
Third Party Reports	Collectively, the Technical Consultant Reports, Traffic Study Reports and the CRISIL Report
TMS	Toll management system
Toll Roads	The toll-based road projects operated by the Initial Portfolio Assets
TOT	Toll, operate and transfer
TOT Roads	The road projects operated by the TOT SPVs
Traffic Consultant or Traffic Study Consultant	Steer Davies Gleave India Private Limited
Traffic Study Reports or Traffic Reports	The traffic study reports, prepared by the Traffic Study Consultant, in relation to the Initial Portfolio Assets (except for APEL)
UGC	Upper Ganga Canal
VGF	Viability Gap Funding
WPI	Wholesale price index

Abbreviations

Term	Description
AIF	Alternative Investment Fund as defined in and registered with SEBI under the SEBI AIF Regulations

Term	Description
AOP	Association of Persons
Big 4 Accounting Firms	Collectively, Deloitte Touche Tohmatsu Limited, Ernst & Young Global Limited, PricewaterhouseCoopers and KPMG International Limited
BOI	Body of Individuals
BSE	BSE Limited
CAN	Confirmation of Allocation Note
CCEA	Cabinet Committee on Economic Affairs
CDSL	Central Depository Services (India) Limited
Companies Act	Companies Act, 1956 and/or the Companies Act, 2013, as applicable
Companies Act, 1956	The erstwhile Companies Act, 1956 read with the rules, regulations, clarifications and modifications thereunder
Companies Act, 2013	Companies Act 2013, as amended read with rules, regulations, clarifications and modifications thereunder
Competition Act	The Competition Act, 2002
CRISIL	CRISIL Research, a division of CRISIL Limited
CRISIL Ratings	CRISIL Ratings Limited
Depositories Act	Depositories Act, 1996
Depository	A depository registered with SEBI under the Securities and Exchange Board of India (Depositories and Participants) Regulations, 2018
Depository Participant	A depository participant as defined under the Depositories Act
DIN	Director Identification Number
EPC	Engineering, Procuring and Construction
FEMA	Foreign Exchange Management Act, 1999, read with rules and regulations thereunder
FEMA Rules	Foreign Exchange Management (Non-debt Instruments) Rules, 2019
Finance Act	Finance Act, 2021
Financial Year or Fiscal Year or Fiscal	Period of 12 months ended March 31 of that particular year, unless otherwise stated
FVCI	Foreign venture capital investors, as defined under the SEBI FVCI Regulations
GAAR	General Anti-Avoidance Rules
GDP	Gross Domestic Product
GoI or Government	Government of India
GST	Goods and Services Tax
HUF	Hindu Undivided Family
ICAI	Institute of Chartered Accountants of India
Ind AS	Companies (Indian Accounting Standards) Rules, 2015, notified on February 19, 2015 by the MCA, including any amendments or modifications thereto
Indian GAAP	Accounting principles generally accepted in India, including the Accounting Standards as prescribed under Section 133 of the Companies Act, 2013 read with Companies (Accounting Standards) Rules, 2006, as amended or Companies (Indian Accounting Standard) Rules, 2015, as amended.
InvIT	Infrastructure Investment Trust
InvIT Regulations	Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended, and circulars, notifications, guidelines and clarifications issued thereunder
IRDAI	Insurance Regulatory and Development Authority of India
IRR	Internal rate of return
IT Act	Income Tax Act, 1961
LODR Regulations	Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015
MAT	Minimum alternate tax
MCA	Ministry of Corporate Affairs
MoEF	Ministry of Environment, Forest and Climate Change
MoRTH	Ministry of Road Transport and Highways
NEFT	National Electronic Funds Transfer
NHAI	National Highways Authority of India
NITI	National Institution for Transforming India
NSDL	National Securities Depository Limited
NSE	National Stock Exchange of India Limited
OCD	Optionally Convertible Debenture
PAN	Permanent Account Number
RBI	Reserve Bank of India

Term	Description
Regulation S	Regulation S under the Securities Act
Rs./Rupees/INR/₹	Indian Rupees
RTGS	Real Time Gross Settlement
SCR (SECC) Regulations	Securities Contract (Regulation) (Stock Exchanges and Clearing Corporations) Regulations, 2018
SCRA	Securities Contracts (Regulation) Act, 1956
SEBI	Securities and Exchange Board of India
SEBI Act	The Securities and Exchange Board of India Act, 1992
SEBI AIF Regulations	Securities and Exchange Board of India (Alternative Investment Funds) Regulations, 2012
SEBI FPI Regulations	Securities and Exchange Board of India (Foreign Portfolio Investors) Regulations, 2019
SEBI FVCI Regulations	Securities and Exchange Board of India (Foreign Venture Capital Investors) Regulations, 2000
SEBI ICDR Regulations	Securities and Exchange Board of India (Issue of Capital and Disclosure Requirements) Regulations, 2018
SEBI VCF Regulations	Securities and Exchange Board of India (Venture Capital Funds) Regulations, 1996
Securities Act	U.S. Securities Act of 1933, as amended
Stock Exchanges	BSE and NSE
STT	Securities transaction tax
Tax	All forms of direct and indirect taxes, duties, charges, levies, including without limitation corporate income tax, withholding tax, minimum alternate tax, sales tax, goods & services tax, value added tax, customs and excise duties, service tax, capital gains tax and all charges, interest, penalties and fines incidental or relating to any taxation falling within the aforesaid or which arise as a result of the failure to pay any taxes on the due date or to comply with any obligation relating to tax
U.S./USA/United States	United States of America
USD/US$	United States Dollars
VCF	Venture capital funds as defined under the SEBI VCF Regulations

PRESENTATION OF FINANCIAL DATA AND OTHER INFORMATION

Certain Conventions

All references in this Final Placement Memorandum to "India" are to the Republic of India and all references to the "U.S.", or the "United States" are to the United States of America.

Unless stated otherwise, all references to page numbers in this Final Placement Memorandum are to the page numbers of this Final Placement Memorandum.

Financial Data

Unless stated otherwise, the financial information in this Final Placement Memorandum is derived from the Audited Special Purpose Combined Financial Statements. The Trust was settled as a trust on December 7, 2021 and has acquired ownership of the Initial Portfolio Assets prior to the Allotment of the Ordinary Units in the Offer.

The Audited Special Purpose Combined Financial Statements have been prepared in accordance with Guidance Note on Reports in Company Prospectuses (Revised 2019), and the Guidance Note on Combined and Carve Out Financial Statements issued by the Institute of Chartered Accountants of India (the "**Guidance Notes**") using the recognition and measurement principles of Indian Accounting Standards as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015 read with Section 133 of the Companies Act, 2013 ("**Ind AS**") and other generally accepted accounting principles and other relevant provisions relating to disclosures required as per the InvIT Regulations. For further details, please see the section entitled "*Audited Special Purpose Combined Financial Statements*" on page 345.

Further, this Final Placement Memorandum includes statements of projections of revenue from operations and cash flows from operating activities of the Trust and the Initial Portfolio Assets for the years ending March 31, 2024, March 31, 2025 and March 31, 2026 prepared in accordance with accounting principles of Indian Accounting Standards ("Ind AS") as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015, as amended prescribed under Section 133 of the Companies Act, 2013 read with InvIT Regulations and the Guidance Note on Combined and Carve- Out Financial Statements issued by the Institute of Chartered Accountants of India. Projected cash flow from operating activities have been calculated using the direct method under Ind AS 7 - Statement of Cash Flows and is computed by deducting the projected operating expenses and income taxes from the projected revenue from operations and adjusted for projected non-cash expenses (the "**Projections of Revenue from Operations and Cash Flow from Operating Activities**"). For further details, please see the section entitled "*Projections of Revenue from Operations and Cash Flow from Operating Activities*" on page 461.

Further, this Final Placement Memorandum includes summaries of the audited financial statements of the (i) Sponsors, as of and for the years ended December 31, 2021, December 31, 2020 and December 31, 2019 (in Singapore, the financial year ends on December 31) prepared in accordance with IFRS; and (ii) Investment Manager, as of and for the period ended March 31, 2022 (as the Investment Manager was incorporated on April 12, 2021 and completed its first financial year on March 31, 2022), prepared in accordance with generally accepted accounting principles in India, including the Accounting Standards as prescribed under Section 133 of the Companies Act, 2013 read with Companies (Accounting Standards) Rules, 2006, under the historical cost convention on accrual basis, derived from the financial statements of the Sponsors for the respective years and from the financial statements of the Investment Manager for the relevant period. For further details, please see the sections entitled "*Summary of Financial Information of the Sponsors*" and "*Summary of Financial Information of the Investment Manager*" on pages 39 and 46, respectively.

The financial year for the Trust, the Investment Manager and the Initial Portfolio Assets, commences on April 1 and ends on March 31 of the next year, and accordingly, all references to a particular financial year or fiscal year, unless stated otherwise, are to the 12 month period ended on March 31 of that year. For Sponsors, the financial year commences on January 1 and ends on December 31 of the same year.

The degree to which the financial information included in this Final Placement Memorandum will provide meaningful information is entirely dependent on the reader's level of familiarity with Indian accounting policies and practices, the Companies Act, the Indian GAAP, Ind AS and the InvIT Regulations. The Investment Manager has not attempted to explain these differences or quantify their impact on the financial data included in this Final Placement Memorandum, and it is urged that you consult your own advisors regarding such differences and their impact on our financial data. Any reliance by persons not familiar with Indian accounting policies and practices on the financial disclosures presented in this Final Placement Memorandum should accordingly be limited.

In this Final Placement Memorandum, any discrepancies in any table between the total and the sums of the amounts listed are due to rounding off. All figures and percentage figures have been rounded off to two decimal places. However, where any figures may have been sourced from third-party industry sources, such figures may be rounded-off to such number of decimal points as provided in such respective sources.

Currency and Units of Presentation

All references to:

- "Rupees" or "₹" or "INR" or "Rs." are to Indian Rupees, the official currency of the Republic of India; and
- "USD" or "US$" or "$" or "U.S. dollars" are to United States Dollars, the official currency of the United States.

Except as otherwise specified, certain numerical information in this Final Placement Memorandum has been presented in "million" units. One million represents 1,000,000 and one billion represents 1,000,000,000.

Unless the context requires otherwise, any percentage amounts, as set forth in this Final Placement Memorandum, have been calculated on the basis of the Audited Special Purpose Combined Financial Statements, and the summary financial statements of (i) each of the Sponsors; and (ii) the Investment Manager.

Exchange Rates

This Final Placement Memorandum contains conversion of certain other currency amounts into Indian Rupees. These conversions should not be construed as a representation that these currency amounts could have been, or can be converted into Indian Rupees, at any particular rate.

The following table sets forth, for the periods indicated, information with respect to the exchange rate between the Rupee and the US$:

(in ₹ per US$)

Currency	As of October 31, 2022	As of March 31, 2022	As of March 31, 2021	As of March 31, 2020
1 US$	82.39	75.81	73.50	75.39

Source: www.fbil.org.in

Note: If the RBI reference rate is not available on a particular date due to a public holiday, exchange rates of the previous working day has been disclosed. The reference rates are rounded off to two decimal places.

Industry and Market Data

Unless stated otherwise, industry and market data used in this Final Placement Memorandum has been obtained or derived from the CRISIL Report with respect to the assessment of the roads sector in India. The Investment Manager has subscribed to the CRISIL Report, to provide an independent estimation of the assessment of the roads sector in India, which is based on historical data and certain assumptions. The CRISIL Report is issued by CRISIL and is subject to the following disclaimer:

"*CRISIL Research, a division of CRISIL Limited ("**CRISIL**") has taken due care and caution in preparing this report ("**Report**") based on the Information obtained by CRISIL from sources which it considers reliable ("**Data**"). However, CRISIL does not guarantee the accuracy, adequacy or completeness of the Data / Report and is not responsible for any errors or omissions or for the results obtained from the use of Data / Report. This Report is not a recommendation to invest / disinvest in any entity covered in the Report and no part of this Report should be construed as an expert advice or investment advice or any form of investment banking within the meaning of any law or regulation. CRISIL especially states that it has no liability whatsoever to the subscribers / users / transmitters/ distributors of this Report.*

Without limiting the generality of the foregoing, nothing in the Report is to be construed as CRISIL providing or intending to provide any services in jurisdictions where CRISIL does not have the necessary permission and/or registration to carry out its business activities in this regard. Cube Highways Trust and Cube Highways Fund Advisors Private Limited will be responsible for ensuring compliances and consequences of non-compliances for use of the Report or part thereof outside India. CRISIL Research operates independently of, and does not have access to information obtained by CRISIL Ratings Limited / CRISIL Risk and Infrastructure Solutions Limited ("CRIS"), which may, in their regular operations, obtain information of a confidential nature. The views expressed in this Report are that of CRISIL Research and not of CRISIL Ratings Limited / CRIS. No part of this Report may be published/reproduced in any form without CRISIL's prior written approval."

Industry publications generally state that the information contained in such publications has been obtained from various sources believed to be reliable but that their accuracy and completeness are not guaranteed and their reliability cannot be assured. Accordingly, no investment decisions should be based solely on such information. The data used in these sources may have been re-classified for the purposes of presentation. Data from these sources may also not be comparable. Such data involves risks, uncertainties and numerous assumptions and is subject to change based on various factors, including those disclosed in the section entitled "*Risk Factors*" on page 63. Accordingly, investment decisions should not be based solely on such information.

The extent to which the market and industry data used in this Final Placement Memorandum is meaningful depends on the reader's familiarity with and understanding of the methodologies used in compiling such data. There are no standard data gathering methodologies in the industry in which the business of the Trust is conducted, and methodologies and assumptions may vary widely among different industry sources.

Traffic Data

The Traffic Reports, prepared by the Traffic Consultant, were commissioned by the Investment Manager for purposes of the Offer. The Traffic Reports were issued by the Traffic Consultant and are subject to the following disclaimers:

For the extracts of the Traffic Reports:

"This document includes selected provisions of or a summary of the

- *Project Transit: Traffic Due Diligence of Hazaribagh Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Lucknow – Raebareli Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Madurai – Kanyakumari Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Kotwa – Muzaffarpur Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Jhansi – Lalitpur Tollway Limited,*
- *Project Transit: Traffic Due Diligence of DA Toll Road Private Limited,*
- *Project Transit: Traffic Due Diligence of Walayar Vadakkencherry Expressways Private Limited,*
- *Project Transit: Traffic Due Diligence of Farakka - Raiganj Highways Limited,*
- *Project Transit: Traffic Due Diligence of Jaipur – Mahua Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Mahua Bharatpur Expressways Limited,*
- *Project Transit: Traffic Due Diligence of Western UP Tollway Limited,*
- *Project Transit: Traffic Due Diligence of Nelamangala Devihalli Expressway Private Limited, and*
- *Project Transit: Traffic Due Diligence of Ghaziabad Aligarh Expressway Private Limited*

*(the "**Reports**") prepared by Steer, Davies & Gleave India Private Limited, solely in its capacity as the Traffic Consultant (the "Traffic Consultant"), on behalf of Cube Highways Fund Advisors Private Limited (the "Client") for the Issue and is not a full statement of the terms of the Reports. Accordingly, such summary or excerpt is qualified in its entirety by reference to and is subject to the full text of the Reports, which are attached to the Placement Memorandum/Final Placement Memorandum as Annexure C. Investors must view the summaries in the context of the full Reports, which are subject to the limitations and disclaimers in such Reports. Without limiting the generality of the foregoing, the Reports are expressly subject to the qualifications, assumptions made, procedures followed, matters considered and any limitations on the scope of work contained therein.*

Investors should note that these summaries, and the Reports, are provided only as of the date set forth therein and do not contemplate any event, circumstances, or changes with respect to Issue or otherwise after such date. The foregoing summaries of the Reports may include projected information and data (financial and otherwise), and other forward-looking information, that may or may not occur or prove to be accurate. Such projected and forward-looking information is based on current expectations and projections about future events which are beyond the control of the Traffic Consultant, the Client or any other participant in the Issue, and such projections and information can be affected by inaccurate assumptions. While these projections and information were prepared in good faith, no assurance can be given as to the accuracy or adequacy of such projections and information, or the assumptions underlying such projections and information.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE OFFER OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES."

Valuation

The Valuation Report, prepared by the Valuer, was commissioned by the Investment Manager for the purposes of the Offer. The Valuation Report issued by the Valuer is subject to the following disclaimer:

For the extracts of the Valuation Report:

"This document includes selected provisions of or a summary of the valuation report dated January 13, 2023 ("Report") prepared by Ernst & Young Merchant Banking Services LLP (EY), solely in its capacity as the registered valuer on behalf of Cube Highways Fund Advisors Private Limited (the "Client") for the Issue and is not a full statement of the terms of the Report. Accordingly, such summary or excerpt is qualified in its entirety by reference to and is subject to the full text of the Report,

which are attached to the Placement Memorandum/Final Placement Memorandum as Annexure A. Investors must view the summaries in the context of the full Report, which are subject to the limitations and disclaimers in such Report. Without limiting the generality of the foregoing, the Report are expressly subject to the qualifications, assumptions made, procedures followed, matters considered and any limitations on the scope of work contained therein.

Investors should note that these summaries, and the Report, are provided only as of the date set forth therein and do not contemplate any event, circumstances or changes with respect to Issue or otherwise after such date. The foregoing summaries of the Reports may include projected information and data (financial and otherwise), and other forward-looking information, that may or may not occur or prove to be accurate. Such projected and forward-looking information is based on current expectations and projections about future events which are beyond the control of the EY, the Client or any other participant in the Issue, and such projections and information can be affected by inaccurate assumptions. While these projections and information were prepared in good faith, no assurance can be given as to the accuracy or adequacy of such projections and information, or the assumptions underlying such projections and information.

The total aggregate liability of EY and its officers, employees and affiliates for any loss, damage, cost or expense suffered or incurred by all persons or entities (including but not limited to the Client, the addressees to this Consent Letter, placement agents, and investors) and for all claims in respect of work performed in connection with the Issue and/or the Report, is hereby limited to the amount of fees actually paid by the Client to EY in connection with the Report (the "Aggregate Liability Cap"). EY is released from all liability in excess of the Aggregate Liability Cap."

This is not an expert opinion, but is a view basis work done in accordance with the SEBI InvIT Regulations requiring an independent valuation"

FORWARD-LOOKING STATEMENTS

Certain statements contained in this Final Placement Memorandum that are not statements of historical fact constitute "forward-looking statements". Investors can generally identify forward-looking statements by terminology such as "aim", "anticipate", "believe", "continue", "can", "could", "estimate", "expect", "intend", "likely", "may", "objective", "plan", "potential", "project", "pursue", "shall", "should", "will", "would", or other words or phrases of similar import. Similarly, statements that describe the strategies, objectives, plans or goals of the Trust are also forward-looking statements. However, these are not the exclusive means of identifying forward-looking statements.

All statements regarding the Trust's expected financial conditions, results of operations, business plans and prospects are forward-looking statements. These forward-looking statements include statements as to the Trust's business strategy, planned projects, revenue and profitability (including, without limitation, any financial or operating projections or forecasts), new business and other matters discussed in this Final Placement Memorandum that are not historical facts. These forward-looking statements and any other projections contained in this Final Placement Memorandum (whether made by the Trustee, Investment Manager, the Selling Unitholders or any third party), are predictions and involve known and unknown risks, uncertainties, assumptions and other factors that may cause the Trust's actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements or other projections. Further, this Final Placement Memorandum also includes the section entitled "*Projections of Revenue from Operations and Cash Flow from Operating Activities*" on page 461.

The Valuation Report included in this Final Placement Memorandum, is based on certain projections and accordingly, should be read together with assumptions and notes thereto. For further details, please see the "*Valuation Report*" attached as Annexure A. The Technical Reports and Traffic Reports, attached as Annexures B and C, respectively, include projections and estimates in relation to operation and maintenance expenses (including routine and periodic maintenance expenses) and traffic data, and accordingly, should be read in conjunction with the relevant notes and assumptions thereto.

All forward-looking statements and financial projections are subject to risks, uncertainties and assumptions. Actual results may differ materially from those suggested by forward-looking statements and financial projections due to certain known or unknown risks or uncertainties associated with the Investment Manager's expectations with respect to, but not limited to, the actual growth in the infrastructure sector, the Investment Manager's ability to successfully implement the strategy, growth and expansion plans, technological changes, cash flow projections, exposure to market risks, general economic and political conditions in India, monetary and fiscal policies of India, inflation, deflation. foreign exchange rates, performance of financial markets in India or globally, changes in domestic laws, regulations and taxes, changes in competition in the infrastructure sector, the outcome of any legal or regulatory proceedings and the future impact of new accounting standards. By their nature, certain of the market risk disclosures are only estimates and could be materially different from what actually occurs in the future. As a result, actual future gains, losses or impact on net income could materially differ from those that have been estimated.

Factors that could cause actual results, performance or achievements of the Trust to differ materially include, but are not limited to, those discussed under the sections entitled "*Risk Factors*", "*Industry Overview*", "*Business*" and "*Discussion and analysis by the Directors of the Investment Manager of the Financial Condition, Results of Operations and Cash Flows of the Initial Portfolio Assets of the Trust*", on pages 63, 158, 172 and 246, respectively. Some of the factors that could cause the Trust's actual results, performance or achievements to differ materially from those in the forward-looking statements, financial projections and financial information include, but are not limited to, the following:

- The Trust has no operating history and may not be able to operate our business successfully, achieve our business objectives or generate sufficient cash flows to make or sustain distributions. Further, the Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum may not accurately reflect our future financial position, results of operation and cash flows;

- Toll collections and Toll Road traffic volumes may be affected by competing roads and bridges and other modes of transportation, and any improvements to, or construction of, such roads, bridges and other modes of transportation**;**

- Toll rates and collections and Toll Road traffic volumes are subject to regulatory constraints, number of road users subject to such rates and dependent on factors beyond our control;

- We have relied on data derived from (i) Technical Consultant Reports commissioned from the Technical Consultant, (ii) Traffic Reports commissioned from the Traffic Consultant and (iii) the CRISIL Report, which are based on certain estimates and assumptions that are subjective and may not be accurate;

- The Valuation Report, and any underlying reports, are not opinions on the commercial merits of the Trust or the Project SPVs, nor are they opinions, expressed or implied, as to the future trading price of the Ordinary Units or the financial

condition of the Trust upon listing, and the valuation contained therein may not be indicative of the true value of the Project SPV's assets; and

- The transfer of the Project SPVs to the Trust under the Share Purchase Agreements may result in certain risks.

The forward-looking statements, Projections of Revenue from Operations and Cash Flow from Operating Activities, Valuation Report, Technical Reports and Traffic Reports reflect current views as of the dates specified therein and are not a guarantee of future performance or returns to Bidders. These statements and projections are based on certain beliefs and assumptions, which in turn are based on currently available information. Although the Investment Manager and the Sponsors believe that the expectations and the assumptions upon which such forward-looking statements are based, are reasonable at this time, none of the Investment Manager or the Sponsors can assure Bidders that such expectations will prove to be correct or accurate.

In accordance with the InvIT Regulations, the assumptions underlying the Projections of Revenue from Operations and Cash Flow from Operating Activities have been examined by the Auditors in accordance with SAE 3400 "The Examination of Prospective Financial Information", issued by the Institute of Chartered Accountants of India. The Projections of Revenue from Operations and Cash Flow from Operating Activities have been prepared for inclusion in this Final Placement Memorandum for the purposes of this Offer, using a set of assumptions that include hypothetical assumptions about future events and management's actions that are not necessarily expected to occur, and have been approved by the board of directors of the Investment Manager. Consequently, Bidders are cautioned that the Projections of Revenue from Operations and Cash Flow from Operating Activities may not be appropriate for purposes other than that described above. In any event, these statements speak only as of the date of this Final Placement Memorandum or the respective dates indicated in this Final Placement Memorandum.

The Trust, the Investment Manager, the Sponsors, the Selling Unitholders and the Placement Agents or any of their affiliates or advisors, undertake no obligation to update or revise any of statements reflecting circumstances arising after the date hereof or to reflect the occurrence of underlying events, whether as a result of new information, future events or otherwise after the date of this Final Placement Memorandum. If any of these risks and uncertainties materialize, or if any of the Investment Manager's underlying assumptions prove to be incorrect, the actual results of operations or financial condition or cash flow of the Trust could differ materially from that described herein as anticipated, believed, estimated or expected. All subsequent forward-looking statements attributable to the Trust are expressly qualified in their entirety by reference to these cautionary statements. Given these uncertainties, Bidders are cautioned not to place undue reliance on such forward-looking statements and financial projections, and not to regard such statements to be a guarantee or assurance of the Trust's future performance or returns to investors.

THE OFFER

The following is a general summary of the terms of this Offer. This summary should be read in conjunction with, and is qualified in its entirety by, the detailed information appearing elsewhere in this Final Placement Memorandum:

Offer	522,582,727 Ordinary Units aggregating to ₹ 52,258.27 million *Comprising* Fresh Issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million; and Offer for Sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million
Offer Price	₹ 100 for the Ordinary Units
Minimum Bid Size	₹ 260 million
Bid/Offer Opening Date	April 10, 2023
Bid/Offer Closing Date	April 13, 2023
Sponsors	Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd.
Trustee	Axis Trustee Services Limited
Investment Manager	Cube Highways Fund Advisors Private Limited
Project Manager	Cube Highways and Transportation Assets Advisors Private Limited
Selling Unitholders	CH-I, CH-II and CH-III
Eligible Investors	In relation to the Ordinary Units, Institutional Investors and Bodies Corporate, Indian or foreign, subject to applicable law
Authority for this Offer	This Offer was authorised and approved by the board of directors of the Investment Manager on July 11, 2022 and March 22, 2023. The Offer for Sale has been authorized by the board of directors of each of the Selling Unitholders on December 19, 2022. Further, with respect to the Ordinary Units offered by the Selling Unitholders in the Offer for Sale, the Selling Unitholders have each held equity shares of the Initial Portfolio Assets, against which such Ordinary Units are to be allotted to the Selling Unitholders, for a period of at least one year immediately preceding the date of the Draft Placement Memorandum
Tenure of the Trust	The Trust shall remain in force perpetually until it is dissolved or terminated in accordance with the Trust Deed. For details, please see the section entitled "*Parties to the Trust*" on page 107.
Units issued and outstanding as of the date of this Final Placement Memorandum	As of the date of this Final Placement Memorandum, there are 910,086,940 issued and outstanding Ordinary Units. As of the date of this Final Placement Memorandum, there are 157,500,000 issued and outstanding Subordinate Units.
Ordinary Units issued and outstanding immediately after this Offer	1,290,346,112 Ordinary Units
Sponsor Units	*Ordinary Units*: 475,892,685 Ordinary Units allotted pursuant to the Share Purchase Agreements The Ordinary Units held by the Sponsors shall rank *pari passu* with, and have the same rights as the Ordinary Units to be Allotted pursuant to this Offer. The Ordinary Units held by the Sponsors have been allotted to the Sponsors pursuant to the resolution of the board of directors of the Investment Manager dated April 17, 2023. *Subordinate Units*: 157,500,000 Subordinate Units allotted pursuant to the Share Purchase Agreements For details in relation to the Subordinate Units allotted to the Sponsors, please see the section entitled "*Information Concerning the Units*" on page 226. The Initial Tranche Subordinate Units held by the Sponsors have been allotted to the Sponsors pursuant to the resolution of the board of directors of the Investment Manager dated April 17, 2023. *Note: Units have been acquired by the Sponsors prior to the Allotment. For details, please see the section entitled "Formation Transactions in Relation to the Trust - Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors" on page 30.*
Distribution	Please see the section entitled "*Distribution*" on page 243.

Indian Taxation	Please see the section entitled "*Statement of Tax Benefits"* on page 331.
Use of Proceeds	Please see the section entitled "*Use of Proceeds*" on page 229.
Listing	Prior to this Offer, there has been no market for the Units. The Ordinary Units are proposed to be listed on the Stock Exchanges. In-principle approvals for listing of the Ordinary Units have been received from BSE and NSE on August 3, 2022 and September 2, 2022, respectively. The validity of the in-principle approval from BSE has been extended by way of letters dated December 1, 2022 and March 10, 2023. The validity of the in-principle approval from NSE has been extended by way of letters dated November 3, 2022 and February 2, 2023. The Investment Manager shall apply to the Stock Exchanges for the final listing and trading approvals, after the Allotment and the credit of the Ordinary Units to the demat accounts of the Allottees.
Designated Stock Exchange	BSE
Closing Date	The date on which Allotment of the Ordinary Units pursuant to this Offer shall be made, i.e. on or about April 17, 2023.
Ranking	The Ordinary Units being issued shall rank *pari passu* in all respects, including rights in respect of distribution. In accordance with the Trust Deed, the Subordinate Units shall carry no rights, including but not limited to, (i) voting rights; (ii) economic rights (including with respect to any distribution made by the Trust in any manner); and (iii) the other rights attached to the Ordinary Units. Please see the sections entitled *"Rights of Unitholders"* and "*Information Concerning the Units*" on pages 317 and 226.
Lock-in and Rights of Unitholders	For details, please see the sections entitled "*Information Concerning the Units*" and "*Rights of Unitholders*" on pages 226 and 317, respectively.
Risk Factors	Prior to making an investment decision, Bidders should consider carefully read the matters discussed in the section entitled *"Risk Factors*" on page 63.

The Offer is a private placement of Ordinary Units under Regulation 14(2) of the InvIT Regulations and consists of the Fresh Issue and the Offer for Sale. The Ordinary Units will be listed within six Working Days from the Bid/Offer Closing Date, or such other timeline as may be prescribed under the InvIT Regulations. Upon listing of the Ordinary Units on the Stock Exchanges, the Ordinary Units shall be traded only on the dematerialized segment of the Stock Exchanges.

In accordance with the InvIT Regulations and Trust Deed, no Unitholder shall enjoy superior voting or any other rights over another Unitholder. Further, there shall not be multiple classes of Units other than (i) the Ordinary Units; and (ii) the Subordinate Units. The Trust has issued the Initial Tranche Subordinate Units of the Trust only to the Sponsors, in compliance with the InvIT Regulations, where such Initial Tranche Subordinate Units shall carry only inferior voting, economic or other rights compared to the Ordinary Units as set out in the Trust Deed. For further details in relation to the Subordinate Units, please see the sections entitled "*Parties to the Trust- Key Terms of the Trust Deed*" and "*Information Concerning the Units*" on pages 109 and 226, respectively.

No person connected with the Offer, including any person connected with the distribution of this Final Placement Memorandum, shall offer any incentive, whether direct or indirect, in any manner, whether in cash or kind or services or otherwise to any person for making an application for Allotment of the Ordinary Units. For further details in relation to this Offer, including the method of application, please see the section entitled "*Offer Information*" on page 322.

OVERVIEW OF THE TRUST

The following overview is qualified in its entirety by, and is subject to, the more detailed information contained in, or referred to elsewhere, in this Final Placement Memorandum. The statements contained in this summary that are not historical facts may be forward-looking statements. Such statements are subject to certain risks, uncertainties and assumptions that could cause actual results of the Trust to differ materially from those forecasted or projected in this Final Placement Memorandum. Under no circumstances should the inclusion of such information herein be regarded as a representation, warranty or prediction of the accuracy of the underlying assumptions by the Trust, the Parties to the Trust or the Placement Agents or any other person or that these results will be achieved or are likely to be achieved. Investment in Ordinary Units involves risks. Bidders are advised not to rely solely on this overview, however, and should read this Final Placement Memorandum in its entirety and in particular, the section entitled "Risk Factors" on page 63.

Structure and description of the Trust

Cube Highways and Transportation Assets Advisors Private Limited ("**Settlor**") set up the Trust by way of the Original Trust Deed dated December 7, 2021 as a contributory irrevocable trust under the provisions of the Indian Trusts Act, 1882 at New Delhi, India. The Settlor has settled the Trust for an initial sum of ₹ 10,000. The Sponsors shall not have any beneficial interest in such initial sum of the Trust and such sum shall not be distributed to Sponsors under any circumstances. The Trust was registered as an infrastructure investment trust under the InvIT Regulations on April 5, 2022 having registration number IN/InvIT/22-23/0022. The Original Trust Deed was amended and restated by way of the Trust Deed dated July 8, 2022.

For details of the registered office and contact person of the Settlor and Sponsors, please see the section entitled "*General Information*" on page 102.

Further, Cube Highways Fund Advisors Private Limited has been appointed as the Investment Manager to the Trust, and Cube Highways and Transportation Assets Advisors Private Limited has been appointed as the Project Manager to the Trust pursuant to a resolution passed by the IM Board. The Project Manager, the Investment Manager and the Initial Portfolio Assets have entered into the Project Implementation and Management Agreement in this regard. For further details, please see the section entitled "*Parties to the Trust*" on page 107.

Investment Objectives

The objective of the Trust is to carry on the activities of, and to make investments as, an infrastructure investment trust, as permissible under the InvIT Regulations and in accordance with the InvIT Documents, to the extent applicable. The investment of the Trust shall be in any manner permissible under, and in accordance with, the InvIT Documents, the InvIT Regulations and applicable law, the investment strategy, and as detailed in the Trust Deed, the Placement Memorandum, this Final Placement Memorandum and the InvIT Documents, to the extent applicable, including in eligible infrastructure projects either directly or through SPVs or Holding Company(ies) or securities of Indian companies related to the infrastructure sector or government securities or money market instruments, liquid mutual funds or cash equivalents (the "**Investment Objectives**").

The Trustee shall ensure that the Capital Contribution and other InvIT Assets shall be utilized solely for the purposes of making investments as stated above, in accordance with the InvIT Regulations and applicable law and shall not be utilized for any activities prohibited under the InvIT Regulations. Further, the Trustee shall ensure that the Trust complies with any additional conditions as may be specified by SEBI or applicable law.

Investments by the Trust shall be in compliance with the provisions of the InvIT Regulations and unless specifically provided under applicable law, the Trust shall not carry out any other principal activity or trade, in contradiction of the restrictions and requirements under applicable law. The Trust, through the Investment Manager, shall do all things necessary and conducive to the attainment of the Investment Objectives, directly or through agents or other delegatees (including the Investment Manager and the Project Manager), subject to the provisions of the InvIT Regulations and any other applicable law.

The Trustee, on the advice of the Investment Manager, may, if it deems expedient, from time to time, review, revise, amend, vary or alter the Investment Objectives in accordance with the Trust Deed, subject to the provisions of the InvIT Documents, the InvIT Regulations and any other applicable law.

Fee and expenses

Annual Expenses

The expenses in relation to the Trust, other than such expenses incurred in relation to operations of the Initial Portfolio Assets, would broadly include fee payable to: (i) the Trustee; (ii) the Investment Manager; (iii) the Project Manager; (iv) the Auditors, (v) the Valuer; and (vi) other intermediaries and consultants.

The estimated recurring expenses on an annual basis, including but not limited to, are as follows:

(₹ in million)

Payable by the Trust	Estimated Expenses*
Fee payable to Credit Rating Agency	25
Fee payable to the Valuer	Please see Note 1 below
Fee payable to the Technical Consultant	12.5
Fee payable to the Auditors	2.50
Fee payable to Trustee	Please see Note 2 below
Fee payable to Investment Manager	Please see Note 3 below
Fee payable to Project Manager	Please see Note 4 below

** The abovementioned expenses relate to the first full year of operation for the Trust i.e. Financial Year 2023.*

Note 1:

The Valuer shall be entitled to a fee of ₹ 6.00 million, excluding out of pocket expenses incurred in connection with the performance of the services, and administrative surcharge, to be calculated as 10% of the out of pocket expenses.

Note 2:

The Trustee shall be entitled to a fee of ₹ 1.60 million (the "**Trusteeship Fee**"), which shall be paid annually to the Trustee for the services rendered to the Trust. In addition, the Trustee shall be entitled to recover from the Trust any (i) any legitimate out of pocket expenses incurred by it in relation to its trusteeship of the Trust, and (ii) any tax or duty including goods and services tax (other than income tax) which is, or has become as on the date of collection of such tax or duty, leviable under the applicable law on the fee payable to the Trustee by the Trust.

Note 3:

The Investment Manager shall be entitled to a fee from the funds of the Trust, on an arm's length basis, in accordance with the Investment Management Agreement ("**Management Fee**"). The Management Fee shall be calculated annually and shall be the higher of:

(a) Subsequent to the initial offer, 0.94% of the revenue of the Initial Portfolio Assets ("**Fee Percentage**");

or

(b) ₹ 190 million ("**Minimum Threshold**") subject to an escalation of 7% per annum.

In addition, the reduction in fee percentage for the Future Assets shall be as set out in the Investment Management Agreement.

The Investment Manager shall raise invoices on a monthly basis in Indian Rupees. Notwithstanding the foregoing, the Management Fee payable by the Trustee shall accrue from the date of the Investment Management Agreement until the date of acquisition of the Initial Portfolio Assets and the Investment Manager shall raise its first invoice only upon acquisition of the Initial Portfolio Assets. All the invoices raised by the Investment Manager to the Trustee (on behalf of the Trust) will be at an arm's length price. Each such invoice shall be raised within 30 (thirty) days from the close of every month and payable within 30 (thirty) days upon receipt thereof.

The Investment Manager may charge a delay interest at the rate of 12% per annum in case of failure of the Trustee (on behalf of the Trust) to make the payment within the time mentioned above and such interest shall be payable for the period of delay. All payments to the Investment Manager shall be made in cash to the bank account provided in writing by the Investment Manager to the other parties to the Investment Management Agreement.

In addition, the Investment Manager shall be entitled to recover from the Trust any tax or duty or levies, including goods and services tax (other than income tax) which is, or may become, leviable under applicable law on the Management Fee. The Trust will be entitled to deduct or withhold applicable tax at source on the Management Fee, in accordance with the tax regulations applicable in India at the time of payment of the Management Fee. Any change in the Management Fee will be subject to approval of the Unitholders, as required under the InvIT Regulations and applicable law.

Note 4:

The Project Manager shall be entitled to a fee from the funds of the relevant Project SPV on an arm's length basis in accordance with the Project Implementation and Management Agreement ("**PM Fee**"). The PM Fee shall be paid by each Project SPV from their respective funds. The PM Fee shall be calculated annually and shall be the higher of:

(a). 1.55% of the standalone revenue of the relevant Project SPV based on the audited financial statements of such Project SPV;

or

(b). during the term of the relevant Concession Agreement for each Project SPV, the following amounts in relation to each Project SPV ("**Minimum Threshold**") as set out in the Project Implementation and Management Agreement subject to an escalation of 7% per annum.

Sr. No.	Name	Minimum Threshold Amount (*in ₹ million*)
1.	APEL	14.90
2.	DATRPL	114.70
3.	FRHL	32.00
4.	GAEPL	15.10
5.	HTL	12.30
6.	JMTL	26.60
7.	JLTL	10.60
8.	JVTL	7.40
9.	KETL	7.20
10.	KMTL	14.30
11.	LRTL	10.80
12.	MKTL	12.10
13.	MBEL	12.30
14.	NKTL	7.50
15.	NDEPL	11.60
16.	SMTL	7.00
17.	WVEPL	10.40
18.	WUPTL	15.40

In addition, the Minimum Thresholds for the Future Assets shall be as set out in the Project Implementation and Management Agreement. The payments of PM Fee shall be subject to applicable tax deduction, as may be required as per applicable law. The PM Fee shall be exclusive of GST which shall be to the account of the relevant Project SPV. The Project Manager may charge delay interest in case of failure to make payments within the agreed timelines in accordance with the provisions of the Project Implementation and Management Agreement.

Set-up expenses

In connection with establishment and registration of the Trust, the Investment Manager has incurred approximately ₹ 1.70 million as expenses. The Investment Manager shall be entitled to seek reimbursement of such expenses from the Trust.

Further, the Investment Manager has also incurred certain expenses during the setting up of the Trust on behalf of the Sponsors, CH-II, CH-ID and Cube Mobility ("**Reimbursing Parties**"). Pursuant to the Reimbursement Agreement, the Reimbursing Parties have reimbursed the Investment Manager and shall reimburse the Incurring Parties (as defined under the Reimbursement Agreement), as agreed between such parties in accordance with the Reimbursement Agreement. For further details in relation to the Reimbursement Agreement, please see the section entitled "*Related Party Transactions-Reimbursement Agreement*" on page 284.

Offer Expenses

The total expenses of this Offer are ₹ 15 million. For details in relation to the Offer expenses, please see the section entitled "*Use of Proceeds*" on page 229.

Details of credit ratings

Please see the section entitled "*General Information – Credit ratings*" on page 106 in relation to the details of credit ratings.

FORMATION TRANSACTIONS IN RELATION TO THE TRUST

Details of arrangements pertaining to the Trust

The Trust's initial portfolio of assets comprises 18 road project SPVs, acquired from the Sponsors, and their affiliates, namely, (i) Andhra Pradesh Expressway Limited; (ii) DA Toll Road Private Limited; (iii) Farakka-Raiganj Highways Limited; (iv) Ghaziabad Aligarh Expressway Private Limited; (v) Hazaribagh Tollway Limited, (vi) Jhansi-Lalitpur Tollway Limited; (vii) Jaipur-Mahua Tollway Limited; (viii) Jhansi-Vigakhet Tollway Limited, (ix) Kanyakumari – Etturavattam Tollway Limited, (x) Kotwa – Muzaffarpur Tollway Limited; (xi) Lucknow – Raebareli Tollway Limited, (xii) Mahua Bharatpur Expressways Limited; (xiii) Madurai-Kanyakumari Tollway Limited, (xiv) Nelamangala Devihalli Expressway Private Limited; (xv) Nanguneri-Kanyakumari Tollway Limited, (xvi) Salaipudhur-Madurai Tollway Limited, (xvii) Western UP Tollway Limited; and (xviii) Walayar Vadakkencherry Expressways Private Limited (collectively, "the **Initial Portfolio Assets**").

The details of the Initial Portfolio Assets as of the date of this Final Placement Memorandum are provided below:

*1. **Andhra Pradesh Expressway Limited ("APEL")***

Andhra Pradesh Expressway Limited is a public company incorporated on November 11, 2005 under the Companies Act, 1956 (CIN U63031DL2005PLC349200). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of APEL is ₹ 3,000,000,000 (divided into 50,000,000 equity shares of ₹ 10 each and 250,000,000 preference shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 11,90,00,600 (divided into 1,19,00,060 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. The shareholding pattern of APEL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	11,900,054	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Amit Bindal*^	1	Negligible
4.	Sandeep Lakhanpal*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Gaurav Malhotra*	1	Negligible
7.	Rohan Sharma*	1	Negligible
Total		**11,900,060**	**100**

**Nominee shareholder of the Trust.*
^ Jointly with Tarun Bindal.

*2. **DA Toll Road Private Limited ("DATRPL")***

DATRPL is a private limited company incorporated on May 26, 2010 under the Companies Act, 1956 (CIN U45203MH2010PTC203502). Its registered office is located at 6, 2nd Floor, Plot No 134, Birla Mansion, Nagindas Master Lane, Kala Ghoda, Fort, Mumbai 400 001. The authorised capital of DATRPL is ₹ 10,00,00,000 (divided into 1,00,00,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 9,01,80,000 (divided into 90,18,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by DATRPL, as at the date of this Final Placement Memorandum. The shareholding pattern of DATRPL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	9,017,999	99.99
2.	Sandeep Lakhanpal*	1	Negligible
Total		**9,018,000**	**100**

**Nominee shareholder of the Trust.*

*3. **Farakka Raiganj Highways Limited ("FRHL")***

FRHL is a public company incorporated on March 11, 2010 under the Companies Act, 1956 (CIN U45400MH2010PLC200733). Its registered office is located at 6, Floor 2nd, Plot No. 134, Birla Mansion, Nagindas Master Lane, Kala Ghoda, Fort, Mumbai 400 001. The authorised capital of FRHL is ₹ 2,60,00,00,000 (divided into 26,00,00,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 2,50,22,10,000 (divided into 25,02,21,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by FRHL, as at the date of this Final Placement Memorandum. The shareholding pattern of FRHL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	250,220,994	99.99
2.	Pankaj Vasani*	1	Negligible

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
3.	Amit Bindal*^	1	Negligible
4.	Sandeep Lakhanpal*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Gaurav Malhotra*	1	Negligible
7.	Rohan Sharma*	1	Negligible
Total		**250,221,000**	**100**

**Nominee shareholder of the Trust.*
^Jointly with Tarun Bindal.

*4. **Ghaziabad Aligarh Expressway Private Limited ("GAEPL")***

GAEPL is a private limited company incorporated on December 18, 2009 under the Companies Act, 1956 (CIN U70101DL2009PTC197148). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092 . The authorised capital of GAEPL is ₹ 1,940,000,000 (divided into 194,000,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 1,940,000,000 (divided into 194,000,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by GAEPL, as at the date of this Final Placement Memorandum. The shareholding pattern of GAEPL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	193,999,999	99.99
2.	Mridul Gupta*	1	Negligible
Total		194,000,000	100

**Nominee shareholder of the Trust.*

*5. **Hazaribagh Tollway Limited ("HTL")***

HTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45500DL2019FLC358748). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, OSE Commercial Block, Hotel Aloft, Asset No. 5B, Aerocity Hospitality District, New Delhi 110 092.The authorised capital of HTL is ₹ 90,000,000 (divided into 9,000,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 45,050,000 (divided into 4,505,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by HTL as at the date of this Final Placement Memorandum. The shareholding pattern of HTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust.	45,04,994	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**45,05,000**	**100**

**Nominee shareholder of the Trust.*

*6. **Jhansi – Lalitpur Tollway Limited ("JLTL")***

JLTL is a public company incorporated on December 17, 2019 under the Companies Act, 2013 (CIN U45100DL2019FLC358903). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of JLTL is ₹ 45,000,000 (divided into 4,500,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 22,185,000 (divided into 2,218,500 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by JLTL as at the date of this Final Placement Memorandum. The shareholding pattern of JLTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	2,218,494	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**2,218,500**	**100**

**Nominee shareholder of the Trust.*

*7. **Jaipur Mahua Tollway Limited ("JMTL")***

JMTL is a public company incorporated on March 18, 2005 under the Companies Act, 1956 (CIN U45200DL2005PLC288617).

Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of JMTL is ₹ 1,95,50,00,000 (divided into 19,55,00,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 1,31,05,10,260 (divided into 13,10,51,026 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by JMTL, as at the date of this Final Placement Memorandum. The shareholding pattern of JMTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	131,051,020	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Saurabh Bansal*	1	Negligible
6.	Mridul Gupta*	1	Negligible
7.	Vinay C. Sekar*	1	Negligible
Total		**131,051,026**	**100%**

**Nominee shareholder of the Trust.*

*8. **Jhansi – Vigakhet Tollway Limited ("JVTL")***

JVTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45309DL2019FLC358750). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of JVTL is ₹ 30,000,000 (divided into 3,000,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 14,520,000 (divided into 1,452,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by JVTL as at the date of this Final Placement Memorandum. The shareholding pattern of JVTL at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	1,451,994	99.99
2.	Pankaj Vasani *	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**1,452,000**	**100**

**Nominee shareholder of the Trust.*

*9. **Kanyakumari – Etturavattam Tollway Limited ("KETL")***

KETL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45209DL2019FLC358745). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of KETL is ₹ 75,000,000 (divided into 7,500,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 36,405,000 (divided into 3,640,500 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by KETL as at the date of this Final Placement Memorandum. The shareholding pattern of KETL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	3,640,494	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**3,640,500**	**100**

**Nominee shareholder of the Trust.*

*10. **Kotwa – Muzaffarpur Tollway Limited ("KMTL")***

KMTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45100DL2019FLC358749). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of KMTL is ₹ 95,000,000 (divided into 9,500,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 47,605,000 (divided into 4,760,500 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by KMTL as at the date of this Final Placement Memorandum. The shareholding pattern of KMTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	4,760,494	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**4,760,500**	**100**

**Nominee shareholder of the Trust.*

*11. **Lucknow – Raebareli Tollway Limited ("LRTL")***

LRTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45209DL2019FLC358746). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of LRTL is ₹ 55,000,000 (divided into 5,500,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 27,010,000 (divided into 2,701,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by LRTL as at the date of this Final Placement Memorandum. The shareholding pattern of LRTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	2,700,994	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**2,701,000**	**100**

**Nominee shareholder of the Trust.*

*12. **Mahua Bharatpur Expressways Limited ("MBEL")***

MBEL is a public company incorporated on March 23, 2005 under the Companies Act, 1956 (CIN U45203DL2005PLC329746). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of MBEL is ₹ 1,00,00,00,000 (divided into 10,00,00,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 99,36,00,000 (divided into 9,93,60,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by MBEL, as at the date of this Final Placement Memorandum. The shareholding pattern of MBEL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name**	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	99,333,994	99.97
2.	Madhucon Infra Limited	26,000	≈0.03
3.	Pankaj Vasani*	1	Negligible
4.	Amit Bindal*^	1	Negligible
5.	Sandeep Lakhanpal*	1	Negligible
6.	Vinay C. Sekar*	1	Negligible
7.	Gaurav Malhotra*	1	Negligible
8.	Rohan Sharma*	1	Negligible
Total		**99,360,000**	**100**

**Nominee shareholder of the Trust.*

***In accordance with Regulation 18(3)(a) of the InvIT Regulations, the Trust (acting through the Trustee), the Trustee, the Investment Manager, the Sponsors, MBEL and Madhucon Infra Limited ("**Madhucon**") have entered into a letter agreement dated November 22, 2022, pursuant to which Madhucon has agreed that it shall not act in any manner that prevent the Trust (acting through the Trustee), the Investment Manager or MBEL from complying with the provisions of applicable law, including the InvIT Regulations.*

^Jointly with Tarun Bindal

*13. **Madurai – Kanyakumari Tollway Limited ("MKTL")***

MKTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45100DL2019FLC358752). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of MKTL is ₹ 77,500,000 (divided into 7,750,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 38,255,000 (divided into 3,825,500 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by MKTL as at the date of this Final Placement Memorandum. The shareholding pattern of MKTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	3,825,494	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**3,825,500**	**100**

**Nominee shareholder of the Trust.*

*14. **Nelamangala Devihalli Expressway Private Limited ("NDEPL")***

NDEPL is a private limited company incorporated on November 20, 2017 under the Companies Act, 2013 (CIN U45100DL2017PTC326190). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of NDEPL is ₹ 100,000,000 (divided into 10,000,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 94,829,860 (divided into 9,482,986 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by NDEPL, as at the date of this Final Placement Memorandum. The shareholding pattern of NDEPL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	9,482,985	99.99
2.	Mridul Gupta*	1	Negligible
Total		**9,482,986**	**100**

**Nominee shareholder of the Trust.*

*15. **Nanguneri - Kanyakumari Tollway Limited ("NKTL")***

NKTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45309DL2019FLC358753). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of NKTL is ₹ 99,000,000 (divided into 9,900,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 50,185,000 (divided into 5,018,500 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by NKTL as at the date of this Final Placement Memorandum. The shareholding pattern of NKTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	5,018,494	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**5,018,500**	**100**

**Nominee shareholder of the Trust.*

*16. **Salaipudhur - Madurai Tollway Limited ("SMTL")***

SMTL is a public company incorporated on December 13, 2019 under the Companies Act, 2013 (CIN U45309DL2019FLC358747). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of SMTL is ₹ 7,00,00,000 (divided into 70,00,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 3,35,90,000 (divided into 33,59,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by SMTL as at the date of this Final Placement Memorandum. The shareholding pattern of SMTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	3,358,994	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**3,359,000**	**100**

**Nominee shareholder of the Trust.*

*17. **Western UP Tollway Limited ("WUPTL")***

WUPTL is a public company incorporated on April 20, 2005 under the Companies Act, 1956 (CIN U90000DL2005PLC310964). Its registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The authorised capital of WUPTL is ₹ 1,200,000,000 (divided into 120,000,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 1,148,752,040 (divided into 114,875,204 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by WUPTL, as at the date of this Final Placement Memorandum. The shareholding pattern of WUPTL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	114,875,198	99.99
2.	Pankaj Vasani*	1	Negligible
3.	Abhijit Sathe*	1	Negligible
4.	Nilesh Shukla*	1	Negligible
5.	Vinay C. Sekar*	1	Negligible
6.	Saurabh Bansal*	1	Negligible
7.	Mridul Gupta*	1	Negligible
Total		**114,875,204**	**100**

**Nominee shareholder of the Trust.*

*18. **Walayar Vadakkencherry Expressways Private Limited ("WVEPL")***

WVEPL is a private company incorporated on August 16, 2012 under the Companies Act, 1956 (CIN U45209TG2012PTC082527). Its registered office is located at 1st floor, 1-2-6 Domalguda, Himayatnagar, Hyderabad, Telangana 500 029. The authorised capital of WVEPL is ₹ 9,000,000 (divided into 900,000 equity shares of ₹ 10 each) and its issued, subscribed and paid-up capital is ₹ 9,000,000 (divided into 900,000 equity shares of ₹ 10 each), as at the date of this Final Placement Memorandum. No preference shares have been issued by WVEPL, as at the date of this Final Placement Memorandum. The shareholding pattern of WVEPL as at the date of this Final Placement Memorandum is provided below:

Sr. No.	Shareholder's Name	No. of Equity Shares	Percentage (%)
1.	Cube Highways Trust	899,999	99.99
2.	Sandeep Lakhanpal*	1	Negligible
Total		**900,000**	**100**

**Nominee shareholder of the Trust.*

Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units and Ordinary Units by the Sponsors

The Trust, acting through the Trustee, has acquired from the Sponsors and the other shareholders, and the Sponsors and the other shareholders have transferred to the Trust in exchange for Ordinary Units and the Initial Tranche Subordinate Units, the entire equity shareholding of each of the Initial Portfolio Assets (except for MBEL where Madhucon will continue to hold approximately 0.03% of the equity share capital, subject to compliance with the InvIT Regulations), pursuant to the Share Purchase Agreements, as set out below:

Sr. No.	Name of the Initial Portfolio Asset	Pre-Offer shareholding of the Sponsors or their affiliates and their respective nominees		Post-Offer shareholding of the Trust (together with its nominee shareholders)
		Name of Entity	Pre-Offer shareholding (in %)	
1.	APEL	CH-I	100	100
2.	DATRPL	CH-III	100	100
3.	FRHL	CH-II	100	100
4.	GAEPL	CH-I	100	100
5.	HTL	Cube Mobility	100	100
6.	JLTL	Cube Mobility	100	100
7.	JMTL	CH-I	100	100
8.	JVTL	Cube Mobility	100	100
9.	KETL	Cube Mobility	100	100
10.	KMTL	Cube Mobility	100	100
11.	LRTL	Cube Mobility	100	100

Sr. No.	Name of the Initial Portfolio Asset	Pre-Offer shareholding of the Sponsors or their affiliates and their respective nominees		Post-Offer shareholding of the Trust (together with its nominee shareholders)
		Name of Entity	Pre-Offer shareholding (in %)	
12.	MBEL	CH-I	99.97	99.97
13.	MKTL	Cube Mobility	100	100
14.	NDEPL	CH-ID	100	100
15.	NKTL	Cube Mobility	100	100
16.	SMTL	Cube Mobility	100	100
17.	WUPTL	CH-I	100	100
18.	WVEPL	CH-III	100	100

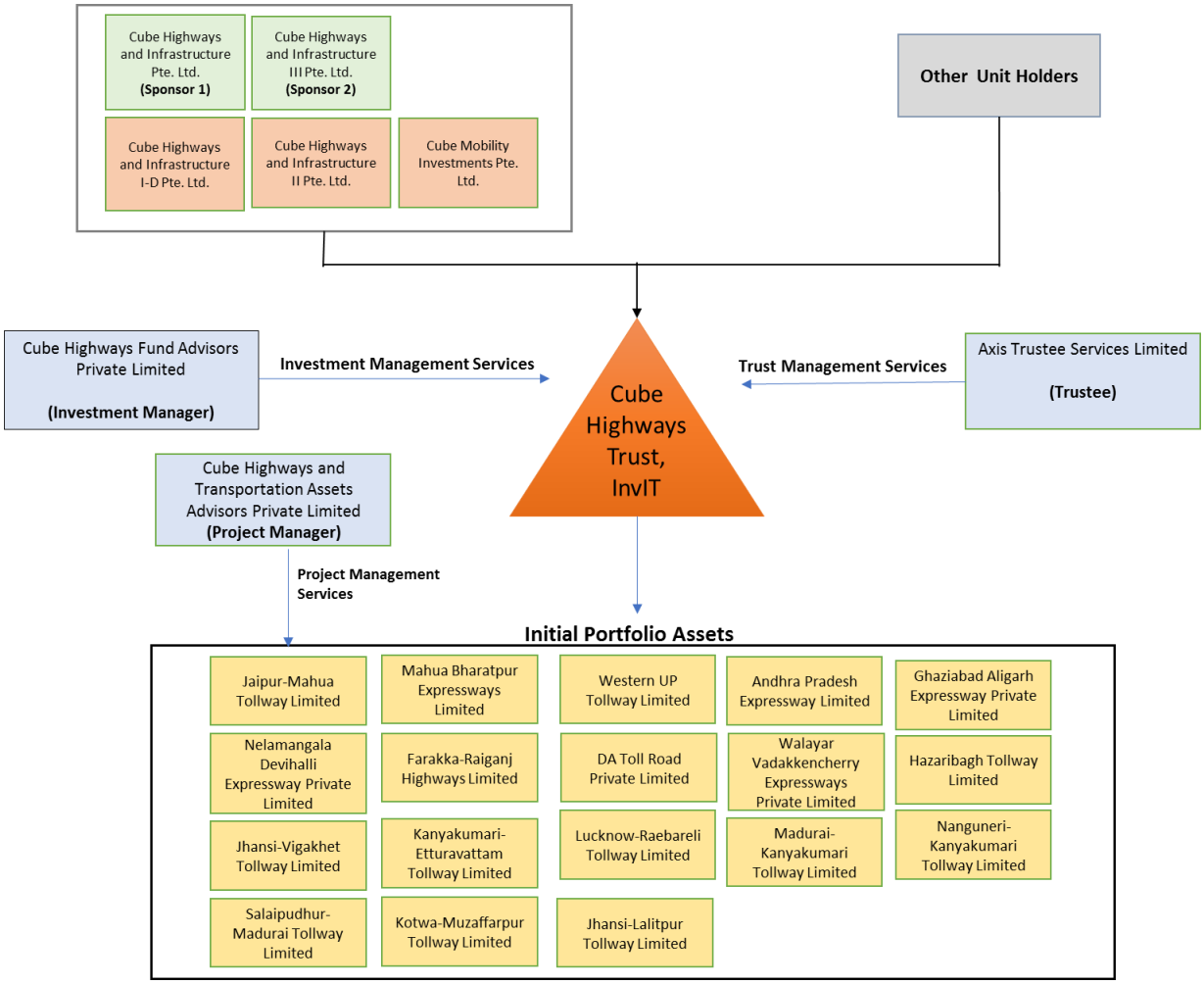
Utilisation of Issue Proceeds

Upon the Allotment and listing of the Ordinary Units, the Trust shall utilize the Issue Proceeds towards providing loans to certain Initial Portfolio Assets, by way of the Trust Loan Agreements, for (i) repayment or pre-payment of debt, availed by them from certain banks and financial institutions and the Cube Group (including all accrued interest), (ii) capital expenditure; and (iii) creation of debt service reserve account for the InvIT Loan, and for general purposes. For further details, please see the sections entitled "*Use of Proceeds*" and "*Financial Indebtedness and Deferred Payments*" on pages 229 and 232, respectively.

The Selling Unitholders will be entitled to the proceeds of the Offer for Sale. The Trust will not receive any proceeds from the Offer for Sale.

Proposed post-listing structure

The following structure illustrates the relationship between the Trust, the Trustee, the Sponsors, the Investment Manager, the Project Manager and the Unitholders as on the Listing Date:



**The Sponsors hold Subordinate Units and Ordinary Units. For further details in relation to the Subordinate Units, please see, "Information Concerning the Units" on page 226.*

SUMMARY OF COMBINED FINANCIAL STATEMENTS

The following tables set forth the summary financial information derived from the Audited Special Purpose Combined Financial Statements of the Trust and its Initial Portfolio Assets which were prepared in accordance with Ind AS read with the InvIT Regulations, as of and for the period ended October 31, 2022 and the Fiscals 2022, 2021 and 2020.

The degree to which the summary financial information included herein below will provide meaningful information is entirely dependent on the reader's level of familiarity with Indian accounting practices, Ind AS, the Companies Act and the InvIT Regulations. Accordingly, any reliance by persons not familiar with Indian accounting practices, Ind AS, the Companies Act and the InvIT Regulations on the summary financial information presented below should be limited.

The summary financial information derived from the Audited Special Purpose Combined Financial Statements, as presented below, should be read together with the section entitled "Discussion and Analysis by the Directors of the Investment Manager of the Financial Condition, Results of Operations and Cash Flows of the Initial Portfolio Assets of the Trust" on page 246 in conjunction with the section entitled "Audited Special Purpose Combined Financial Statements" on page 345.

(The remainder of this page is intentionally kept blank.)

CUBE HIGHWAYS TRUST
Special Purpose Combined Balance Sheet
(All amounts in ₹ million unless otherwise stated)

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
ASSETS				
Non-current assets				
Property, plant and equipment	156.12	166.93	110.13	50.46
Capital work-in-progress	4.45	3.94	13.82	0.58
Investment properties	7.35	7.35	7.35	7.92
Intangible assets	123,925.88	119,777.48	121,536.39	63,953.30
Intangible assets under development	416.12	7,260.76	10,422.91	9,706.31
Financial assets:				
Investments	0.01	0.01	0.01	-
Other financial assets	742.94	970.67	1,731.54	2,529.42
Deferred tax assets (net)	257.04	215.70	198.94	494.29
Current tax assets (net)	461.14	433.58	128.44	239.54
Other non-current assets	765.05	141.48	66.27	90.98
Total non-current assets	**126,736.10**	**128,977.90**	**134,215.80**	**77,072.80**
Current assets				
Inventories	119.75	41.84	23.02	12.98
Financial assets				
Investments	2,798.38	-	1,159.46	224.46
Trade receivables	798.08	751.21	755.54	658.89
Cash and cash equivalents	10,718.79	18,490.11	8,851.89	2,424.36
Bank balances other than cash and cash equivalents	3,435.88	2,633.84	4,284.98	3,907.77
Other financial assets	2,187.91	3,135.74	10,238.34	1,392.13
Current tax assets (net)	-	-	40.04	31.82
Other current assets	1,417.77	985.83	385.42	391.43
Total current assets	**21,476.56**	**26,038.57**	**25,738.69**	**9,043.84**
Assets held for sale	4.67	4.67	4.67	-
Total assets	**1,48,217.33**	**155,021.14**	**159,959.16**	**86,116.64**
EQUITY AND LIABILITIES				
EQUITY				
Capital	8,522.87	8,522.87	7,792.87	7,337.16
Other equity	(7,636.53)	(8,283.01)	(4,478.78)	2,923.95
Total equity	**886.34**	**239.86**	**3,314.09**	**10,261.11**
LIABILITIES				
Non-current liabilities				
Financial liabilities				
Borrowings	119,130.54	112,338.40	110,138.20	50,469.38
Trade payables				
- total outstanding dues of micro enterprises and small enterprises	0.41	6.04	1.65	0.96
- total outstanding dues of creditors other than micro enterprises and small enterprises	32.73	6.52	8.66	23.15
Other financial liabilities	4,777.49	3,335.10	1,615.73	809.51
Provisions	3,559.83	3,303.47	3,401.34	3,927.10
Deferred tax liabilities (net)	610.50	777.11	1,071.73	468.77

Total non-current liabilities	**128,111.50**	**119,766.64**	**116,237.31**	**55,698.87**
Current liabilities				
Financial liabilities				
Borrowings	6,122.31	17,502.62	13,156.01	9,533.58
Trade payables				
- total outstanding dues of micro enterprises and small enterprises	143.31	144.75	148.88	57.86
- total outstanding dues of creditors other than micro enterprises and small enterprises	2,490.04	1,876.01	2,465.72	1,687.61
Other financial liabilities	4,239.65	4,193.14	10,337.88	8,791.24
Other current liabilities	70.20	226.30	294.67	81.00
Provisions	6,153.98	11,071.82	12,964.96	5.37
Current tax liabilities (net)	-	-	1,039.64	-
Total current liabilities	**19,219.49**	**35,014.64**	**40,407.76**	**20,156.66**
Total liabilities	**147,330.99**	**154,781.28**	**156,645.07**	**75,855.53**
Total equity and liabilities	**148,217.33**	**155,021.14**	**159,959.16**	**86,116.64**

CUBE HIGHWAYS TRUST

Special Purpose Combined Statement of Profit and Loss
(All amounts in ₹ million unless otherwise stated)

	For the seven months period ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
Income				
Revenue from operations	14,180.96	20,550.40	16,285.19	13,270.92
Other income	378.36	1,021.91	513.40	622.26
Total income	**14,559.32**	**21,572.31**	**16,798.59**	**13,893.18**
Expenses				
Cost of construction	799.02	1,387.77	2,308.40	1,073.05
Operation and maintenance expenses	2,477.52	8,404.82	3,799.46	3,532.06
Employee benefit expenses	191.86	306.41	210.65	211.32
Other expenses	629.94	1,298.28	1,015.11	351.11
Total expenses	**4,098.34**	**11,397.28**	**7,333.62**	**5,167.54**
Earnings before finance costs, depreciation, amortisation, impairment, exceptional item and tax	**10,460.98**	**10,175.03**	**9,464.97**	**8,725.64**
Finance costs	7,934.11	13,940.24	10,417.46	6,837.75
Depreciation and amortisation expense	3,535.41	5,492.71	3,778.03	3,255.73
Impairment charge / (reversal) of impairment of intangible assets	-	(268.67)	167.40	156.09
Loss before exceptional item and tax	**(1,008.54)**	**(8,989.25)**	**(4,897.92)**	**(1,523.93)**
Exceptional item:				
Claims receivable on NHAI settlement	-	-	3,243.74	-
Loss before tax	**(1,008.54)**	**(8,989.25)**	**(1,654.18)**	**(1,523.93)**
Less: Tax expense/(income)				
Current tax	93.85	85.67	1,122.94	44.52
Deferred tax	(534.62)	(823.25)	(367.76)	(231.58)
	(440.77)	**(737.58)**	**755.18**	**(187.06)**
Profit/(Loss) for the period/year	**(567.77)**	**(8,251.67)**	**(2,409.36)**	**(1,336.87)**
Other comprehensive income				
Items that will not be reclassified to profit or loss				
Re-measurement (losses)/gains on defined benefit obligations	**(2.87)**	**(1.59)**	**18.94**	**(7.47)**
Income tax relating to these items	0.75	0.32	(4.65)	1.95
Total other comprehensive income/(loss) for the period/year	**(2.12)**	**(1.27)**	**14.29**	**(5.52)**
Total comprehensive profit/(loss) for the period/year	**(569.89)**	**(8,252.94)**	**(2,395.07)**	**(1,342.39)**

Cube Highways Trust
Special Purpose Combined Statement of Cash Flows
(All amounts in ₹ million unless otherwise stated)

	For the seven months period ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
A Cash flows from operating activities				
.				
Loss before tax	**(1,008.54)**	**(8,989.25)**	**(1,654.18)**	**(1,523.93)**
Adjustments for:				
Depreciation and amortisation expense	3,535.41	5,492.71	3,778.03	3,255.73
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	(0.15)	(2.12)	0.44	0.06
Net gain on sale of mutual funds	(1.99)	(95.49)	(11.12)	(7.11)
Net loss on investments/derivatives measured at fair value through profit or loss	0.33	29.64	92.81	39.08
Liabilities no longer required written back/ Remission of loan liability	(44.43)	(220.68)	(55.80)	(125.32)
Interest income	(307.33)	(420.59)	(284.95)	(183.12)
Claims for compensation/ concession extension	-	-	(576.30)	(41.19)
Impairment charge/ (reversal) of intangible assets and investment property (net)	-	(268.67)	167.87	157.50
Impairment loss allowance on financial assets (including write-offs)	1.08	44.82	46.19	17.23
Gain on cash flows changes on non - convertible debentures (net)	-	-	(19.38)	-
Finance costs (excluding derivative hedging cost)	7,921.94	13,910.60	10,316.38	6,797.55
Provision for damages	-	-	41.61	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	(96.75)	310.51
Operating cashflows before working capital changes and other adjustments	**10,096.32**	**9,480.97**	**11,744.85**	**8,696.99**
Working capital changes and other adjustments:				
Decrease/(Increase) in inventories	(77.91)	(18.80)	(10.04)	(2.73)
Decrease/(Increase) in trade receivables	(46.87)	(20.62)	(130.13)	188.46
Decrease/(Increase) in financial assets and non financial assets	818.51	3,353.13	(2,883.80)	(675.35)
(Decrease)/Increase in trade payables	677.44	(371.00)	1,120.34	379.76
(Decrease)/Increase in provisions	(4,356.86)	4,904.79	1,587.66	253.79
(Decrease)/Increase in financial liabilities and non financial liabilities	(889.18)	(7,314.79)	2,100.31	88.83
Cash flow generated from operating activities post working capital changes	**6,221.45**	**10,013.68**	**13,529.19**	**8,929.75**
Income tax (paid) / refund (net)	(120.02)	(1,385.88)	32.19	21.45
Net cash generated from operating activities (A)	**6,101.43**	**8,627.80**	**13,561.38**	**8,951.20**
B Cash flows from investing activities				
.				

Payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under developments (net) and advances for capital expenditure)	(1,645.90)	(9,375.92)	(59,726.08)	(1,116.11)
Proceeds from sale of property, plant and equipment	0.27	2.13	1.49	0.01
Proceeds from NHAI on settlement [Refer note 54(iii)]	-	5,253.91	-	-
Movement in bank balances (including deposits) not considered as cash and cash equivalents (net)	449.13	(306.07)	(1,506.65)	(2,163.60)
Investment in equity shares	-	-	(0.01)	-
Investment/(redemption) from mutual funds (net)	(2,784.55)	1,254.97	(915.62)	(206.22)
Interest received	296.07	409.28	221.34	136.03
Net cash used in investing activities (B)	**(3,684.98)**	**(2,761.70)**	**(61,925.53)**	**(3,349.89)**
C. Cash flows from financing activities				
Proceeds from share application money pending allotment	-	-	-	5.20
Proceeds from issue of capital (including security premium)	-	730.00	6,653.02	180.90
Payment for capital reduction [Refer note 21]	-	-	(600.00)	-
Proceeds from long term borrowings	14,306.79	42,184.30	69,458.25	730.00
Repayment of long term borrowings	(14,695.79)	(32,221.95)	(11,402.46)	(3,162.52)
Repayment /Proceeds from short term borrowings (net)	(3,134.24)	346.06	11.48	1,219.84
Interest paid (including interest capitalised)	(5,391.29)	(9,204.41)	(10,458.04)	(5,578.64)
Net cash generated from/(used in) financing activities (C)	**(8,914.53)**	**1,834.00**	**53,662.25**	**(6,605.22)**
D. Net increase/(decrease) in cash and cash equivalents (A+B+C)	**(6,498.08)**	**7,700.10**	**5,298.10**	**(1,003.91)**
E. Cash and cash equivalents at the beginning of the period/ year	14,780.62	7,080.52	1,782.42	2,786.33
Cash and cash equivalents at the end of the period/ year (D+E) (Refer reconciliation below)	**8,282.54**	**14,780.62**	**7,080.52**	**1,782.42**
Reconciliation of cash and cash equivalents as per Statement of Cash Flows				
Cash and cash equivalents as per above comprise of following:				
Cash and cash equivalents [Refer note 15]	10,718.79	18,490.11	8,851.89	2,424.36
Less: Earmarked balances [Refer note 15]	(2,436.25)	(3,709.49)	(1,771.37)	(641.94)
Balance as per Special Purpose Combined Statement of Cash Flows	**8,282.54**	**14,780.62**	**7,080.52**	**1,782.42**

Note:

The above cash flows has been prepared under the 'Indirect Method' as set out in Ind AS 7, 'Statement of Cash Flows'.

SUMMARY OF FINANCIAL INFORMATION OF THE SPONSORS

The following tables set forth the summary financial information derived from the audited financial statements of the Sponsor which were prepared in accordance with the IFRS, as of and for the years ended December 31, 2021, December 31, 2020 and December 31, 2019.

The summary financial information of the Sponsors is included in this Final Placement Memorandum as per the requirements of the InvIT Regulations.

The degree to which the summary financial information included herein below will provide meaningful information is entirely dependent on the reader's level of familiarity with IFRS. Accordingly, any reliance by persons not familiar with the same on the summary financial information presented below should be limited.

(*This page has been left intentionally blank*)

CUBE HIGHWAYS AND INFRASTRUCTURE PTE. LTD.
Statement of profit or loss and other comprehensive income for the year ended 31 December 2021, 31 December 2020 and 31 December 2019

(All amounts in USD, unless otherwise stated)

	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Income			
Dividend income	13,500,000	1,311,998	6,364,910
Interest income	-	70	26,144
Other income	494,467	480,792	472,013
Net realised gains on financial assets at fair value through profit or loss	-	5,397,056	-
Net unrealised losses on financial assets at fair value through profit or loss	(17,350,382)	(123,280,938)	(2,094,855)
Net foreign currency gains/ (losses)	(8,957)	5,899	2,922
Total operating income	**(3,364,872)**	**(116,085,123)**	**4,771,134**
Management fees	(494,467)	(480,792)	(472,013)
Deal costs	(1,269,633)	(491,923)	(2,376,199)
Finance costs	(1,006,323)		
Other operating expenses	(1,217,890)	(635,057)	(978,829)
Total operating expenses	**(3,988,313)**	**(1,607,772)**	**(3,827,041)**
Profit/(loss) before income tax	**(7,353,185)**	**(117,692,895)**	**944,093**
Income tax expense	-	-	-
Profit/(loss) for the year	**(7,353,185)**	**(117,692,895)**	**944,093**
Other comprehensive income/(loss)	**-**	**-**	**-**
Total comprehensive income/(loss) for the year	**(7,353,185)**	**(117,692,895)**	**944,093**

CUBE HIGHWAYS AND INFRASTRUCTURE PTE. LTD
Statement of financial position as at 31 December 2021, 31 December 2020 and 31 December 2019
(All amounts in USD, unless otherwise stated)

	As at December 31, 2021	As at December 31, 2020	As at December 31, 2019	As at January 1, 2019
ASSETS				
Non-current assets				
Financial asset at fair value through profit or loss	631,595,052	508,129,556	732,808,953	632,124,352
Total non current assets	**631,595,052**	**508,129,556**	**732,808,953**	**632,124,352**
Current assets				
Cash and cash equivalents	13,146,008	1,178,124	655,793	6,820,775
Derivative financial instruments	-	127,727	-	-
Amount due from subsidiary	-	-	198,509	1,769,009
Amount due from immediate holding company	126,126	120,203	-	841,114
Amount due from related parties	9,526	-	142,536	-
Other current assets	187,864	250,861	482,289	250,496
Total current assets	**13,469,524**	**1,676,915**	**1,479,127**	**9,681,394**
Total assets	**645,064,576**	**509,806,471**	**734,288,080**	**641,805,746**
LIABILITIES				
Current liabilities				
Other payables	127,231,464	196,171	99,093,025	288,376
Amount due to immediate holding company	-	-	148,586	-
Amount due to related parties	134,972	128,999	-	839,389
Derivative financial instruments	-	127,727	-	-
Loan from shareholder	2,572,751	-	-	-
Non current liabilities				
Loan from shareholder	13,125,000	-	-	-
	143,064,187	452,897	99,241,611	1,127,765
Total liabilities	**143,064,187**	**452,897**	**99,241,611**	**1,127,765**
Net assets	**502,000,389**	**509,353,574**	**635,046,469**	**640,677,981**
EQUITY				
Share capital	302,107,145	302,107,145	302,107,145	302,107,145
Retained earnings	199,893,244	207,246,429	332,939,324	338,570,836
Total equity	**502,000,389**	**509,353,574**	**635,046,469**	**640,677,981**

CUBE HIGHWAYS AND INFRASTRUCTURE PTE. LTD.
Statement of cash flows for the year ended 31 December 2021, 31 December 2020 and 31 December 2019
(All amounts in USD, unless otherwise stated)

	For the year ended December 31, 2021	For the year ended December 31, 2020	For the year ended December 31, 2019
Cash flows from operating activities:			
Profit/(loss) for the year	**(7,353,185)**	(117,692,895)	944,093
Adjustments for-			
Dividend income	(13,500,000)	(1,311,998)	(6,364,910)
Finance cost	1,006,323	-	-
Operating cash flows before working capital changes	**(19,846,862)**	**(119,004,893)**	**(5,420,817)**
Working capital adjustments:			
Increase/(decrease) in trade and other payables	127,035,293	(98,896,854)	98,804,649
(Increase)/decrease in other current assets	62,997	231,428	(231,793)
(Increase)/decrease in amount due from subsidiaries	-	198,509	1,570,500
(Increase)/decrease in amount due from immediate holding company	(5,923)	(120,203)	841,114
Increase/(decrease) in amount due to immediate holding company	-	(148,586)	148,586
(Increase)/decrease in amount due from related parties	(9,526)	142,536	(142,536)
Increase/(decrease) in amount due to related parties	5,973	128,999	(839,389)
Increase/(decrease) in financial assets at fair value through profit or loss	(123,465,496)	224,679,397	(100,684,601)
Cash used in operations	**(16,223,544)**	**7,210,333**	**(5,954,287)**
Dividend received	13,500,000	1,311,998	6,364,910
Income taxes paid (net off refunds)	-	-	-
Net cash (used in)/generated from operating activities	**(2,723,544)**	**8,522,331**	**410,623**
Cash flows from financing activities			
Loan from shareholder	15,000,000	-	-
Loan interest paid	(308,572)	-	-
Dividends Paid	-	(8,000,000)	(6,575,605)
Net cash flows from/(used in) financing activities	**14,691,428**	**(8,000,000)**	**(6,575,605)**
Net increase/(decrease) in cash and cash equivalents	**11,967,884**	**522,331**	**(6,164,982)**
Cash and cash equivalent at the beginning of the period	1,178,124	655,793	6,820,775
Effect of exchange differences on restatement of foreign currency cash and cash equivalents	-	-	-
Cash and cash equivalent at the end of the period	**13,146,008**	**1,178,124**	**655,793**

CUBE HIGHWAYS AND INFRASTRUCTURE III PTE. LTD.

Statement of profit or loss and other comprehensive income for the year ended 31 December 2021, 31 December 2020 and 31 December 2019

(All amounts in USD, unless otherwise stated)

	Year ended December 31, 2021	Year ended December 31, 2020	Year ended December 31, 2019
Income			
Interest income	-	2,368	20,308
Other income	372,539	170,000	170,000
Net realised gains on financial assets at fair value through profit or loss	3,014,639	-	-
Net unrealised gains on financial assets at fair value through profit or loss	35,030,103	210,044,510	-
Net foreign currency gains / (losses)	(86,267)	1,968	83
Total operating income	**38,331,014**	**210,218,846**	**190,391**
Management fees	(372,539)	(170,000)	(170,000)
Deal costs	(2,823,253)	(3,624,811)	(1,270,937)
Other operating expenses	(389,848)	(322,603)	(277,964)
Total operating expenses	**(3,585,640)**	**(4,117,414)**	**(1,718,901)**
Profit/(loss) before income tax	**34,745,374**	**206,101,432**	**(1,528,510)**
Income tax expense	-	-	-
Profit/(loss) for the year	**34,745,374**	**206,101,432**	**(1,528,510)**
Other comprehensive income/(loss)	-	-	-
Total comprehensive income/ (loss) for the year	**34,745,374**	**206,101,432**	**(1,528,510)**

CUBE HIGHWAYS AND INFRASTRUCTURE III PTE. LTD.

Statement of financial position as at 31 December 2021, 31 December 2020 and 31 December 2019

(All amounts in USD, unless otherwise stated)

	As at December 31, 2021	As at December 31, 2020	As at December 31, 2019	As at January 1, 2019
ASSETS				
Non-current assets				
Financial asset at fair value through profit or loss	580,652,022	432,062,911	-	-
Total non current assets	**580,652,022**	**432,062,911**	-	-
Current assets				
Amount due from immediate holding company	96,408	42,500	33,575	-
Amount due from related parties	-	-	21,807	-
Derivative financial instruments	-	132,743	-	-
Cash and cash equivalents	6,892,474	1,595,275	1,289,433	2,507,712
Other current assets	430,808	946,805	69,444	23,521
Total current assets	**7,419,690**	**2,717,323**	**1,414,259**	**2,531,233**
Total assets	**588,071,712**	**434,780,234**	**1,414,259**	**2,531,233**
LIABILITIES				
Current liabilities				
Amount due to immediate holding company	-	-	-	177,718
Amount due to related parties	103,194	151,219	65,550	354,126
Trade and other payables	460,261	733,389	687,258	39,122
Derivative financial instruments	-	132,743	-	-
Other current Liabilities	-	181,000,000	-	-
Total current liabilities	**563,455**	**182,017,351**	**752,808**	**570,966**
Total liabilities	**563,455**	**182,017,351**	**752,808**	**570,966**
Net assets	**587,508,257**	**252,762,883**	**661,451**	**1,960,267**
EQUITY				
Share capital	348,729,694	48,729,694	2,729,694	2,500,000
Retained earnings	238,778,563	204,033,189	(2,068,243)	(539,733)
Total equity	**587,508,257**	**252,762,883**	**661,451**	**1,960,267**

CUBE HIGHWAYS AND INFRASTRUCTURE III PTE. LTD.
Statement of cash flows for the year ended 31 December 2021, 31 December 2020 and 31 December 2019
(All amounts in USD, unless otherwise stated)

	For the year ended December 31, 2021	For the year ended December 31, 2020	For the year ended December 31, 2019
Cash flows from operating activities:			
Profit/(loss) for the year	34,745,374	206,101,432	(1,528,510)
Adjustments for-	-	-	-
Operating cash flows before working capital changes	**34,745,374**	**206,101,432**	**(1,528,510)**
Working capital adjustments:			
Increase/ (decrease) in trade and other payables	(273,128)	46,131	648,136
(Increase)/ decrease in other current assets	515,997	(877,361)	(45,923)
(Increase) in amount due from immediate holding company	(53,908)	(8,925)	(33,575)
(Increase)/decrease in amount due from related parties	-	21,807	(21,807)
(Decrease) in amount due to immediate holding company	-	-	(177,718)
Increase/(decrease) in amount due to related parties	(48,025)	85,669	(288,576)
(Increase) in financial assets at fair value through profit or loss	(148,589,111)	(432,062,911)	-
	(113,702,801)	**(226,694,158)**	**(1,447,973)**
Income taxes paid (net off refunds)	-	-	-
Net cash used in operating activities (A)	**(113,702,801)**	**(226,694,158)**	**(1,447,973)**
Cash flows from financing activities			
Proceeds from issue of ordinary shares	30,000,000	4,600,000	22,969
Proceeds from issue of redeemable convertible preference shares	270,000,000	41,400,000	206,725
Share application money received in advance	(181,000,000)	181,000,000	-
Net cash flows from financing activities (B)	**119,000,000**	**227,000,000**	**229,694**
Net increase/(decrease) in cash and cash equivalents (A+B)	**5,297,199**	**305,842**	**(1,218,279)**
Cash and cash equivalent at the beginning of the period	1,595,275	1,289,433	2,507,712
Cash and cash equivalent at the end of the period	**6,892,474**	**1,595,275**	**1,289,433**
	-	-	-

SUMMARY OF FINANCIAL INFORMATION OF THE INVESTMENT MANAGER

The following tables set forth the summary financial information derived from the audited financial statements of the Investment Manager, which was prepared in accordance with Indian GAAP, as of and for the Fiscal 2022. The Investment Manager completed its first financial year on March 31, 2022.

The summary financial information of the Investment Manager is included in this Final Placement Memorandum as per the requirements of the InvIT Regulations.

The degree to which the summary financial information included herein below will provide meaningful information is entirely dependent on the reader's level of familiarity with Indian accounting practices, Ind AS, the Companies Act and the InvIT Regulations. Accordingly, any reliance by persons not familiar with Indian accounting practices, Ind AS, the Companies Act and the InvIT Regulations on the summary financial information presented below should be limited.

(*This page has been left intentionally blank*)

Cube Highways Fund Advisors Private Limited
CIN: U74999DL2021FTC379941
Balance Sheet as at March 31, 2022
(All amounts in ₹ lacs unless otherwise stated)

Particulars	As at March 31, 2022
Equity and Liabilities	
Shareholders' funds	
Share capital	1,465.00
Reserves and surplus	(60.52)
	1,404.48
Non-current liabilities	
Long-term provisions	73.86
Current liabilities	
Trade payables	
-total outstanding dues of micro enterprises and small enterprises; and	0.24
-total outstanding dues of creditors other than micro enterprises and small enterprises	72.85
Other current liabilities	19.99
Short-term provisions	6.44
	99.52
Total	**1,577.86**
Assets	
Non Current assets	
Deferred Tax Assets (net)	15.15
	15.15
Current assets	
Cash and cash equivalents	1,088.70
Short-term loans and advances	83.28
Other current assets	390.73
	1,562.71
Total	**1,577.86**

Cube Highways Fund Advisors Private Limited
CIN: U74999DL2021FTC379941
Statement of Profit and Loss for the period April 12, 2021 (Date of incorporation) to March 31, 2022
(All amounts in ₹ lacs unless otherwise stated)

Particulars	From April 12, 2021 (Date of incorporation) to March 31, 2022
Revenue	
Revenue from operations	120.82
Other income	13.83
Total income	**134.65**
Expenses	
Employee benefits expense	174.00
Other expenses	36.32
Total expenses	**210.32**
Loss before tax	**(75.67)**
Tax expense	
- Current tax	-
- Deferred tax credit	(15.15)
Total tax expense	**(15.15)**
Loss for the period	**(60.52)**
Earnings per equity share [Nominal value per share ₹ 10- Absolute value]	
Basic (₹)	**(0.68)**
Diluted (₹)	**(0.68)**

Cube Highways Fund Advisors Private Limited

CIN: U74999DL2021FTC379941

Cash Flow Statement for the period April 12, 2021 (Date of incorporation) to March 31, 2022

(All amounts in ₹ lacs unless otherwise stated)

Particulars	For the period April 12, 2021 (Date of incorporation) to March 31, 2022
A. Cash flow from Operating Activities	
Loss before tax	**(75.67)**
Adjustments for:	
Interest income on bank deposits	(13.83)
	(13.83)
Operating loss before working capital changes	**(89.50)**
Changes in working capital:	
Increase in Trade payables	73.09
Increase in Other current liabilities	19.99
(Increase) in Short-term loans and advances	(81.90)
(Increase) in Other current assets	(389.03)
Increase in Provisions	80.30
Cash used in operations	**(387.05)**
Income-tax paid (net)	(1.38)
Net cash used in operating activities (A)	**(388.43)**
Cash flow from investing activities	
Interest received	12.13
Net cash from investing activities (B)	**12.13**
Cash flow from financing activities	
Proceeds from issue of equity shares	1,465.00
Net cash from financing activities (C)	**1,465.00**
Net increase in cash and cash equivalents (A+B+ C)	1,088.70
Cash and cash equivalents at the beginning of the period	-
Cash and cash equivalents at the end of the period	**1,088.70**
Cash and cash equivalents comprise of:	
Balances with Bank	
– In current accounts	21.59
– In deposits accounts (with original maturity of less than 3 months)	1,067.11
	1,088.70

Notes:

1. The above Cash Flow Statement has been prepared under the indirect method set out in Accounting Standard - 3 "Cash Flow Statement" notified under section 133 of the Companies Act, 2013.

2. Figures in brackets indicate cash outflow.

SUMMARY OF INDUSTRY

Unless otherwise stated, the information contained in this section is derived from the CRISIL Report. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry publications are also prepared based on information available as of specific dates and may no longer be current or reflect current trends. Accordingly, investment decisions should take these limitations into account. All references to years refer to calendar years except as otherwise stated. References to Indian fiscal years are to the one-year period ending March 31 of the named year.

Overview of the Indian Economy

India's Gross Domestic Product ("**GDP**") grew at a CAGR of 5.4%, growing to ₹ 147 trillion in Fiscal Year 2022 from ₹ 87 trillion in Fiscal Year 2012. Fiscal Year 2021 was a significant aberration from this trajectory, primarily on account of the COVID-19 pandemic. At approximately ₹ 136 trillion in Fiscal Year 2021, India's GDP (in absolute terms) was below the Fiscal Year 2019 level of approximately ₹ 140 trillion.

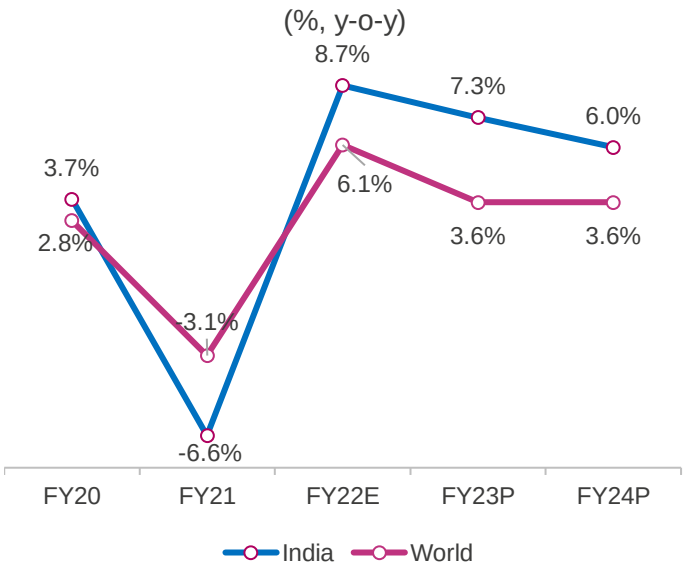
After contracting in the first half of Fiscal Year 2021 due to the COVID-19 pandemic, the economy rebounded in the second half of the year. The economy got into recovery mode, with GDP expanding 20.1% on-year in the first quarter of Fiscal Year 2022, 8.4% in the second quarter and 5.4% in the third quarter before slowing to 4.1% in the fourth quarter primarily due to a sharp decline in private final consumption expenditure.

Outlook for GDP growth in India

Fiscal Year 2022 GDP growth at 8.7%

Fiscal Year 2022 had been a story of two halves — the first half characterised by a base effect-driven recovery amid the challenges associated with resurgence in COVID-19 infections, and the second half seeing a more broad-based growth, as vaccine rollout and less stringent nationwide restrictions supporting lagging sectors. The gains made by the economy in the fourth quarter of Fiscal Year 2021 had evaporated in the first quarter of Fiscal Year 2022 on account of the fierce second wave, which led to localised lockdowns in most states. As per the provisional estimates released by the National Statistical Office, India's real GDP grew at 8.7% in Fiscal Year 2022, compared with 8.9% estimated in February.

India is expected to surpass global GDP growth in the next two fiscal years as represented below:



CRISIL EXPECTS INDIA'S GDP TO GROW AT 7.3% IN FISCAL YEAR 2023, GROWING FASTER THAN THE WORLD BACKED BY BROAD BASING OF ECONOMIC ACTIVITY, ESPECIALLY THE UPTICK IN THE CONTACT INTENSIVE SERVICES AND FORECAST OF A NORMAL MONSOON LENDING THE MUCH NEEDED SUPPORT TO GROWTH THIS FISCAL.

Note: Forecasts for World are for calendar year; Fiscal Year 2020 corresponds to 2019 and so on; P: Projected; India numbers for Fiscal Year 2020, 2021 and 2022 are based on Ministry of Statistics and Programme Implementation's latest GDP estimates and Fiscal Year 2023 onwards are CRISIL Research's forecast. World GDP growth rates are from IMF world economic outlook update as of April 2022.

Overview of the Infrastructure Sector in India

Developing and modernising the infrastructure sector has been a priority area for the GoI and has witnessed increasing public investments and budgetary support. Further, the government has also undertaken several reforms and initiatives in the infrastructure sector which has resulted in robust secular growth in most of the segments within the sector. Road

construction by NHAI registered a strong pace, growing to 4,673 kms 12.8 km per day in Fiscal Year 2022 from 3,071 kms (8.4 kms per day) in Fiscal Year 2018. The investment in roads and highways sector has risen from ₹ 1.7 trillion in Fiscal Year 2018 to ₹ 2.9 trillion in Fiscal Year 2022, registering a rise of more than 1.7 times during such period. Civil aviation has witnessed strong growth as well. India's air passenger traffic grew at a CAGR of approximately 8% from around 265 million in Fiscal Year 2017 to around 341 million in Fiscal Year 2020 before declining to 115 million in Fiscal Year 2021 majorly led by restrictions on account of the pandemic. In Fiscal Year 2022 passenger traffic increased to 180 million. In ports and shipping sector, the installed capacity of major ports in India rose to 2,346 million tonnes in Fiscal Year 2021 as compared to 1,869 million tonnes in Fiscal Year 2017.

National Infrastructure Pipeline ("**NIP**") has been launched by the GoI for Fiscal Year 2020 to 2025, to boost infrastructure. As per the Final Report of NIP Task Force, the NIP is expected to have an investment of ₹ 111 trillion during the Fiscal Years 2020 to 2025. Investments in energy (24%), roads (18%), urban (17%), and railways (12%) will account for over 70% of the projected capital expenditure during the said period. As per the economic survey, NIP will be funded by the Central Government (39%), State Government (40%), and the private sector (21%). As per the official India investment grid website accessed on June 20, 2022, 2,420 projects are currently under development covering over 34 sub sectors.

The Government of India set up the Public Private Partnership Appraisal Committee ("**PPPAC**") responsible for the appraisal of public-private partnership ("**PPP**") projects. During Fiscal Year 2020, PPPAC recommended four projects with a total project cost of ₹ 50.41 billion. Of these four projects, two were tourism related projects, one was a railways project pertaining to upgradation of railway stations and one was a port expansion project. In Fiscal Year 2021, PPPAC recommended six projects with total project cost of ₹ 444 billion. Of these six projects, three were railway sector projects, one was a Ministry of Home Affairs project (eco-tourism projects), one was a Ministry of Shipping project and one was a telecom project pertaining to deployment of Bharat Net optical fibre. Further, in Fiscal Year 2022, PPPAC approved 3 projects worth ₹ 316 billion, of which two are railways projects and one is a Ministry of Home Affairs project.

In Fiscal Year 2021, the GoI approved the continuation of the revamped Infrastructure Viability Gap Funding ("**VGF**") scheme till Fiscal Year 2025. The objective of the revamped VGF scheme is to attract PPP projects and facilitate the private investment in social sectors such as, health, education, waste water and solid waste management and water supply.

Review of Roads Infrastructure in India

The share of road transport in India's GDP has been stable at approximately 3.3% from Fiscal Years 2012 to 2020 and stood at 2.6% in Fiscal Year 2021.

Road Network in India

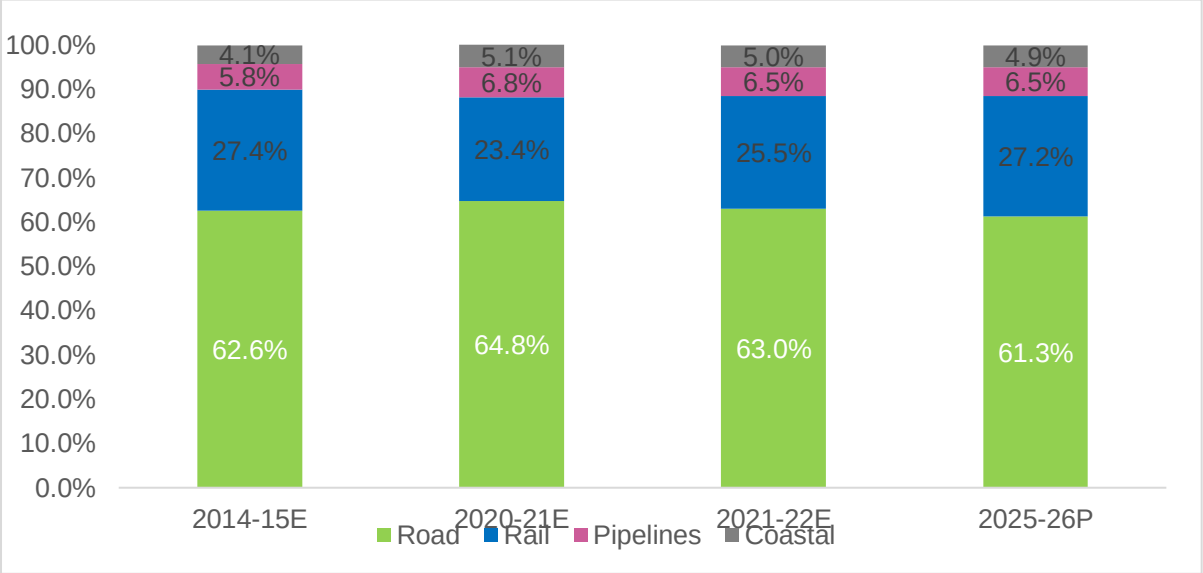
India has the second-largest road network in the world, spanning 6.372 million km as of Fiscal Year 2022. Road transportation, the most frequently used mode of transportation in India, accounts for approximately 86% of passenger traffic and approximately 64% of freight traffic as of Fiscal Year 2022. Although Indian national highways span nearly 140,995 km, constituting just 2% of road length, they accounted for about 40% of total road traffic in Fiscal Year 2022. The secondary system of roads comprises of state roads and major district roads, which accounted for the remaining 60% of traffic and 98% of road length. A detailed break-down of national highways, state and rural roads is as follows:

(in km)

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY 22
National highways	97,991	101,011	114,158	126,350	132,500	132,995	136,440	140,995
State highways	167,109	176,166	175,036	186,908	186,528	194,900	176,818	171,039
Other roads	5,207,044	5,326,116	5,608,477	5,902,539	6,067,269	6,165,660	5,902,539	6,059,813
Total	**54,72,144**	**56,03,293**	**58,97,671**	**62,15,797**	**63,86,297**	**64,93,555**	**6,215,797**	6,371,847

Indian freight traffic analysis

Roads are expected to continue having a dominant share in the overall freight movement. In Fiscal Year 2022, roads are estimated to have a share of approximately 63% in overall freight movement as compared to approximately 26% of rail mode of transport. According to CRISIL, road freight traffic is expected to grow at a CAGR of 4-6% (in billion tonne kilometers ("**BTKM**")) between Fiscal Years 2022 and 2026. A bar chart representing the share of roads in total freight movement (in BTKM) is as follows:

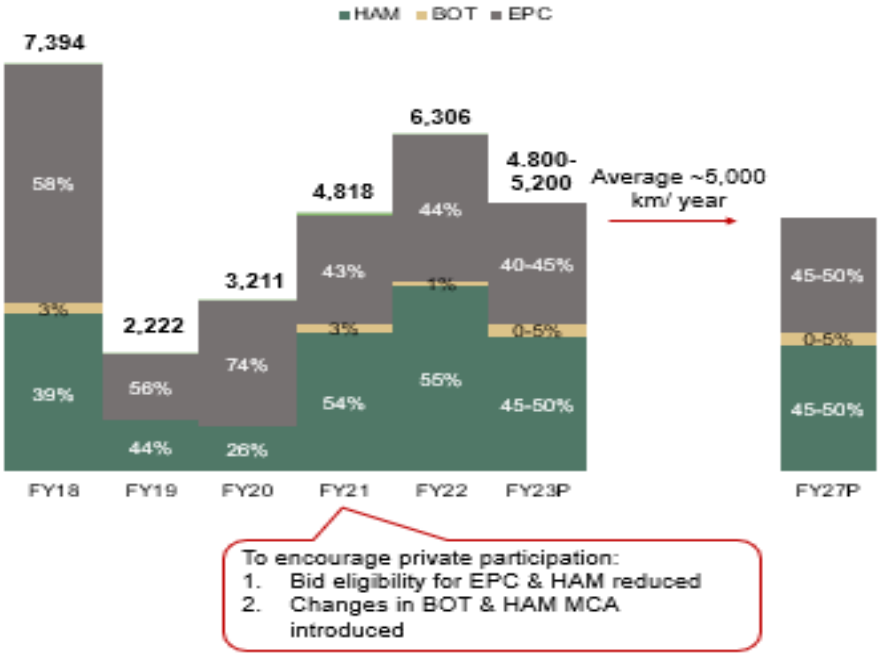


Note: E: Estimated; P: Projected

Review and outlook of investments in national highways

According to CRISIL, the awarding momentum is likely to moderate. In order to revive the roads sector, amidst the pandemic-led disruption – NHAI awarded 4,818 kms in Fiscal Year 2021, a three-year high. Of these, 54% were awarded under the HAM, 3% under the BOT mode and rest under the EPC mode. Favourable changes in the BOT and HAM agreements, and relaxation of bidder eligibility criteria indicated a clear policy shift last fiscal year to improve private-sector participation.

Fiscal Year 2022 witnessed even higher awarding, with NHAI awarding 6,306 kms with 55% projects under HAM. The awarding momentum is expected to moderate over the medium term at approximately 5,000 km per year with similar share of HAM, EPC and BOT, as shown in the graph below:



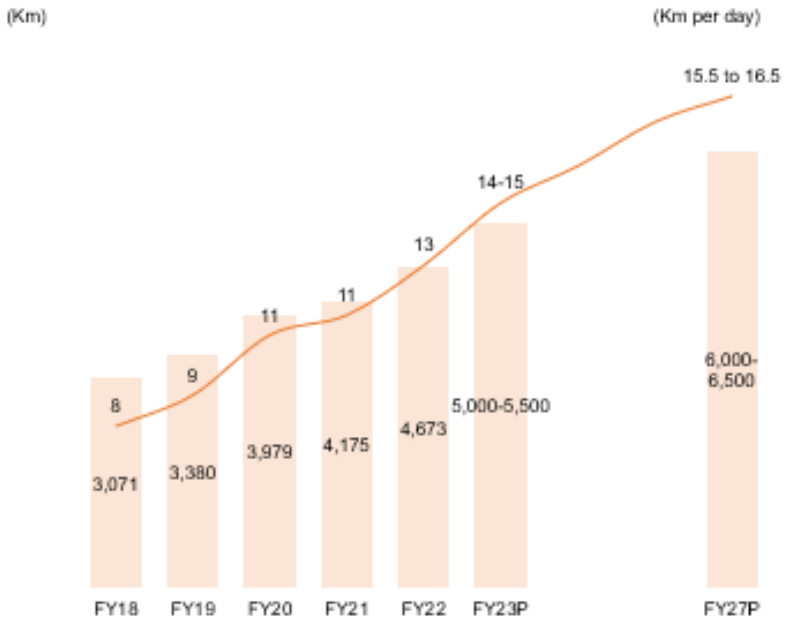
P: Projected

Further, developers will be able to free up capital through stake sales supported by the strong pipeline of projects under Bharatmala Pariyojana and the NIP. Furthermore, despite the lockdowns and labour-related issues, developers made up for lost time and construction at NHAI projects rose 5% on-year to 4,175 kms in Fiscal Year 2021. Given the acceleration in project awards, sharper focus on resolving land acquisition issues, and the 'Atmanirbhar Bharat' initiatives to ease liquidity (monthly milestone payments, release of retention money, reduction in performance security and extension of 3-6 months in milestones and Scheduled Commercial Operation Date) for EPC road players, the pace of construction should continue to increase steadily.

As COVID-19 hit India, and the first lockdown was imposed on March 25, 2020, road construction activities came to a standstill. While some resumption was allowed from April 20, 2021 itself, normalcy returned post monsoons. Shortage of labour and mobilization of raw materials were some of the biggest challenges developers were facing during the lockdown amidst the fear of the virus spread.

By the time the nationwide lockdown was announced, highway construction under NHAI in Fiscal Year 2020 was already at 3,979 km, 18% higher than the 3,380 km constructed in Fiscal Year 2019. A shift in focus to swifter execution has paid off for NHAI. In Fiscal Year 2022, NHAI constructed 4,673 kms, 12% higher due to swifter focus on execution.

CRISIL Research expects Fiscal Year 2023 NHAI construction to be in the range of 5,000-5,500 kms and to rise steadily to approximately 16 km per day by Fiscal Year 2027 as shown in the chart below:



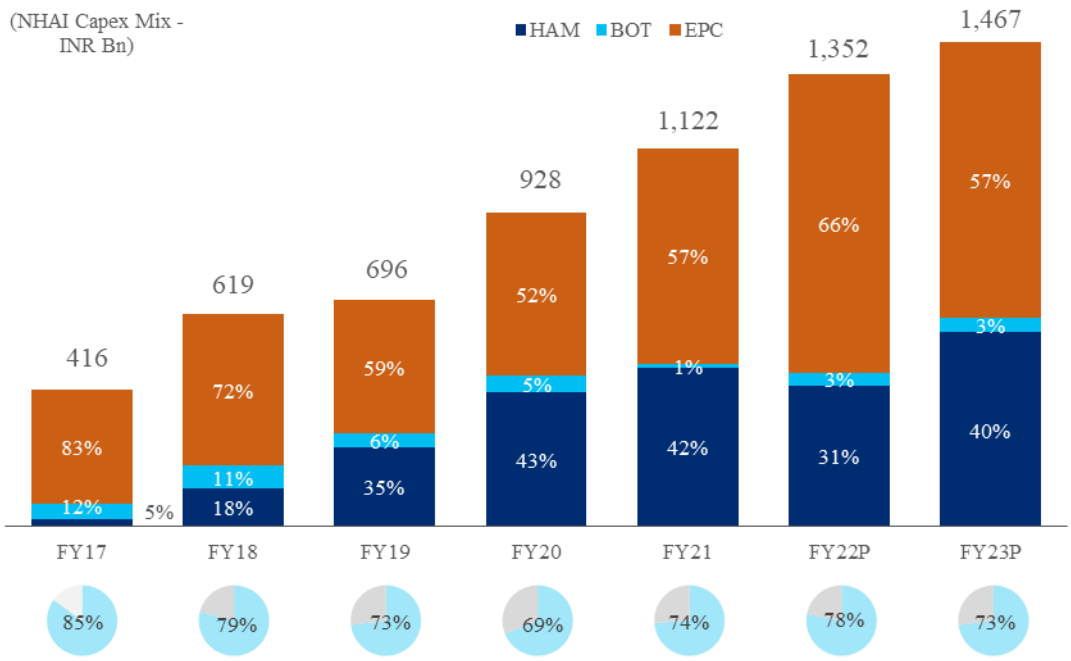
Policy push for HAM enabled higher share in awarding concessions

The Ministry of Road Transport and Highways and NHAI, post multiple suggestions from various stakeholders have amended the HAM Model Concession Agreement across the below mentioned parameters in October 2020. These are largely aimed to protect developers' returns and ease their liquidity. A summary of the changes to HAM Model Concession Agreement and their impact is presented below:

	Old Clause	Revised Clause	Impact
Annuity Payments	Interest on annuity payment linked to RBI determined Bank Rate +3%	Interest on annuity payment linked to average of one year MCLR of top 5 Scheduled Commercial banks + 1.25%	Differential between cost of borrowing and interest on annuity reduced, thus preventing erosion of developers' returns due to RBI repo rate changes
Milestone Payments	5 instalments, each equal to 8% of the Bid Project Cost	10 instalments, each equal to 4% of the Bid Project Cost	Quicker payments helping developers' liquidity
Change in ownership	Original sponsor / concessionaire shall hold at least 26% of equity during construction period and 2 years thereafter	Original sponsor / concessionaire shall hold at least 26% of equity during construction period and 6 months thereafter	Quicker stake sell-off would ease up developers' balance sheets to bid for new projects
Financial Closure	No clarity on amount on FC	FC to be undertaken for an amount no lower than either: 1. Total Project Cost (60% of BPC); or	Would likely prevent termination of projects due to inadequate financing

		2. 10% less than (Estimated Project Cost minus 40% of Bid Project Cost)	
Dispute Resolution	In case of a dispute, either party may call upon the Independent Engineer to mediate.	Failing mediation by the Independent Engineer, either party may require such dispute to be referred to the Dispute Resolution Board.	Quicker dispute resolution mechanism to prevent stuck projects.

According to CRISIL of the approximately 7,000 kms of NHAI tenders floated between December 2020 and August 2021, 60-70% projects are under HAM and rest are under the EPC mode. This is the highest share of HAM in the past two years. Despite the higher HAM awarding, according to CRISIL, EPC projects continue to represent a significant majority of NHAI's capital expenditure. Thus, NHAI funding would remain critical to sustain the sector forward. A bar chart of NHAI capital expenditure mix for the periods indicated is reproduced below:

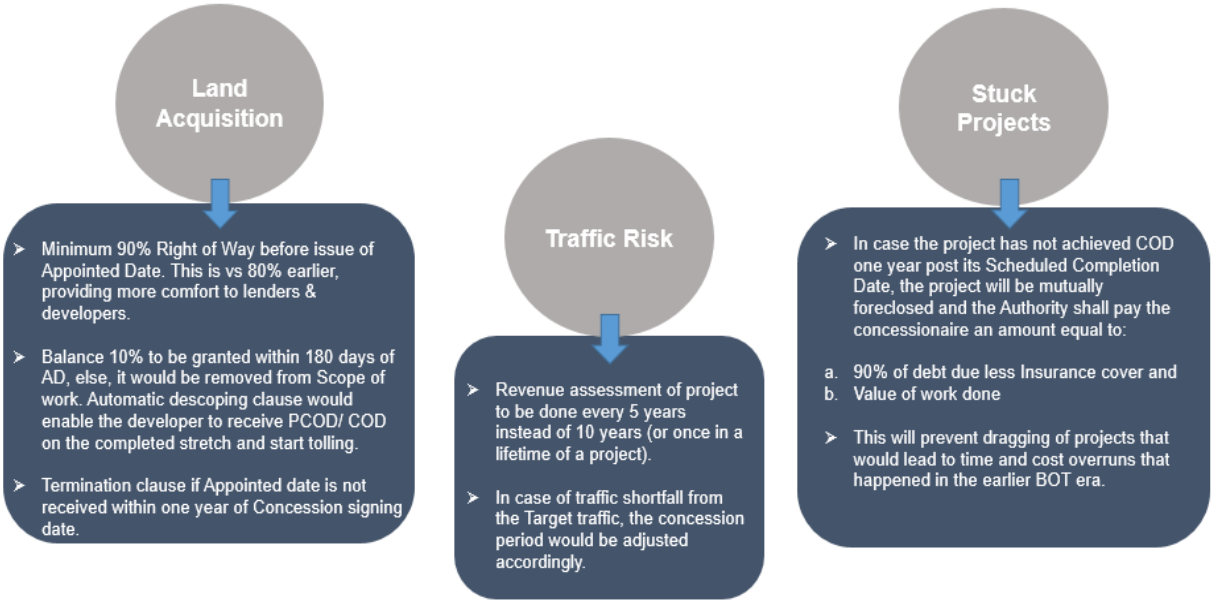


Number of lanes in highways upgraded over the past five fiscal years

NHAI has also focused on the number of lanes in national highways. Single lane roads decreased from 32% in 2014-2015 to 21% in 2015-2016. Two lane roads increased from 47% to 56%, while four lane roads increased from 12% to 25% during the same period.

Changes in BOT MCA were also introduced

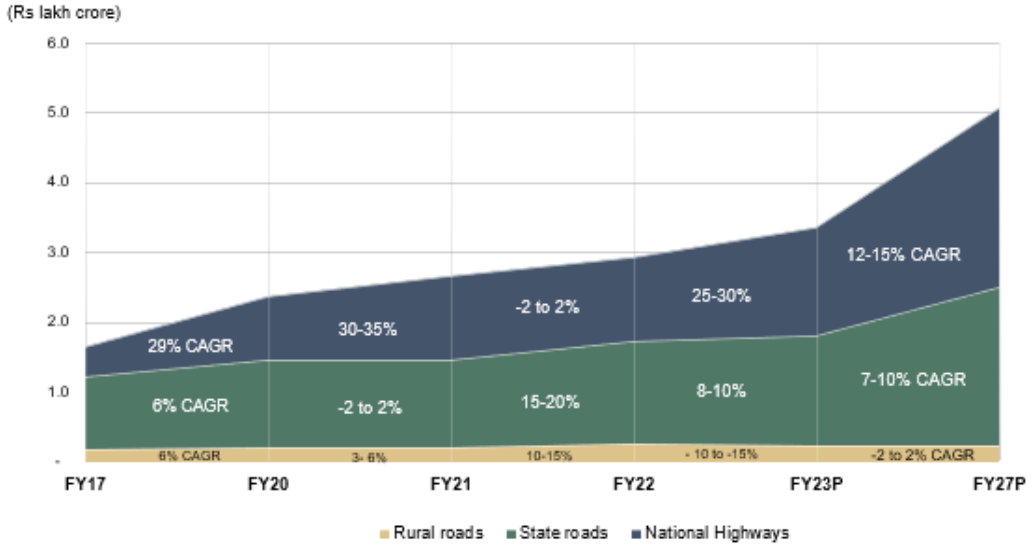
In order to improve private participation *via* the BOT-toll mode, NHAI and the Ministry of Road Transport and Highways also introduced changes to the BOT MCA aimed at key issues such as land acquisition, revenue assessment in case of traffic shortfall and stuck projects. According to CRISL, despite these changes, they don't expect any BOT awarding this fiscal year due to the uncertainty in traffic growth on account of COVID-19 restrictions and muted economic activity this fiscal year. The revamped BOT MCA is as follows:



Despite COVID-19 induced lockdowns, national highways capital expenditure grew by 30-35% in Fiscal Year 2021, boosted by COVID relief measures taken under Atmanirbhar Bharat

According to CRISIL, despite the setbacks witnessed in the first in Fiscal Year 2021, where state expenditure was constrained due to the COVID-19 pandemic and then in Fiscal Year 2022 where elongated monsoon hampered national highway construction, the sector's medium term growth story remains intact. This is based on comfort derived from the Bharatmala Pariyojana, NIP pipeline, higher awards in Fiscal Year 2022 and revival in state government expenditure.

The chart below represents investments towards national highways for the periods indicated:



E: Estimated, P: Projected
Note: Investments excludes land acquisition costs

Outlook of toll collection and remittance on national highways

According to CRISIL, the total toll collection is estimated to have reached ₹ 430 billion in the Fiscal Year 2022. Further, toll collections are expected to grow at a CAGR of 9.5-10.0% between Fiscal Years 2022 and 2027 on a like-to-like basis and to grow at 18-19% considering new road additions and subsequent tolling on them over the same period. The growth will be driven by factors such as improvement in overall economic activity, efficiency gains due to removal of check posts post implementation of GST, increase in both passenger and commercial vehicles, strong execution pipeline of road and highway projects, better compliance and blocking of leakages due to electronic toll collection.

SUMMARY OF BUSINESS

Some of the information in this section, including information with respect to our plans, strengths, and strategies, contain forward-looking statements that involve risks and uncertainties. You should read "Forward Looking Statements" on page 18 for a discussion on the risks and uncertainties related to those statements and also "Risk Factors", "Summary of Combined Financial Statements", "Projections of Revenue From Operations and Cash Flow from Operating Activities" and "Discussion and Analysis by the Directors of the Investment Manager of Financial Condition and Results of Operations and Cash Flows of the Initial Portfolio Assets of the Trust" on pages 63, 33, 461 and 246 respectively, for a discussion of certain factors that may affect our business, financial condition or results of operations. Our actual results may differ materially from those expressed in or implied by these forward-looking statements. Our fiscal year ends on March 31 of each year, and references to a particular Fiscal are to the twelve months ended March 31 of that year. Unless otherwise stated or the context requires otherwise, the financial information included herein is based on our Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum. For further details, please see the section entitled "Summary of Combined Financial Statements" on page 33.

Unless otherwise stated or the context requires otherwise, references in this section to "we", "our" or "us" are to Cube Highways Trust along with the Initial Portfolio Assets. However, for the purpose of the Audited Special Purpose Combined Financial Statements, references to "we", "us", and "our" refers to the Initial Portfolio Assets. We have included various operational and financial performance indicators in this section, some of which may not have been derived from our Audited Special Purpose Combined Financial Statements and which may not have been subject to an audit or review of the auditors. The manner in which such operational and financial indicators are calculated and presented, and the assumptions and estimates used in such calculations, may vary from that used by other entities in the business similar to ours. Investors are accordingly cautioned against placing undue reliance on such information in making an investment decision and must evaluate such information in the context of the Audited Special Purpose Combined Financial Statements.

Unless stated otherwise or the context otherwise requires, industry and market data used in this section has been obtained or derived from the CRISIL Report dated June 2022 with respect to the assessment of the roads sector in India, publicly available information as well as industry publications and sources, including from various government publications and websites. The data may have been re-classified by us for the purposes of presentation. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry sources and publications are also prepared based on information as of specific dates and may no longer be current or reflect current trends. Industry sources and publications may also base their information on estimates, projections, forecasts and assumptions that may prove to be incorrect. Investors must rely on their independent examination of, and should not place undue reliance on, or base their investment decision solely on this information.

Overview

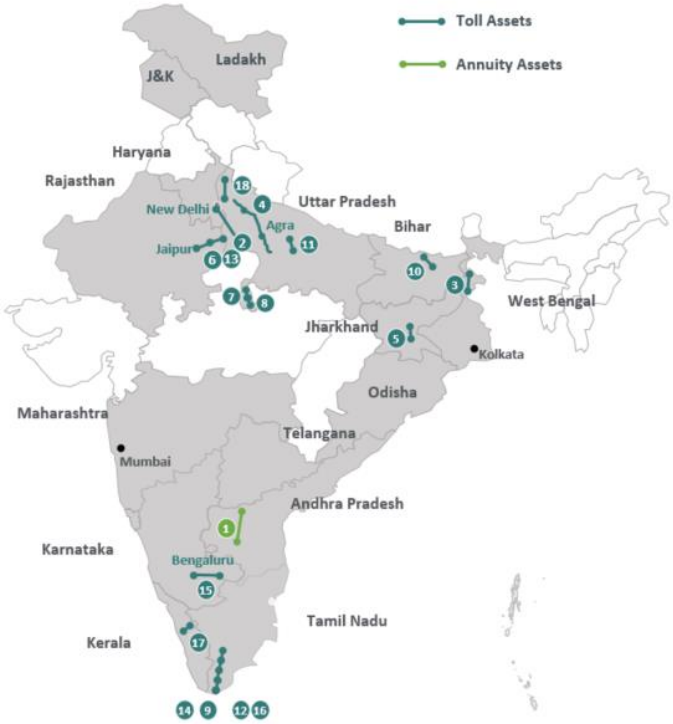
Cube Highways Trust is an Indian infrastructure investment trust sponsored by Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd. (collectively referred to as the "**Sponsors**"), established with the objective of acquiring and operating road assets in India and registered under the InvIT Regulations. We believe that, based on our robust financial position and support from our Sponsors, we are well positioned to take advantage of the growth potential of India's highways sector and make consistent distributions to our Ordinary Unitholders.

The Cube Group is engaged in implementing the public-private partnership ("**PPP**") model in the country's highways sector to operate and manage highway projects in association with the central and state governments. The Cube Group is a 100% institutionally-owned platform backed by a diversified investor base, including ISQ Asia Aggregator Pte. Ltd., Platinum Rock B 2014 RSC Limited (as trustee of the Platinum Stone A 2014 Trust) and Japan Highways International B.V.

The Settlor has set up Cube Highways Trust, which, has acquired 100.00% of the issued and paid-up equity share capital in each of the Project SPVs of the Initial Portfolio Assets (other than Mahua Bharatpur Expressways Limited, in which the Trust has acquired 99.97% of the issued and paid-up equity share capital). These Project SPVs together operate 18 road assets, aggregating to 1,423.6 kilometers, located across 11 states in India.

The Initial Portfolio Assets had a weighted average residual concession life (weighted on the basis of residual life-time pre-MM EBITDA) of 22.10 years as on October 31, 2022 and a weighted average operating history (weighted on the basis of Fiscal 2023 estimated pre-MM EBITDA, assuming COD and appointed date as the beginning date for BOT/DBFOT and TOT assets, respectively) of 8.03 years as on October 31, 2022.

The map below sets forth the location of our projects in the Initial Portfolio Assets:



Legends

1. Andhra Pradesh Expressway Limited (APEL)
2. DA Toll Road Private Limited (DATRL)
3. Farakka – Raiganj Highways Limited (FRHL)
4. Ghaziabad Aligarh Expressway Private Limited (GAEPL)
5. Hazaribagh Tollway Limited (HTL)
6. Jaipur Mahua Tollway Limited (JMTL)
7. Jhansi – Lalitpur Tollway Limited (JLTL)
8. Jhansi – Vigakhet Tollway Limited (JVTL)
9. Kanyakumari – Etturavattam Tollway Limited (KETL)
10. Kotwa – Muzaffarpur Tollway Limited (KMTL)
11. Lucknow – Raebareli Tollway Limited (LRTL)
12. Madurai – Kanyakumari Tollway Limited (MKTL)
13. Mahua Bharatpur Expressways Limited (MBEL)
14. Nanguneri – Kanyakumari Tollway Limited (NKTL)
15. Nelamangala Devihalli Expressway Private Limited (NDEPL)
16. Salaipudhur – Madurai Tollway Limited (SMTL)
17. Walayar Vadakkencherry Expressways Private Limited (WVEPL)
18. Western UP Tollway Limited (WUPTL)

The tables below set forth an overview of the Initial Portfolio Assets:

S. No.	Relevant Project SPV	Project Length and number of lanes	State(s)	Residual Life (in years, as of October 31, 2022)	Actual Revenue in FY 2022
1.	Andhra Pradesh Expressway Limited ("**APEL**")	74.6 kms 4 lanes	Telangana and Andhra Pradesh	3.92 years	₹443.00 million
2.	DA Toll Road Private Limited ("**DATRPL**")	179.5 kms 6 lanes	Uttar Pradesh and Haryana	15.97 years	₹3,937.53 million
3.	Farakka – Raiganj Highways Limited ("**FRHL**")	100.1 kms 4 lanes	West Bengal	18.51 years	₹2,019.57 million
4.	Ghaziabad Aligarh Expressway Private Limited **("GAEPL")**	125.2 kms 4 lanes	Uttar Pradesh	16.65 years	₹2,254.55 million
5.	Hazaribagh Tollway Limited ("**HTL**")	73.8 kms 4 lanes	Jharkhand	27.98 years	₹763.94 million
6.	Jaipur Mahua Tollway Limited ("**JMTL**")	109.0 kms 4 lanes	Rajasthan	8.67 years	₹1,692.61 million
7.	Jhansi – Lalitpur Tollway Limited ("**JLTL**")	49.7 kms 4 lanes	Uttar Pradesh	27.98 years	₹669.77 million
8.	Jhansi – Vigakhet Tollway Limited ("**JVTL**")	49.3 kms 4 lanes	Uttar Pradesh	27.98 years	₹472.12 million
9.	Kanyakumari – Etturavattam Tollway Limited ("**KETL**")	64.2 kms 4 lanes	Tamil Nadu	27.98 years	₹427.95 million
10	Kotwa – Muzaffarpur Tollway Limited ("**KMTL**")	80.0 kms 4 lanes	Bihar	27.98 years	₹905.00 million
11	Lucknow – Raebareli Tollway Limited ("**LRTL**")	70.0 kms 4 lanes	Uttar Pradesh	27.98 years	₹668.02 million
12	Madurai – Kanyakumari Tollway Limited ("**MKTL**")	52.3 kms 4 lanes	Tamil Nadu	27.98 years	₹733.59 million
13	Mahua Bharatpur Expressways Limited ("**MBEL**")	57.3 kms 4 lanes	Rajasthan	8.64 years	₹811.25 million
14	Nanguneri – Kanyakumari Tollway Limited ("**NKTL**")	63.5 kms 4 lanes	Tamil Nadu	27.98 years	₹440.27 million
15	Nelamangala Devihalli Expressway Private Limited ("**NDEPL**")	80.3 kms 4 lanes	Karnataka	10.30 years	₹724.91 million
16	Salaipudhur – Madurai Tollway Limited ("**SMTL**")	63.5 kms 4 lanes	Tamil Nadu	27.98 years	₹448.19 million
17	Walayar Vadakkencherry Expressways Private Limited ("**WVEPL**")	53.5 kms 4 lanes	Kerala	10.80 years	₹657.26 million
18	Western UP Tollway Limited ("**WUPTL**")	77.8 kms 4 lanes	Uttar Pradesh	3.65 years	₹1,059.08 million

(1) FRHL toll fee revenue includes 100% share of overloading revenue. However, only 25% of the overloading revenue is to the account of FRHL/ CH-II and the balance 75% of the overloading revenue is to the account of the erstwhile owner of FRHL.
(2) APEL is an annuity asset and hence revenue corresponds to annuity income.

In addition to the Initial Portfolio Assets, the Trust through the Investment Manager will also have the ability to acquire new projects through (i) a right of first offer with CH-I and CH-III in accordance with the Right of First Offer Agreement ("**ROFO Agreement**") and the Valuation Policy; and (ii) through other acquisitions in terms of the Investment Policy, on an arm's length basis. For further details, please see, "*Corporate Governance*" and "*Related Party Transactions*" on pages 144 and 275, respectively. The Investment Manager, Cube Highways Fund Advisors Private Limited, is responsible for managing the Trust and the Initial Portfolio Assets, as well as undertaking investment decisions relating to us and our assets. The Investment Manager meets the experience criteria as required under the SEBI InvIT Regulations. The cumulative experience of the key personnel (i.e. directors/ partners or employees, as applicable) of the Investment Manager in fund management or advisory services or development in the infrastructure sector is above 30 years. Further, the Investment Manager is responsible for defining our strategic direction, including in relation to our future acquisitions, divestments or enhancement of assets. For further details, please see "*Parties to the Trust – The Investment Manager – Cube Highways Fund Advisors Private Limited*" – on page 120.

The Trustee, Axis Trustee Services Limited, is a trusteeship company registered with SEBI as a debenture trustee under the Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993, as amended. On behalf of our Unitholders, the Trustee is responsible for (a) ensuring that our business objectives and investment policies comply with the provisions of the InvIT Regulations and other applicable law, and (b) monitoring the activities of the Investment Manager (in terms of the Investment Management Agreement) and the Project Manager (in terms of the Project

Implementation and Management Agreement). For further details, please see "*Parties to the Trust – The Trustee – Axis Trustee Services Limited*" on page 108.

The Project Manager, Cube Highways and Transportation Assets Advisors Private Limited, shall undertake operations and management of the Trust, including advising the Trustee on undertaking operations and management of the SPVs, and ensuring compliance with the respective concession agreements and project documents, making arrangements for appropriate maintenance, oversee the progress of development, status of approvals and other aspects of the projects of the SPVs. The Project Manager has been appointed as per the terms of the Project Implementation and Management Agreement. Neither the Project Manager nor any of the promoters or directors of the Project Manager (i) is debarred from accessing the securities market by SEBI; (ii) are or have been a promoter, director or person in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/ or (iii) are or have been declared a wilful defaulter by any bank or financial institution or consortium thereof in accordance with the guidelines on wilful defaulters published by the RBI. For further details, please see "*Parties to the Trust – The Project Manager – Cube Highways and Transportation Assets Advisors Private Limited*" – on page 133.

Each financial year, we intend to distribute, at least quarterly, a minimum of 90% of the net distributable cash flows of the Trust available for distribution to our Ordinary Unitholders. For further details, please see, "*Distribution*" on page 243.

Our revenue from operations for the seven months period ended October 31, 2022, Fiscals 2022, 2021 and 2020, were ₹14,180.96 million, ₹20,550.40 million, ₹16,285.19 million and ₹13,270.92 million, respectively. Our profit/(loss) after tax for the seven months period ended October 31, 2022, Fiscals 2022, 2021 and 2020, were ₹(567.77) million, ₹(8,251.67) million, ₹(2,409.36) million and ₹(1,336.87) million, respectively.

For details of credit ratings obtained by the Trust, please see "*General Information – Credit ratings"* on page 106.

Our Strengths

The Investment Manager believes the following to be the key strengths of the Trust:

Large and Diversified Portfolio of Highway Assets

Upon completion of the Formation Transactions, Trust has a sizeable initial portfolio consisting of the 18 Initial Portfolio Assets. These assets represent a scaled and diversified portfolio, as the Initial Portfolio Assets consist of 18 highway assets having an aggregate of 1,423.6 kilometers, located across 11 states in India. In addition, pursuant to the right of first offer available to the Trust under the ROFO Agreement with CHI-I and CH-III, the Trust will also have an opportunity to access a pipeline of assets consisting of seven highway assets having an aggregate of 512.86 kilometers, located in four states in India.

Each Project SPV has entered into a long-term concession agreement with NHAI with tenors of between 20 and 30 years. As of October 31, 2022, the Initial Portfolio Assets had a weighted average residual concession life (weighted on the basis of residual life-time pre-MM EBITDA) of approximately 22.10 years.

Our assets are operated under different types of concessions, and for the fiscal years ending March 31, 2020, March 31, 2021, March 31, 2022 and the seven months period ended October 31, 2022, revenue from toll assets represented 78.93%, 79.12%, 90.93% and 92.40% of our combined revenue and 120.04%, 136.13%, 183.64% and 125.26% of the combined EBITDA, while revenue from annuity assets represented 3.41%, 2.97%, 2.15% and 1.69% of our combined revenue and 5.18%, 5.11%, 4.35% and 2.29% of the combined EBITDA, respectively.

Strong Portfolio Construction Capabilities

The Cube Group's portfolio construction philosophy is underpinned by assets with long vintage, proven operating life and long residual life. Further, a number of our assets are contiguously located which minimizes the risk of changes in the network surrounding the asset. Further, the contiguous nature of some of our assets allows us to benefit from economies of scale, especially in relation to maintenance costs for such assets.

The Cube Group employs a robust asset appraisal, evaluation and selection framework, supported by a due diligence approach that has resulted in them acquiring assets with resilience to external shocks and low traffic elasticity.

The vast experience in the Indian roads sector of the key personnel forming a part of the Investment Manager and their technical skills provide us with a competitive advantage over other platforms in India. Further, some of our assets, such as Farakka – Raiganj Highways Limited, Walayar Vadakkencherry Expressways Private Limited and Madurai – Kanyakumari Tollway Limited are located in areas where geographic barriers may preclude competing roads from being constructed, which provides us with a competitive advantage in these regions. Furthermore, with increasing infrastructure

development projects on the roads in the central parts of India, the north-south traffic is moving eastwards which can directly result in higher volumes of traffic for the Initial Portfolio Assets.

Differentiated M&A Capabilities

The Investment Manager believes that the Sponsors (along with its affiliates and subsidiaries) have developed differentiated M&A capabilities, enabling them to construct a large and high–quality portfolio of assets. Over the last seven years, our Sponsors (along with its affiliates and subsidiaries) have evaluated approximately 350 road assets and submitted 80 non–binding expressions of interest, which resulted in an acquisition of 24 assets, representing a conversion ratio of 30%.

Our Project Manager has a dedicated M&A and Project Finance team of approximately 16 professionals with specialized deal making capabilities and a wide relationship network, which enables them to execute transactions bilaterally and execute repeat transactions, reducing deal execution costs and timelines. Further, our Sponsors (along with its affiliates and subsidiaries) also have in-house experience in key areas of asset appraisal, evaluation and selection and due diligence such as traffic and technical assessment, legal diligence, financial diligence and ESG assessment, which enables them to make quick and informed early assessments of opportunities.

Furthermore, we believe that our Ordinary Unitholders will benefit from our ability to leverage each of our Sponsor's extensive network of relationships, its extensive market experience, operating expertise, demonstrated track record of managing capital and its commitment of adequate resources to the Investment Manager.

Asset Management and Maintenance Strategy

We have developed an asset management and maintenance strategy based on procurement, technology and engineering capabilities which is aimed at reducing lifecycle maintenance costs.

Our procurement is managed centrally, which enables us to benefit from economies of scale by negotiating advantageous commercial terms from our vendors. We also have a dedicated team for bitumen procurement given its importance to our overall maintenance strategy. We take various measures to ensure quality control of bitumen, including testing along various stages of the value chain, GPS monitoring and sealing of bitumen tankers at the source. Further, on account of annual maintenance shutdowns observed by domestic refineries and to ensure continuous supply of bitumen, we import the same directly from suppliers.

We have developed in-house capabilities for modelling and analytics which enable us to undertake predictive and preventive maintenance. One of our competitive advantages is the use of advanced testing methodologies such as, (i) falling weight deflectometer (which measures deflection values and structural strength of the pavement); and (ii) network survey vehicle (with an integrated laser profilometer to measure pavement roughness and texture). These tests provide extremely accurate micro level data which we analyse to understand the structural and functional condition of each segment of the pavement. Based on such data we are able to devise a major maintenance ("**MM**") strategy that addresses the immediate stress points and life cycle load patterns. We have experience and capability to use advanced construction materials that result in higher resilience and durability of our assets. For example, we use materials such as polymer modified bitumen and highly modified asphalt ("**HiMA**") thereby providing high riding quality to the users, which can reinforce toll-paying behaviour.

We believe that the Project Manager will also benefit from the Sponsors' approach of employing a tactical mix of in-house and outsourcing maintenance operations based on the strategic importance of the function. Thus, while the Project Manager will maintain control over key functions of strategy, design and procurement, it expects to outsource routine maintenance to third party vendors.

Strong Corporate Finance Capabilities

We have strong corporate finance capabilities which have been developed and built on the following principles:

- a deep understanding of regulations concerning highway construction and operations in India;
- long-standing lender relationships with infrastructure lenders, including public and private sector banks and NBFCs;
- proactive engagement with credit rating agencies and as of October 31, 2022, 14 of the 18 Initial Portfolio Assets were rated AAA (or equivalent) by certain rating agencies in India; and
- an established track record of negotiation and structuring capabilities.

These corporate finance capabilities enable us to generate additional value by designing optimal capital structures and debt repayment profiles that are calibrated with the cash flow profile of the Project SPVs for reducing cost of borrowings and increasing the tenor of the loans.

Investment in a Team of Specialists and Human Resources

Prior to the Offer, both our Sponsors' platform in India were led by a management team with vast experience and a track record in the Indian infrastructure sector. The senior management of our Sponsors' platform, including the Chief Executive Officer, Chief Financing Officer and Chief Operating Officer, each have significant experience in the infrastructure sector.

As a result, the Investment Manager's team has deep knowledge and experience in managing road projects in the infrastructure sector. The Investment Manager (along with its affiliates) also has invested in a team of qualified professionals with diverse academic backgrounds and work experience.

Attractive sector fundamentals with favourable policy environment

The roads sector is an area of national strategic importance to the Indian government, and development of the road infrastructure continues to be a priority for successive governments. In order to spur the development of India's road infrastructure, the GoI has undertaken a series of policy measures to drive investment from the public sector through traditional means of public investment and new channels, such as PPPs.

The GoI has undertaken various initiatives such as National Infrastructure Pipeline ("**NIP**") to boost infrastructure development in India, including an expected investment of ₹ 111 trillion between Fiscals 2020 to 2025, of which 18% is allocated to the roads sector. *(Source: CRISIL Report)* Further, according to CRISIL, toll collections are expected to grow at a CAGR of 9.5-10.0% between Fiscal Years 2022 and 2027 on a like-to-like basis and to grow at 18-19% considering new road additions and subsequent tolling on them over the same period. Through the PPP model, among others, the Investment Manager believes that the Sponsors have acquired, and will continue to capture through further acquisitions, a significant share in the PPP format of the road infrastructure sector.

For further details on the market opportunity for the road infrastructure industry in India, please see, "*Industry Overview*" on page 158.

Business Strategies:

The Investment Manager believes the following to be the key strategies of the Trust:

Active asset management to drive organic growth

The Investment Manager will employ an active asset management strategy in the existing assets to drive growth of the portfolio. In particular, the Investment Manager will seek to maintain or improve the Project SPVs' net incomes and free cash flows by, among other initiatives, minimizing revenue leakages, formulating and adopting policies and procedures and structuring investments to address regulatory considerations. The Project Manager will assist the Investment Manager by carrying out the operations, management and maintenance of the projects in accordance with the relevant concession agreement and the Project Implementation and Management Agreement and by procuring, operating and maintaining the relevant project's toll management systems, improving the effectiveness of routine and major maintenance activities and instituting controls on administrative expenditures and overheads.

Calibrated expansion of the portfolio

The Investment Manager also intends to expand the portfolio of the Trust by acquiring assets from the Sponsors (and their affiliates) that adhere to certain asset selection criteria, which includes access to important locations in the vicinity, connecting roads, industrial and manufacturing hubs, connectivity with raw materials, ports, and also evaluating competing modes of transportation.

The Investment Manager believes that it will be able to leverage each of our Sponsors' network of relationships, extensive knowledge, experience and expertise in the roads sector in India to implement its acquisition strategy, to acquire operational road projects and road projects that may require last mile construction. The Investment Manager intends to expand the portfolio without compromising on the operation and management of the existing Project SPVs while providing attractive cash flows and yields, and opportunities for future income and capital appreciation for our Unitholders.

Pursuant to the ROFO Agreement between CH-I, CH-III, the Investment Manager and the Trustee (on behalf of the Trust), the Trust has a "right of first offer", for a specified period from the date of listing of the Ordinary Units pursuant to the Offer, to acquire the future assets which CH-I or CH-III elect to dispose of. Under the ROFO Agreement, the Trust can make an offer for the acquisition and/ or re-financing of the securities of the ROFO SPVs (*as defined in the ROFO Agreement*), subject to the terms of the ROFO Agreement. For further details, see "*Related Party Transactions – Acquisition of future assets by the Trust*" on page 278.

Implementing prudent capital management policies

The Investment Manager intends to institute and implement a capital management strategy that is consistent with its objective of maximizing distributions to our Ordinary Unitholders while also generating consistent total returns. To achieve these objectives, the Investment Manager will aim to ensure an optimal capital structure of the Trust and the Project SPVs to maximize cash distribution to Ordinary Unitholders while also retaining adequate flexibility to acquire assets in the future.

After utilising the Issue Proceeds, the Trust's total consolidated borrowings are expected to be less than 49% of the total value of the Trust's consolidated assets, in compliance with the InvIT Regulations. As a result, the Trust's consolidated balance sheet will provide flexibility to incur additional debt if needed to support the Investment Manager's strategy of acquiring additional assets.

RISK FACTORS

An investment in the Ordinary Units involves risk. Before investing in the Ordinary Units, prospective investors should pay particular attention to the fact that the Trust, the Parties to the Trust, each Project SPV and each of their activities are governed by the legal, regulatory and business environment in India, which differs from that which prevails in other countries. Investors should carefully consider the risks and uncertainties described below and the information contained elsewhere in the Placement Memorandum and this Final Placement Memorandum before making an investment in the Ordinary Units. In making an investment decision, each investor must rely on its own examination of the Trust and the terms of the offering of the Ordinary Units. The risks and uncertainties described in this section may not be the only risks and uncertainties the Trust currently faces. Additional risks and uncertainties not presently known to the Trustee or the Investment Manager, or that the Trustee or the Investment Manager currently deem immaterial, may arise or may adversely affect our business, financial condition, cash flows and results of operations. If any of the following risks, or other risks that are not currently known or are now deemed immaterial, actually occur, our business prospects, results of operations, cash flows and financial condition could suffer, the price of the Ordinary Units could decline and Investors may lose all or part of their investments.

The financial and other related implications of the risk factors, wherever quantifiable, have been disclosed in the risk factors mentioned below. However, there are certain risk factors where the financial impact is not quantifiable and, therefore, cannot be disclosed in such risk factors. Unless specified or quantified in the relevant risk factors below, we are not in a position to quantify the financial or other implication of any of the risks described in this section.

Investors should be aware that the price of the Ordinary Units, and the income from them, may be subject to volatility. If any of the risks described below occurs, our business and prospects could be materially and adversely affected, the trading price of the Ordinary Units could decrease, and investors could lose all or part of their original investment. This section should be read in conjunction with the sections entitled "Business" and "Discussion and Analysis by the Directors of the Investment Manager of Financial Condition and Results of Operations and Cash Flows of the Initial Portfolio Assets of the Trust" on pages 172 and 246, respectively, as well as the financial statements and other financial information included elsewhere in this Final Placement Memorandum.

This Final Placement Memorandum also contains forward-looking statements (including Projections of Revenue from Operations and Cash Flow from Operating Activities) that involve risks, assumptions, estimates and uncertainties. Our actual results could differ materially from those anticipated in such forward-looking statements as a result of certain factors including the considerations described below and elsewhere in this Final Placement Memorandum, including the section entitled "Forward-Looking Statements" on page 18.

In making an investment decision, prospective investors must rely upon their own examination and the terms of the Offer, including the merits and the risks involved. The investors should consult their tax, financial and legal advisors about the particular consequences of investing in the Offer.

In this section, unless specified otherwise, a reference to "we", "us" and "our" refers to the Trust and each Project SPV on a combined basis. Furthermore, unless the context otherwise requires, the financial information used in this section is derived from the Audited Special Purpose Combined Financial Statements.

Risks Relating to Our Business and the Concession Agreements

1. The Trust has no operating history and may not be able to operate our business successfully, achieve our business objectives or generate sufficient cash flows to make or sustain distributions. Further, the Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum may not accurately reflect our future financial position, results of operation and cash flows.

The Trust was settled as a contributory, irrevocable and determinate trust, under the provisions of the Indian Trusts Act, 1882, on December 7, 2021 and registered with SEBI as an InvIT on April 5, 2022. The Trust does not have an operating history by which its performance may be judged and has acquired the Project SPVs pursuant to the Share Purchase Agreements. We are subject to business risks and uncertainties associated with any new business enterprise formed through a combination of existing business enterprises. Accordingly, our Investment Manager cannot assure you that we will be able to operate our business successfully or profitably or achieve our investment objectives as described in this Final Placement Memorandum.

The Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum are prepared by combining the historical financial data of the Project SPVs, as required under the InvIT Regulations and have been prepared on the assumption that all the Project SPVs have been acquired pursuant to the Share Purchase Agreements. The Audited Special Purpose Combined Financial Statements have been prepared and presented on the basis that the Trust holds 100% of the shareholding in all the Project SPVs (other than MBEL, in which the Trust holds 99.97% of the shareholding) on or prior to the date of the Allotment of the Ordinary Units pursuant to the Offer. For the purpose of this

Final Placement Memorandum, the Audited Special Purpose Combined Financial Statements have been prepared in order to present the financial position, results of operations and cash flows of the Project SPVs, on a combined historical basis, as of and for the seven months period ended October 31, 2022 and financial years ended March 31, 2022, 2021 and 2020, and do not necessarily represent the financial position, results of operations and cash flows had the Trust been in existence during the periods presented. As a result, our Investment Manager cannot assure you that our future performance will be consistent with the Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum.

2. Toll collections and toll road traffic volumes may be affected by competing roads and bridges and other modes of transportation, and any improvements to, or construction of, such roads, bridges and other modes of transportation.

For the toll-based Project SPVs, their principal source of revenue is the collection of toll fees from users of the toll roads. The level of toll collections may be affected by competing routes and alternative modes of transportation, such as adjacent free roads, new or existing toll roads, railways or air transport. Although the Concession Agreements contain certain restrictions on the ability of the NHAI or the GoI to construct or improve certain competing roads within 15 kilometers of the toll roads, neither the NHAI nor the GoI is prohibited from constructing or improving such competing free or toll roads if the average traffic on the toll road exceeds 90% of its stipulated designed capacity for three consecutive years. Furthermore, neither the NHAI nor the GoI is restricted under the Concession Agreements from constructing alternative modes of travel which service the same areas as are serviced by the toll roads. In the event such alternative modes of travel are constructed, it may adversely impact our revenue from toll roads.

In particular, certain of our toll roads are located along National Highway 44 (erstwhile NH7). As a result, we may experience a significant decrease in traffic levels on our toll roads if competing roads and bridges affect the traffic level on National Highway 44. For further details, see, "*Business — Summary of Our Toll Roads*" on page 181 of this Final Placement Memorandum.

Additionally, given the renewed focus of the GoI, at the national, state and local levels, on the development and strengthening of the highway network across India, there can be no assurance that there will not be any construction, widening or improvement of any free or toll roads, or construction of other modes of transportation including local routes by local authorities/ communities, in the proximity of the toll roads or which provide an alternative or more direct routing to locations served by the toll roads. Any such construction, widening or improvement may divert traffic away from the toll roads, which may adversely affect toll collections and, therefore, our ability to make distributions to the Ordinary Unitholders.

3. We are subject to risks associated with outbreaks of diseases or similar pandemics or public health threats, such as the novel coronavirus ("COVID-19"), which could have a material adverse impact on our business and our results of operations and financial condition.

In the past, various contagious diseases have spread throughout the world, including India, where the entire operations of the toll roads are located. Most recently, beginning in late 2019 and continuing in 2020, 2021 and 2022, the global spread of COVID-19 has created significant economic and political volatility and uncertainty and business disruption. The spread of COVID-19 has led to governments around the world taking various restrictive measures designed to limit the spread of the virus, such as the implementation of travel restrictions, mandatory cessations of business operations, mandatory quarantines and work-from-home and other alternative working arrangements, curfews, limitations on social and public gatherings and partial lockdowns of cities or regions.

The spread of COVID-19 and governmental responses have resulted in workforce absence, reduced business productivity, other business disruptions, reduced demand and stagnated economic activity in India and around the world. This has resulted in significantly fewer customers using our toll roads and therefore has had a material adverse impact on the revenues of the toll roads, as well as other aspects of our operations. The long term effects of COVID-19, including the mutation of more transmittable strains is highly uncertain and cannot be predicted. More generally, any epidemic, pandemic or other health crisis, whether similar to COVID-19, SARS, MERS or other past global diseases, could materially and adversely affect our business, financial condition and results of our operations.

4. Toll rates and collections and toll road traffic volumes are subject to regulatory constraints, number of road users subject to such rates and dependent on factors beyond our control.

Toll revenue depends on the tolling rates set by the concessioning authority in accordance with the concession agreement and the actual traffic volume using our roads. Our Concession Agreements typically limit and regulate fluctuations in tolling rates. Usually, the concessioning authority sets the applicable tolling rates and mechanism for periodically resetting the tolling rates. We may not be able to increase tolling rates to cover increases in our operations or financing or other costs. Such tolling rates and the scope of our arrangements with the concessioning authority may be revised by the

concessioning authority in accordance with the provision of the concession agreement and applicable law. Thus, revenue from toll receipts is affected by traffic volume and toll rates, both of which are beyond our control.

The toll rate structure for most of our Project SPVs is laid down under National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended from time to time (the "**Fee Rules**"). The Fee Rules specify that the applicable toll rates shall be increased by a certain fixed percentage (3% on a non-cumulative basis) each year plus an adjustment based on an increase in the wholesale price index (the "**WPI**") (40% of the increase in WPI over the previous year, calculated on the basis of December WPI) and do not provide us any flexibility to adjust the toll rates unless the rates are explicitly changed by the GoI in accordance with the Fee Rules. Further, the toll rate structure for certain Project SPVs (whose concession agreements were executed prior to December 5, 2008) is governed by National Highways (Rate of Fee) Rules, 1997 or by fee notifications issued by the state concessioning authorities, as applicable. Furthermore, for certain toll roads the adjustment in toll rates on account of WPI is capped at a percentage of the increase in the WPI. As such, in the event of high consumer price index inflation or increased minimum wages, we may experience significantly higher operating costs, but there may be little variation in the WPI resulting in a muted increase in the applicable toll rate. Thus, while our tolling rates may increase with an increase in WPI, any increase may not be adequate to offset the negative impact of increases in interest rates or O&M costs. Further, our tolling rates may also decrease with a decrease in WPI and accordingly, the business, financial condition and results of operations of the Trust may be adversely affected.

Our toll collections may also be affected by the level of exemptions, i.e., toll may not be levied during certain festive periods, the number of road users not required to pay the applicable toll rates when using the toll roads, which may be higher in urban settings. The Concession Agreements provide that certain users of the toll roads are exempt from paying user fees for non-commercial use of the roads, while frequent users are entitled to discounted fees to use the toll roads. For further details, please see, "*Summary of Key Agreements— Summary of the Concession Agreements*" on page 216 of this Final Placement Memorandum. We are also subject to fluctuations of traffic flow at new toll plazas that may not stabilize within the timelines anticipated or at all.

Traffic volumes on the toll roads and toll collections are directly and indirectly affected by a number of other factors beyond our control, including but not limited to:

- the decline in manufacturing or exports of commodities plying on the toll roads due to regulatory restrictions or other reasons including financial crises and war, which can potentially distort global prices of traded commodities;
- the number and type of motor vehicles in operation and the cost of purchasing and operating motor vehicles, including financing costs, environmental law compliance costs, exchange rate fluctuations and fuel prices, in the project influence areas of the toll roads;
- weather conditions, such as floods or torrential rain, acts of God, strikes or any other force majeure event, including epidemics, such as COVID-19, that could impair the safe operation of, restrict traffic access to, or prevent use of the toll roads. Further, any political/ non-political agitations may also significantly impact traffic movement on the roll roads;
- traffic on the roads providing access to and from the toll roads including the waiting time at toll plazas and congestion at the gateways, or the physical condition of such roads, which hampers the ability of road users to gain access to and from the toll roads;
- the capacity of the toll roads including any structure forming part of the toll roads, such as bridges, bypasses or tunnels, and the need for maintenance and repair of parts or all of the toll roads, or any structure forming part of the toll roads, which may result in restricted or no access to the toll roads for material periods of time;
- overall security of the toll roads as managed by the relevant security contractors, including the possible threat of terrorist attacks on the toll roads or any of their free-standing structures;
- a change in the applicable toll policies or other applicable laws (including environmental regulations) which affects any category of vehicle or fuel;
- development of other transportation modes and incentives associated with such modes such as the National Rail Plan that is expected to increase rail's modal share traffic which may adversely impact the modal share for road-freight;
- changes in consumption pattern of commodities transported on the toll roads;
- changes to axle load norms in order to further increase the permissible axle load limits in India, which may adversely impact traffic growth along Indian national and state highways and cause accelerated deterioration of the condition of the pavement of the toll roads;
- the reactions of the public or other national or state government institutions to toll rate increases;
- leakage of toll fees or any form of violation by users of the toll roads; and
- seasonal fluctuations, specifically during the monsoon season, may adversely affect traffic volumes and cash flow. Traffic volumes tend to decrease during the monsoon season and tend to increase during holiday season. The monsoon season may also restrict our ability to carry on activities related to our operations and maintenance of the roads. This may result in delays in periodic maintenance and reduce productivity, thereby materially and adversely affecting our business, financial condition and results of operations.

In the event there is a significant decrease in traffic volume or change in toll rates on the toll roads, there may be a corresponding decrease in toll collections which could have a material adverse effect on our ability to make distributions to the Ordinary Unitholders. Further, while there are provisions under the Concession Agreements to compensate the Project SPVs, there may be a considerable delay in the receipt of such compensation.

Furthermore, certain regulatory and policy guidelines issued by the NHAI from time to time may adversely affect the toll-based Project SPVs business, results of operations and financial condition. For instance, on May 26, 2021, NHAI issued guidelines to ensure service time of not more than 10 seconds per vehicle at toll plazas on National Highways. In accordance with these guidelines, queues of vehicles at toll plazas must not exceed 100 meters, and in the event of queues longer than 100 meters, the vehicles will be allowed to pass without paying toll till the queue comes within 100 meters from the toll booth. Such guidelines may adversely impact collections of our toll-based Project SPVs.

5. Leakage of the toll fees of any of the toll-based Project SPV's roads may materially and adversely affect our revenues and financial condition.

Each of the toll-based Project SPV's toll receipts are primarily dependent on the integrity of toll-collection systems and the willingness of road users to pay toll fees. While each toll-based Project SPV has an integrated toll-collection system in place, the level of revenues derived from collection of tolls may be reduced by leakage through toll evasion, theft, fraud or technical defaults in the relevant Project SPV's toll systems or forced violations by users of the toll roads. Furthermore, any toll-based Project SPV may also, at times, be unable to collect tolls due to political protests or other agitations, including relating to tolling. In addition, in certain circumstances, the governmental authorities or Indian courts could seek to suspend toll collection for or during certain periods, in full or in part, on the toll roads, which suspension would result in a reduction in our revenues. For example, during the national lockdown imposed from March 24, 2020 in India on account of the COVID-19 pandemic, the concessioning authority suspended toll collection for a certain period. Furthermore, beginning in December 2020 and continuing until January 2021, there was a closure of the eastern and western peripheral expressways due to protests against certain agricultural laws in India which significantly impacted traffic flow and toll collection on DATRPL during such period.

Furthermore, toll-collection errors may amount to a loss of revenue as there is an inherent risk of under-collection of toll fees, especially in instances where the users of toll roads pay in cash. Any failure by us to monitor and control leakage in toll-collection systems could have a material adverse effect on our business, prospects, financial condition and results of operations and our ability to make distributions. We may be exposed to leakage even in non-cash based toll collection systems, such as software or digitally enabled toll payment options that are susceptible to cyber security breaches and theft.

Further, there have been occasions where political parties and local communities protest against the collection of tolls on roads and some of these occasions have turned violent and resulted in the destruction of toll collection booths. During such an event, the affected toll-based Project SPV could have a limited ability to collect tolls. Under the terms of the Project SPV's concession agreement, in the event that the concession agreement is terminated by either party as a result of an occurrence of a political event, the concessioning authority is required to make payments to the concerned Project SPV as a result of such an event, which may not adequately compensate the loss of revenue or aid in recovering the amount invested. However, there is no assurance that concessioning authority will do so in a timely manner or at all.

6. We have relied on data derived from (i) Technical Consultant Reports commissioned from the Technical Consultant, (ii) Traffic Reports commissioned from the Traffic Study Consultant and (iii) the CRISIL Report prepared by CRISIL, which are based on certain estimates and assumptions and are subject to the limitations set out therein.

We have appointed AECOM India Private Limited, an independent third-party technical engineering firm, as our technical consultant (the "**Technical Consultant**") to forecast the operations and maintenance expenses for each Project SPV and to prepare technical reports on the Initial Portfolio Assets, which are set out in Annexure B to this Final Placement Memorandum (the "**Technical Consultant Reports**"). We have also appointed Steer Davies Gleave India Private Limited as our traffic consultants ("**Traffic Study Consultant**") to provide their analysis and forecast of traffic volumes for each Project SPV (other than APEL, which is an annuity asset) which are set out in Annexure C to this Final Placement Memorandum (the "**Traffic Reports**"). Furthermore, we have also included data from a report titled "*An assessment of the roads sector in India*" dated June 2022, prepared by CRISIL ("**CRISIL Report**").

The Technical Consultant Reports, the Traffic Reports and the CRISIL Report (together referred to as "**Third Party Reports**") are subject to various limitations and are based upon certain bases, estimates and assumptions that are subjective in nature and are based, in part, on information provided by and discussions with or on behalf of us, the Sponsors and the Investment Manager. The Third Party Reports reflect current expectations and views regarding future events, and therefore, necessarily involve known and unknown risks and uncertainties. The Third Party Reports contain forecasts, projections and other "forward-looking" statements that relate to future events, which are, by their nature, subject to significant risks and uncertainties, including population growth, gross domestic product growth, vehicle

ownership rates, per capita income, agricultural output and fuel consumption. The future events referred to in the Third Party Reports involve risks, uncertainties and other factors which may cause the actual traffic volumes to be materially different from any future traffic volumes expressed or implied by the Third Party Reports. There can be no assurance that the bases, estimates and assumptions adopted by the Technical Consultant, Traffic Study Consultant or CRISIL for the purposes of preparing their respective reports will prove to be accurate. If any of these bases traffic assumptions is incorrect, future traffic volumes for the Initial Portfolio Assets could be materially different from those that are set forth in these reports and this Final Placement Memorandum. Accordingly, no investment decision should be made solely on the basis of such information.

7. Certain provisions of the standard form of Concession Agreements may be untested, and the Concession Agreements may contain certain restrictive terms and conditions which may be subject to varying interpretations.

The Concession Agreements that our Project SPVs have entered into are substantially based on a model concession agreement prescribed by NHAI. For example, the toll fees under the Concession Agreements is fixed, subject to annual adjustments to account for inflation as specified in the Concession Agreements. In addition, the operation and maintenance standards and specifications require each Project SPV to incur operation and maintenance costs on a regular and periodic basis. The Concession Agreements also provide for a fixed term concession and, although the Concession Agreements provide for an extension or reduction of the concession period based on certain factors, including actual traffic volumes on specified target dates, the Concession Agreements do not provide for renewal of the Concession Agreements after the expiry of the term.

There is limited guidance available on the interpretation of a number of terms and conditions of the Concession Agreements. In addition, certain terms of the Concession Agreements, such as those related to an augmentation in the capacity of the toll roads, termination payments, construction of additional competing roads by the concessioning authority, the Government or State Governments and payment of compensation for changes in law are untested. Accordingly, the interpretation of certain terms and conditions in the Concession Agreements of the Project SPVs by the concessioning authority, the courts or regulators may be different from our interpretation of such terms and conditions.

The terms and conditions of the Concession Agreements contain restrictive terms and conditions. For example, the Concession Agreements contain provisions that mandate substitution clauses in the project agreements. Such substitution clauses allow the lenders of such project to step into project agreements in place of a Project SPV in the event of suspension of the Concession Agreement for the concerned Project SPV due to a breach or default by the said Project SPV. The Concession Agreements also provides that the lenders to a Project SPV may substitute the Project SPV with new entities in the event of a default by the concerned Project SPV under the relevant Concession Agreements or financing agreements. For example, one of our Initial Portfolio Assets was acquired by our Sponsors and their associates pursuant to such substitution provisions and the framework prescribed by the NHAI. The terms of each of the Project SPV's Concession Agreements requires the Project SPVs to indemnify the concessioning authority for losses arising out of breach of the obligations of the Project SPVs under the Concession Agreements. Further, the Concession Agreements may mandate the requirement of a consent from the concessioning authorities prior to the undertaking of certain activities by the relevant Project SPV.

In the event the concessioning authority or a lender invokes any restrictive term or condition in the Concession Agreements, or the concessioning authority, a court, or regulator interprets any term or condition in an adverse manner, such invocation or interpretation may materially and adversely affect our business, financial condition and results of operations.

The concession agreements contain terms that may be onerous to the Project SPVs in relation to, among other things, compliance with and monitoring of O&M requirements. The O&M requirements include, among other things, permitting the safe, smooth and uninterrupted flow of traffic, undertaking routine maintenance, including repairs of potholes, cracks, concrete joints, drains, line markings, lighting and signage, undertaking major maintenance in accordance with the relevant concession agreement, including but not limited to resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment and preventing, with the assistance of the concerned law enforcement agencies, any encroachments on, or unauthorized entry to the relevant Project SPV. Failure to comply with these requirements could result in adverse consequences, including the Project SPVs being liable for compensating the relevant concessioning authorities for such breach or termination, or even being blacklisted by certain authorities which could impact our ability to acquire new assets and grow our operations.

8. The Valuation Report, and any underlying reports, are not opinions on the commercial merits of the Trust or the Project SPVs, nor are they opinions, expressed or implied, as to the future trading price of the Ordinary Units or the financial condition of the Trust upon listing, and the valuation contained therein may not be indicative of the true value of the Project SPV's assets.

Ernst & Young Merchant Banking Services LLP has been appointed as the independent valuers (the "**Valuers**") to undertake independent valuation of the Project SPVs. The Valuers have issued a report (the "**Valuation Report**"), included in this Final Placement Memorandum, which sets out their opinion as to the fair enterprise value of the Project SPVs as on October 31, 2022. In order to issue their Valuation Report, the Valuers based their assumptions regarding the traffic volume, toll rates, operation and maintenance costs, amortization, debt repayments and non-cash net working capital projections amongst other things, on information provided by and discussions with or on behalf of us, the Sponsors and the Investment Manager, and which reflects current expectations and views regarding future events and, therefore, necessarily involves known and unknown risks and uncertainties. Please see the Valuation Report included as Annexure A in this Final Placement Memorandum for a detailed description of all assumptions relied upon in the preparation thereof. The Valuation Report contains forecasts, projections and other "forward-looking" statements that relate to future events, which are, by their nature, subject to significant risks and uncertainties. The future events referred to in these forward-looking statements involve risks, uncertainties and other factors which may cause the actual results or performance to be materially different from any future results or performance expressed or implied by the forward-looking statements.

The Valuation Report is not an opinion on the commercial merits and structure of the Trust or the Project SPVs, nor is it an opinion, expressed or implied, as to the future trading price of the Ordinary Units or the financial condition of the Trust upon listing. The Valuation Report does not purport to contain all the information that may be necessary or desirable to fully evaluate the Trust or the Project SPVs or an investment in the Trust or the Ordinary Units. The Valuation Report is not based on a comprehensive review of the business, operational or financial condition of the Project SPVs and, accordingly, makes no representation or warranty, expressed or implied, in this regard. The Valuation Report does not confer rights or remedies upon investors or any other person, and does not constitute and should not be construed as any form of assurance as to the financial condition or future performance of the Trust or as to any other forward-looking statements included therein, including those relating to certain macro-economic factors, by or on behalf of the Sponsors, the Investment Manager, the Project Manager, the Trust, the Selling Unitholders or the Placement Agents. Further, we cannot assure you that the valuation prepared by the Valuers reflects the true value of the net future revenues of the Project SPVs or that other valuers would arrive at the same valuation. Accordingly, the valuation contained therein may not be indicative of the true value of each Project SPV's assets. The Valuation Report has been issued on January 13, 2023 but does not take into account any subsequent developments and should not be considered as a recommendation by the Sponsors, the Investment Manager, the Project Manager, the Trust, the Selling Unitholders or the Placement Agents or any other party that any person should take any action based on the Valuation Report. Accordingly, investors should not rely solely on the Valuation Report in making an investment decision to purchase Ordinary Units in the Trust.

9. Inadequate operation and maintenance practices by the prior concessionaire or its subcontractors prior to the O&M Handover Date of certain of the toll roads may result in higher than expected costs to restore or repair the toll roads and reduced traffic on, and toll collections from, such toll roads.

The operation and maintenance of four of the toll roads, namely LRTL, HTL, JLTL and JVTL, will be carried out by the prior concessionaire's existing subcontractors until the O&M Handover Date under the relevant Concession Agreement (as defined in "*Summary of Key Agreements— Summary of the Concession Agreements.*" on page 216). For details on the O&M Handover Date of the toll roads mentioned above, see "*Business - Summary of our Toll Roads*" on page 181. To the extent the prior concessionaire or its subcontractors have adopted or would adopt inadequate maintenance practices with respect to the toll roads prior to the relevant O&M Handover Date, we may be subject to higher than expected costs to restore or repair the toll roads.

Under the relevant Concession Agreements, the prior concessionaire is obligated to maintain, or cause to be maintained, the relevant toll roads to ensure their traffic worthiness and safety are at no time materially inferior as compared to the condition seven days prior to the last date for submission of the bid in respect of such toll road and to undertake the repair of any material deterioration or damage other than normal wear and tear or pay to the concessionaire the cost and expense required to undertake such repair (as determined by the Independent Engineer) after the O&M Handover Date. There can be no assurance that the prior concessionaire will comply with its obligations under the Concession Agreements, or that, in the event of non-compliance therewith, there will be any agreement as to the liability for any material deterioration of the toll roads. Furthermore, the cost and expense determined by the Independent Engineer as payable to us may not be sufficient to compensate us for the actual cost of the repair of the relevant Toll Road. As the prior concessionaire has not provided any warranties regarding the operation and maintenance of the toll roads, we will need to bear any additional or unanticipated maintenance costs ourselves.

To the extent the prior concessionaire's subcontractors responsible for the operation and maintenance of the toll roads prior to the O&M Handover Date do not adopt the necessary operation and maintenance practices or in a manner inconsistent with the level of operation and maintenance that we would adopt, the state of the relevant toll roads may deteriorate, which may result in a diversion of traffic away from such roads. A reduction in the volume of traffic on the toll roads would result in a decrease in the amount of toll collections, which would adversely affect our revenue and results of operations.

10. Any infrastructure project that we acquire which is still under construction and development may be subject to cost overruns or delays.

We may acquire infrastructure projects which are still under construction and development subject to certain thresholds and other considerations, in accordance with the InvIT Regulations and subject to the Ordinary Unitholders' approval in certain cases. The development of such projects is subject to substantial risks, including various planning, engineering and construction risks, along with regulatory hurdles on land acquisition and necessary environmental clearances. The concessionaire generally begins generating a return on investment only after the commencement of commercial operations, which may be delayed due to various reasons.

Under the InvIT Regulations, we can acquire eligible infrastructure projects (as defined in the InvIT Regulations) as well as under-construction projects. Several key steps must be taken before these assets commence operations, generate revenue and recover costs, including but not limited to: conducting surveys and investigations for the proposed route; entering into construction contracts and long-term service agreements with contractors with sufficient expertise; purchasing necessary equipment; acquiring land/ obtaining rights of way from land owners and local authorities; complying with ongoing requirements of the required permits, approvals and licenses; procuring sufficient equity, debt, mezzanine and other necessary financing.

During the construction and development phases, we may also suffer from the unavailability of equipment/ materials, shortage of technically skilled personnel and labour, work stoppages, labour or social unrest, adverse weather conditions, accidents, natural calamities, delays in construction, delays in clearances, unforeseen construction-related and/ or operational delays and defects, delivery failures by, and disputes with contractors, limited availability of competent construction companies, increased cost of raw materials, unavailability of adequate funding, failure to complete projects within budget and in accordance with the required specifications, additional interest costs incurred due to project delays, legal actions brought by third-parties, changes in government, regulatory policies and tax policies, foreign exchange movements, adverse trends in the infrastructure industry or general economic conditions in India. These factors, as well as other unforeseeable problems and circumstances may lead to substantial increases in the time and costs required to complete the projects that we may acquire. We may also not be able to recover the additional costs and may also be subjected to levy of liquidated damages or penalties in case of delay in achieving commercial operations date for the project.

The foregoing factors may also give rise to risks in the building and construction phase of projects and create delays in the completion of such projects. Construction disruptions or delays could impede our ability to undertake future acquisition of assets, and in turn materially and adversely affect our financial and operational estimates, our business, prospects, financial condition, results of operations and cash flows.

11. There can be no assurance that we will be able to successfully undertake future acquisitions of road assets or efficiently manage the infrastructure road assets we have acquired or may acquire in the future.

Our growth strategy in the future involves strategic acquisitions pursuant to (i) the ROFO Agreement and (ii) the Investment Policy, for acquisition of entities owned by the Sponsors or their affiliates. For details of the ROFO Agreement, see "*Related Party Transactions – Acquisition of Future Assets by the Trust*" on page 278 and for details of the Investment Policy, please see the section entitled "*Corporate Governance*" on page 144. We may not be able to identify or consummate such acquisitions in a timely manner and any future acquisitions will depend upon several factors, including:

- our ability to identify, finance and acquire operational toll roads and other road assets on a cost-effective basis. Also see, "*Risk Factors – The Sponsors are under no obligation to provide the Trust with access to future assets, and the Trust may be unable to bid effectively for them.*" on page 88.
- our ability to integrate acquired personnel, operations, products and technologies into our organisation effectively;
- unanticipated problems or legal liabilities of the acquired businesses; and
- tax or accounting issues relating to the acquired businesses.

There can be no assurance that we will be able to obtain financing for new projects as we have done in the past or that the interest rates and the other terms of available financing will remain attractive. In addition, rising interest rates could adversely affect our ability to secure financing on favourable terms and increase our cost of capital. Any additional equity financing may be dilutive to our Unitholders and any debt financing may contain restrictive covenants that limits our flexibility going forward. Even if the Investment Manager is able to successfully make additional acquisitions or investments, there can be no assurance that such acquisitions or investments will produce incremental distributions to our Ordinary Unitholders or that we will be able to achieve the strategic purpose of such acquisitions or operational integration or an acceptable return on such investments, which may materially and adversely affect our profits, financial condition and distributions.

Furthermore, concession agreements for future road projects may also contain terms and conditions that are more restrictive than those under the current Project SPVs' Concession Agreements for the toll roads. These restrictions may

restrict our flexibility in managing our business or projects and could in turn materially and adversely affect our business prospects, financial condition and results of operations. For further details, please see "*Risk Factors – Certain provisions of the standard form of Concession Agreements may be untested, and the Concession Agreements may contain certain restrictive terms and conditions which may be subject to varying interpretations.*"

12. We may be subject to increases in costs, including operation and maintenance costs, which we cannot recover by increasing toll fees or annuity income under the relevant Concession Agreements.

The terms and conditions of the Concession Agreements are fixed and are not negotiable during the concession period. The costs of operating and maintaining the toll roads may be subject to cost overruns as a result of increased or unforeseen costs due to a number of factors beyond each Project SPV's control, including, among other things:

- increase in the cost of labour, materials (for example, bitumen) and insurance;
- the Project SPVs being required to install intelligent toll-collection systems or other new technologies for monitoring projects at their own costs, including remedial costs incurred to rectify any defects caused on account of a failure of any technology;
- Project SPVs being required to install/ deploy sustainable solutions to adhere with evolving and stringent environmental and social norms;
- higher axle loading, traffic volume or environmental stress leading to more extensive or more frequent heavy repairs or maintenance costs, which may be substantial;
- the Project SPVs being required to restore their project roads in the event of any landslides, floods, road subsidence, other natural disasters, accidents or other events causing structural damage or compromising safety;
- changes to the laws and regulations relating to insurance in India which results in an increase in the insurance premiums payable by the Project SPVs;
- increase in electricity tariff rates or other fuel costs resulting in an increase in the cost of energy;
- adverse weather conditions;
- an increase in minimum wages or other operating costs;
- the introduction of a levy on the usage of water for maintenance of the toll roads, among other things, in states in which the toll roads are located;
- unforeseen legal, tax and accounting liabilities relating to acquired assets; or
- other unforeseen operational and maintenance costs such as unexpected escalations in third-party fees or insurance premium.

In the event that our costs increase, we may be unable to offset such increases with higher revenues by increasing toll fees due to the restrictions of the Concession Agreements. Any significant increase in operation and maintenance costs beyond the amounts budgeted by us, or any failure to meet quality standards, may reduce our profits, could expose us to penalties imposed by the concessioning authorities and could have a material, adverse effect on our business, financial condition and results of operations. Such events may also impact the ability of the Project SPVs to service the debt obtained from the Trust and our ability to make distributions to the Ordinary Unitholders. As such, the inability to change the terms and conditions, including the toll fees of the concession during the concession period, may materially and adversely affect our operational and financial flexibility.

13. Any payment by the Project SPVs is subject to mandatory escrow arrangements that restrict our flexibility to utilize the available funds in the escrow account.

The escrow arrangements mandated under the Concession Agreements require that all funds received by any Project SPV in relation to the toll roads, including any financing availed in connection with the payment of the concession fee, toll revenues, and all payments received by the concerned Project SPV from the concessioning authority, to be deposited in an escrow account and utilized only in accordance with the order prescribed under the escrow agreement. The authorities may also freeze our funds in the escrow account if we fail to comply with the terms of our obligations, as set out in the Concession Agreements. For a summary of the escrow arrangements, please see "*Summary of Key Agreements — Summary of the Concession Agreements.*" on page 216 of this Final Placement Memorandum. The escrow arrangements typically prioritize the payment of all taxes due, followed by payment of expenses in connection with the construction of the project, operation and maintenance expenses including expenses for repair works, reimbursement of expenditure incurred by the concessioning authority and concession fee due and payable to concessioning authority. In addition to the escrow arrangements mandated by the Concession Agreements, the lenders to our Project SPVs have also imposed certain restrictions on our flexibility to utilize the available funds in the escrow account. There can be no assurance that future lenders of the Trust or Project SPVs will not impose similar restrictions.

14. We will depend on various third parties to undertake certain activities in relation to the operation and maintenance of the toll roads and any delay, default or unsatisfactory performance by these third parties could materially and adversely affect our ability to effectively operate or maintain the toll roads. Further, the operation of the Project SPVs will also depend on our relationships with other stakeholders.

We will depend on the availability and skills of third-party employees and contractors, including an Independent Engineer, for the operation and maintenance of the toll roads. We can also make no assurance that the services of such third parties will continue to be available at reasonable rates in the areas in which we conduct our operations or at all. We may also be exposed to risks relating to the inability of such third parties to obtain requisite approvals for the operation and maintenance activities, as well as the quality of their services, equipment and supplies. In particular, nonavailability of, or our inability to engage an independent engineer may impact our ability to take timely decisions which could impact our operations. We may also fail to ensure the reliability and sustainability of toll collectors who are required to man the toll booths continuously may materially and adversely affect our overall level of net revenue. We may also be exposed to civil and criminal liability in relation to the actions of other third parties, including our directors, employees and contractors. For details of such civil and criminal proceedings, see "*Legal and Other Information*" on page 301 of this Final Placement Memorandum.

Further, if we undertake limited development, while we may sub-contract our construction work, we may still be liable for accidents on our projects due to defects in design and quality of construction/ repair works of our projects during their construction and operation. In addition, we can make no assurance that such contractors or their sub-contractors will continue to hold or renew valid registrations under the relevant labour laws in India or be able to obtain the requisite approvals for undertaking such construction and operation. Furthermore, in case of failure by the sub-contractor to pay the labour costs of the workers engaged by them, we may be liable to pay such costs to the contracted labourers. Any delay, default or unsatisfactory performance by these third parties could materially and adversely affect our ability to manage the operation and maintenance of the toll roads under the Concession Agreements in a timely manner or at all and may require us to implement traffic diversion measures, and expose us to penalties and premature termination of our Concession Agreements. Any of the foregoing factors could have a material adverse effect on our business, financial condition, reputation and results of operations.

The operation of the Project SPVs will also depend on our relationships with other shareholders and stakeholders. Under the InvIT Regulations, the Trust is permitted to invest in SPVs containing other shareholders or partners subject to such other shareholders or partners executing an agreement confirming that they will not exercise any rights that prevent the Trust from complying with the InvIT Regulations. In particular, the Trust has acquired 99.97% of the equity share in capital in MBEL, with a third-party shareholder holding the remaining approximately 0.03% and has consequently entered into an agreement with such shareholder in accordance with the requirements of the InvIT Regulations. The shares held by the third-party shareholder in MBEL or any other shareholder in any SPVs acquired by the Trust in the future, will continue to remain an asset of such shareholder and may be subject to encumbrances, regulatory proceedings and other restrictions imposed on such shareholder, which are beyond our control.

15. Our revenue from APEL is dependent on receiving consistent annuity income from NHAI.

APEL, an annuity asset, forms a part of the Initial Portfolio Assets. Pursuant to the relevant Concession Agreement, a fixed amount is paid semi-annually as annuity by NHAI. There can be no assurance that APEL would receive such annuity income on time. Under the Concession Agreement, APEL has in the past and may in the future also be subject to a reduction in the annuity amount for delayed completion of the project. Any reduction or non-receipt of annuity income from NHAI may adversely affect our business, prospects, financial condition, cash flows and results of operations.

Further, there can be no assurance that the tax authorities will not make any adverse judgement/decision on taxability of annuity income. This may result in a deduction of annuity income along with additional tax liability on APEL (on account of past annuities including interest and penalty), which may adversely impact our cashflow and prospects.

16. The operation of the toll roads and our ability to collect tolls from road users may be interrupted as a result of any capacity augmentation work required to be carried out in accordance with the terms of the Concession Agreements.

Under the respective Concession Agreement, the concessioning authority (and in certain cases the concerned toll-based Project SPV) has the right/ obligation to undertake capacity augmentation work on the toll roads. The conditions under which such capacity augmentation work has to be undertaken is prescribed in the concerned concession agreement. For instance, for our TOT Roads in case the average daily traffic on the toll roads exceeds a certain number of passenger car units (average daily traffic) for four consecutive years, the NHAI has the right to undertake, through a contractor (an "**EPC Contractor**"), at its own cost, capacity augmentation of the TOT Roads. Similarly, for certain of our BOT(Toll) Roads and APEL, NHAI may decide to augment the capacity based on a detailed traffic study to transform the existing project highway to maintain the desired level of service to the users of toll roads. In connection with any capacity augmentation work in respect of the toll roads, the concessioning authority has the right to close the toll road lanes and divert traffic from the toll roads. Such work may interrupt the operation of the toll roads as well as our ability to collect tolls from road users, which may result in a loss of revenue and a reduction in profitability. Furthermore, for our TOT Roads, although we may be entitled to compensation under the Concession Agreements if we suffer monetary loss as a result of the execution of the capacity augmentation, for example, as a result of a reduction in toll collections due to any

lane closures or traffic diversions, the NHAI is only obligated to compensate us for monetary loss if the lane closure or traffic diversion resulted in a decrease in actual traffic on the relevant toll road of more than 20% of the normalized toll revenue based on a comparison of traffic surveys conducted by the NHAI. In addition, toll rates for our TOT Roads are capped at 75% of the toll fee as at the starting year of capacity augmentation and until the capacity augmentation exercise is completed. Accordingly, any monetary compensation to which we may be entitled under the Concession Agreements may not be sufficient to cover the full monetary loss incurred by us as a result of the capacity augmentation work. Furthermore, for certain of our BOT Roads, the relevant Project SPV also has the right to participate in the bid for the capacity augmentation work, and if it fails to provide the lowest bid, the Project SPV shall be given the right of first refusal to match the preferred offer. On a successful bid, the concession life will be extended by up to five years to ensure that the concerned Project SPV receives a 16% IRR on investment made towards capacity augmentation. However, if the concerned Project SPV refuses to undertake the capacity augmentation, the relevant concession agreement may be terminated. Furthermore, if the relevant Project SPV does not submit a bid, or is not the preferred bidder and declines to match the preferred offer, the Project SPV shall be required to pay the lowest bidder ₹ 1 million and again the relevant concession agreement may be terminated, which may adversely our business and results of operations.

Further, one of the Project SPVs, GAEPL, is required, under the relevant concession agreement to undertake the six laning of the project highways before the expiry of a certain time period. If GAEPL does not meet such timelines, the concessioning authority may, amongst things, terminate the concession agreement. However, if the concessioning authority constructs an additional tollway or competing road prior to the six-laning of the project highway, GAEPL will be deemed to be relieved of its obligation to undertake the six laning and the revenues collected by GAEPL may be adversely impacted.

17. We may be liable for the costs to repair any defects or deficiencies arising in the augmented stretch of the TOT Roads as a result of capacity augmentation work undertaken by an EPC Contractor.

In case of TOT Roads, if any capacity augmentation work is carried out by an EPC Contractor appointed by the NHAI, such EPC Contractor shall be responsible for defects and deficiencies arising in the augmented stretch of the toll road for a period of 1,460 days following the completion of such augmentation work, and shall have the obligation to repair or rectify, at its own cost, all defects and deficiencies as observed by the Independent Engineer in the augmented stretch. If the EPC Contractor fails to repair or rectify such defects or deficiencies arising in the augmented stretch of such toll road in a timely manner or at all, or if such defects or deficiencies arise more than four years after the completion of the augmentation work, we may be liable for the costs to repair such defects or deficiencies. Further, there is no assurance that the NHAI would compensate us for any additional costs incurred in connection with any work undertaken by us to repair the augmented stretch of the relevant toll road in the event the EPC Contractor fails to comply with its obligations.

18. Our actual results may be materially different from the expectations, express or implied, or Projections of Revenue from Operations and Cash Flows from Operating Activities included, in this Final Placement Memorandum.

In view of the InvIT Regulations, this Final Placement Memorandum includes certain forward-looking statements, such as Projections of Revenue from Operations and Cash Flows from Operating Activities, expectations, plans and analysis of the projections, as set out in the section "*Projections of Revenue from Operations and Cash Flows from Operating Activities*" on page 461. The Projections of Revenue from Operations and Cash Flows from Operating Activities have been prepared and presented on the basis that the Trust holds all the Project SPVs on or prior to the date of the Allotment of the Ordinary Units pursuant to the Offer by March 31, 2023 and that the Trust will complete the debt financing transactions in the manner described in this Final Placement Memorandum, as per the statement of Projections of Revenue from Operations and Cash Flows from Operating Activities. Certain assumptions have been made regarding our future financial and operating performance, including but not limited to the revenue from operations, construction income, operating and maintenance costs, Trust expenses, the portfolio remaining unchanged through the projections period and no outflow on account of any litigation related matters during the projections period. It has been assumed all projects will continue to operate at the current or estimated levels. In case such assumptions are not satisfied, the associated revenue from operations, profit and cash flows would need to be revised accordingly. Hence, the projections of revenue from operations and cash flows are only estimates and there can be no assurance from the Investment Manager on any of these parameters. The Trust's revenue will be dependent on the cash flows from the Project SPVs, including principal and interest payments (net of applicable taxes and expenses) from the Project SPVs, whose revenue in turn is dependent on a number of factors, including the receipt of toll revenues, which may decrease for a number of reasons including traffic volumes.

Given that the Projections of Revenue from Operations and Cash Flows from Operating Activities are based on assumptions, there could be uncertainties and contingencies, which could adversely affect the Investment Manager's ability to achieve the Projections of Revenue from Operations and Cash Flows from Operating Activities. The Investment Manager cannot assure you that the assumptions will be realized and the actual revenue from operations and cash flows from operating activities, will be as projected. The Projections of Revenue from Operations and Cash Flows from

Operating Activities for Fiscals 2024, 2025 and 2026 are derived assuming post-Offer capital structure and corporate structure as if it was in existence from March 31, 2023.

19. We may face limitations and risks associated with debt financing and refinancing.

We are subject to regulatory restrictions in relation to our debt financing and refinancing. We may from time to time require debt financing and refinancing to carry out the Investment Manager's investment strategy. In the event that we undertake debt financing or refinancing, we may be limited by Indian law as to the nature of financing or refinancing that we may undertake. Under the InvIT Regulations, the aggregate consolidated borrowings and deferred payments of the Trust shall not exceed 70% of the value of the Trust Assets and any borrowings above 25% of the value of the Trust Assets shall be subject to certain conditions, including Ordinary Unitholder approval. For further borrowings exceeding 49% of the value of the Trust Assets, the funds are permitted to be utilized only for acquisition or development of infrastructure projects, the prescribed credit rating and threshold of unitholder approval are required to be obtained and the Trust is required to have a track record of at least six distributions on a continuous basis post listing in the year preceding the financial year in which the enhanced borrowings are proposed to be made. There is no assurance that the relevant approval can be obtained in a timely manner, or at all.

Debt financing to fund the acquisition of a project may not be available on short notice or may not be available on acceptable terms or at all. Since the timing and size of acquisitions cannot be readily predicted, the Trust may need to be able to obtain funding on short notice to benefit fully from opportunities. Also, as a trust, we may be unable to access certain debt capital available to companies. Debt raised by us may be subject to regulatory restrictions. For instance, as we would be considered a foreign owned and controlled entity, we are not permitted to leverage debt from domestic markets in order to make downstream investments.

In the event that we undertake new debt financing or refinance existing debt, we may also be subject to risks associated with debt financing and refinancing, including prior consent or intimation to lenders required to carry out certain actions and the risk that our cash flows may be insufficient to meet required periodic payments of principal and interest under such arrangements and to make distributions to the Ordinary Unitholders. Our ability to generate sufficient cash to satisfy our debt obligations will depend on our future operating performance, which may be affected by prevailing economic conditions and financial, business and other factors beyond our control. There is no assurance that we will be able to generate sufficient cash flow to meet all of our debt obligations. If we are unable to make payments due under our debt facilities, the lenders may be able to declare an event of default and initiate enforcement proceedings relating to any security provided in respect of the loan facilities, and/or call upon any guarantees, and this may materially and adversely affect our ability to make distributions to the Ordinary Unitholders. Furthermore, a lender may, in accordance with the terms and conditions of applicable documentation and applicable law, seek recourse to, and enforce security interest, if any, against the Initial Portfolio Assets, by initiating proceedings against the Trustee or the Investment Manager (acting on behalf of the Trust); provided that on initiation of the proceedings against the Trust or the Initial Portfolio Assets, the Trustee shall not be personally liable and the Trustee's assets shall not be utilized towards recovery of such debt. The Initial Portfolio Assets, which remain after any such recovery by the lenders, shall remain the property of the Trust, to be utilized in accordance with the Trust documents and applicable law.

Furthermore, restrictions in relation to external commercial borrowings may limit the Trust's ability to borrow overseas for projects under development and hence could constrain its ability to obtain financing on competitive terms and refinance existing indebtedness. In addition, there can be no assurance that any required regulatory approvals or borrowing in foreign currencies will be granted to the Trust without onerous conditions, or at all.

20. The Project SPVs' toll-road concessions may be terminated prematurely under certain circumstances.

The toll-road concessions of the Project SPVs are our principal assets. Our ability to receive toll collections and apply such amounts to make distributions to our Ordinary Unitholders will depend on concerned Project SPV's continuing concession right from the concessioning authority to operate the toll roads. The concessioning authority may terminate the Concession Agreements and revoke the concessions for a number reasons set forth in the Concession Agreement, including, but not limited to, one or more of the following:

- any failure by any Project SPV to comply with the change of ownership requirements;
- any failure by any Project SPV to make any payments, including negative grants, to the concessioning authority in a timely manner;
- any failure by any Project SPV to comply with operational or maintenance standards or to undertake the required maintenance work in a timely manner;
- creation of any encumbrance in breach of the concession agreements;
- any abandonment of operations by any Project SPV without prior written consent of the concessioning authority;

- any continuation of a force majeure event, such as an act of God, act of war, expropriation or compulsory acquisition of any project assets by the government, industrial strikes, and civil commotions, boycotts and political agitations, beyond a specified time, usually 120 days within a continuous period of 365 days; and
- any failure by any Project SPV to comply with any provision of the Concession Agreements if such default causes a material adverse effect on the concessioning authority in the manner stipulated in the Concession Agreements.

For further details, please see, "*Summary of Key Agreements— Summary of the Concession Agreements.*" on page 216 of this Final Placement Memorandum.

Upon termination of the Concession Agreements due to a breach by any Project SPV, the Project SPV will forfeit its performance security, in the form of an irrevocable and unconditional bank guarantee, and be entitled to only 70% of the Unexpired Cash Flow (as defined in the Concession Agreement) in addition to remaining liable for any antecedent liability, any obligations which accrued prior to termination, and any costs related to the divestment of the toll roads. In certain situations, upon an event of default by the Project SPV, the concessioning authority may terminate the arrangement and pay such Project SPV an amount equal to 90% of the debt due, less any insurance claims, provided that if any of the insurance claims are not admitted and paid, an amount equal to 80% of such unpaid sums will be included in the calculation of the debt due.

If any Project SPV is in breach or default of its obligations, then the concessioning authority has the right to (a) suspend the right of the concerned Project SPV, including the right to collect tolls and other fees or receive annuities, (b) claim compensation for all direct, additional costs suffered or incurred by concessioning authority arising out of such default, or (c) terminate the Concession Agreements. In the event any Project SPV is in material default or breach of the Concession Agreements, the concessioning authority has the right to claim the termination payment due under the Concession Agreements as well as compensation for all direct, additional costs suffered or incurred by the concessioning authority arising out of such default or breach.

In addition, the Concession Agreements may be terminated by any Project SPV in certain circumstances, including as a result of any material default by the concessioning authority which results in a material adverse effect, or the concessioning authority taking any action that amounts to or manifests an irrevocable intention not to be bound by the Concession Agreements. In the event of such termination, the concessioning authority must pay to concerned Project SPV a contractually agreed termination amount, as set out in "*Summary of Key Agreements— Summary of the Concession Agreements.*"

If any of the Concession Agreements are terminated, the right to collect tolls or receive annuity income is suspended or the concerned Project SPV is required to pay any such compensation or damages under any of the Concession Agreements. Due to this, our business, prospects, financial condition, cash flows and results of operations may be materially and adversely affected.

21. The Project SPVs have a limited period to operate the toll roads as the concession periods granted to the Project SPVs are fixed.

Each of the concession agreements entered into by the Project SPVs generally provide for a fixed term concession, at the end of which the operation of the relevant toll road will be transferred to the relevant concessioning authority. While the term of the concession agreements are typically fixed, certain concession agreements also provide that, if, amongst other things, the actual traffic volume falls short of, or exceeds, the target traffic volume on specified dates mentioned in such Concession Agreement, the concession period may be deemed to be extended or reduced, as the case may be, in accordance with the terms of the Concession Agreement. Furthermore, there is no assurance that the concessioning authority will grant extensions for the toll roads. In addition, there can be no assurance that we will be able to successfully acquire new assets once the existing Concession Agreements expire. Further, if the operating periods of the toll roads are shortened or disrupted or the Project SPVs' rights to operate the toll roads are terminated before the expiration of the concessions, our business, financial condition and results of operations may be adversely affected.

22. The termination payment due to us upon termination of the Concession Agreements may not adequately compensate us for the actual costs and investments associated with the toll roads in a timely manner or at all.

The Concession Agreements may be terminated by us or the concessioning authority prior to their expiration for a number of reasons. For further details, please see "*—The Project SPVs' toll-road concessions may be terminated prematurely under certain circumstances."* on page 73. In the event that the early termination of the Concession Agreements is due to a breach by the relevant Initial Portfolio Asset, we are entitled to receive a termination payment equal to (i) 70% of the Unexpired Cash Flow in addition to remaining liable for costs and liabilities in relation to the toll roads, for TOT roads; and (ii) 90% of debt due after subtracting the insurance amounts along with 80% of unpaid insurance claims, for most of the BOT and DBFOT Roads. In the event that the early termination of the Concession Agreements is due to a breach by the concessioning authority, we are entitled to receive a contractually agreed termination amount, as set out in "*Summary*

of Key Agreements— Summary of the Concession Agreements." As the termination payment payable to us in the event of a breach by us would be lower than what we would have otherwise been entitled to receive in the event that the Concession Agreement had not been terminated, we may not be adequately compensated for the actual costs and investments associated with the toll roads and, therefore, may adversely affect our ability to make distributions to the Ordinary Unitholders.

There is no assurance that any termination payment due to us will be paid in a timely manner or at all. The Concession Agreements do not specify when the termination payment must be made by the concessioning authority and no representation is made by the concessioning authority with respect to the timing of the release of such payment. In the event of a delay in the disbursement of a termination payment by the concessioning authority, in particular, if any dispute arises in respect of such payment, or in the event the concessioning authority fails to make the termination payment at all, we may be unable to make distributions to the Ordinary Unitholders.

23. The Project SPVs may be liable to pay damages to the concessioning authority for non-compliance or delayed compliance with terms of the Concession Agreements.

Under the terms of the Concession Agreements, any Project SPV may be liable to pay damages to the concessioning authority for non-compliance or delayed compliance with certain terms of the Concession Agreements, including for a delay in the fulfilment of the conditions precedent, delays in achieving commercial operations date, delays in completing punch list items specified in provisional completion certificates or for a failure to comply with the maintenance obligations set out in the agreements. There have been delays in the receipt of final completion certificates by certain Project SPVs in the past. In the event we fail to fulfil any condition precedent within the specified period and such delay is not as a result of a breach of the agreement by the concessioning authority or due to a *force majeure* event, the concerned Project SPV will be liable to pay damages to the concessioning authority typically in an amount ranging from 0.1% to 0.2% of the performance security for each day of delay until the fulfilment of such condition precedent, subject to a maximum of 20% of the performance security.

Further, any failure by any Project SPV to maintain or repair the toll roads in conformity with the maintenance requirements specified in the Concession Agreements, the maintenance program, maintenance manual or safety requirements, and it fails to commence remedial works within 15 days of receipt of an inspection report from the Independent Engineer or such other period specified by the concession authority, the concessioning authority will be entitled, in addition to any other rights available to the concessioning authority, including the right to terminate the Concession Agreements, to take the required remedial measures at the concerned Project SPV's risk and cost. In addition to covering the costs of the remedial work, concessioning authority may levy on the concerned Project SPV 20% to 25% (in case of BOT/DBFOT assets) and 50% (in case of TOT assets) of the cost of such work to the concessioning authority as damages.

The Project SPVs have, in the past, exchanged correspondences with the NHAI and the respective independent engineer under the relevant Concession Agreements, in relation to various matters including (i) payment of amounts pursuant to claims raised by the NHAI; (ii) matters where a penalty, demand or action has been recommended by the independent engineer but no further action has been taken by the NHAI; and (iii) letters issued by the NHAI without the imposition of any penalty or demand. A summary of certain correspondence is set out below.

Payments made by the SPVs pursuant to claims from NHAI:

The Project SPVs have made payments to the NHAI in the past, pursuant to claims raised by the NHAI, including as set out below. We cannot assure you that NHAI shall not raise further claims in future or that we will be able to make the payments in a timely manner or at all.

(in ₹ million)

S. No.	Project SPVs	Basis of Demand	Demand Amount	Amount paid by SPV
1.	TOT SPVs	Delay in the completion of the conditions precedent	83.70	83.70
2.	APEL	Default in rectifying certain defects	7.97	7.97
3.	APEL	Delay in completion of overlay work	149.76	149.76
4.	APEL	Towards lower core thickness of layers of project highway	10.00	10.00
5.	FRHL	Reimbursement of penalty from users of vehicles not fitted with FASTag; or without valid or functional FASTag	0.46	0.46
6.	MBEL	Non-compliance of operation and maintenance of the project	19.77	19.77
7.	NDEPL	Delay in completion of punch list items	41.26	41.26
8.	WVEPL	Reimbursement of penalty from users of vehicles not fitted with FASTag; or without valid or functional FASTag	5.88	5.88

Matters where penalty, damages or action has been recommended by the Independent Engineer but no action has been taken by the NHAI:

In certain cases, the independent engineer of the relevant Project SPV(s) has issued letters recommending certain remedial or other action, damages or penalties, which have been responded to by the relevant Project SPV(s), and there has been no correspondence from the NHAI in this regard. We cannot assure you that the NHAI or any other relevant authority may not impose such penalties or take action in the future.

(in ₹ million)

S. No.	SPV	Rationale adopted by IE	Amount (INR million)
1.	JMTL	Improper maintenance of the road markings and kerb paintings	1.34
2.	JMTL	Delay in painting of median kerb	1.07
3.	MBEL	Removal encroachment at the site	0.98
4.	NDEPL	Failure in conducting the required test at the major bridges	2.43
5.	NDEPL	Not carrying out periodical maintenance work (for instance, repair of shoulder, studs, road marking and BC overlay) for the period of January 2021 to May 2022.	41.19
6.	NDEPL	Non-rectification of notified defects.	1.15
7.	WVEPL	Delay in rectification of defects and deficiencies of road and bridge operations in operations and maintenance.	3.82

Other letters issued by the NHAI:

NHAI has also issued certain letters, without imposing any penalty or damages, as disclosed below, which have been responded to by the Project SPVs, and no further correspondence has been received in this regard. We cannot assure you that the NHAI or any other relevant authority will not impose penalties or take action in this regard in the future.

S. No.	SPVs	Description
1.	APEL	Breach in the obligations prescribed under the APEL Concession Agreement endangering the safety of the traffic and causing obstruction in the movement of vehicles
2.	APEL	Submission of site inspection reports, observations and recommendations within the stipulated timelines
3.	DATRPL	Progress achieved on each of the balance works
4.	DATRPL	Non-collection of overload penalties
5.	JMTL	Defects and deficiencies in terms of operation and maintenance obligations under the JMTL Concession Agreement
6.	JMTL	Defects and deficiencies in relation to failure to replace a metal beam crash barrier in terms of operation and maintenance obligations under the JMTL Concession Agreement
7.	JMTL	Defects and deficiencies in relation to rectifying the service road in terms of operation and maintenance obligations under the JMTL Concession Agreement
8.	JMTL	Defects and deficiencies in relation to dumping encroachment bolder waste material dump in right of way of the project highway in terms of operation and maintenance obligations under the JMTL Concession Agreement
9.	MBEL	Unauthorized payments amounting to (a) ₹5.50 million in October 2014; (b) ₹3.50 million in November 2014; and (c) ₹3.65 million in December 2014, from the escrow account for the project
10.	MBEL	Defects and deficiencies in terms of operation and maintenance obligations under the MBEL Concession Agreement
11.	NDEPL	Delay in construction of toilets, along with civil and electrical works for highway nest
12.	NDEPL	High mast lighting at Mallarabanavadi Gate on NH-75
13.	WUPTL	Rectification of blackspots

Other Outstanding Matters

S. No.	Project SPVs	Basis of Demand	Demand Amount
1.	APEL	Delay damages for pending ancillary works.	3.16
2.	WUPTL	Delay in completion of punch list items	118.00
3.	WVEPL	Outstanding bills of the previous independent engineer	2.85

We also face risks in relation to non-collection of overload penalty under National Highway Fee (Determination of Rates and Collection) Rules, 2008.

Further, in the event that any Project SPV fails to repair or rectify any defect or deficiency in respect of the toll roads in accordance with the maintenance requirements specified in the agreements, or if it is in breach of the maintenance program, maintenance manual or safety requirements, it will be liable to pay damages to the concessioning authority, in addition to any other rights available to the concessioning authority, including the right to terminate the Concession

Agreements. The damages payable for such a breach may be an amount equal to the higher of 0.5% of the performance security/average daily fee or ₹ 10,000 and 0.1% of the cost of such repair or rectification, as estimated by the Independent Engineer, and will be payable for each day of delay until the breach is cured.

Any failure by the Project SPVs to fulfil the conditions precedent to the Concession Agreements or to maintain compliance with the operation and maintenance specifications set out in the agreements may result in the imposition of financial penalties on us that may have a material adverse effect on our results of operations and our ability to make distributions to the Ordinary Unitholders.

24. Disruptions to traffic flows on the long network corridors connecting to the toll roads or a failure by local or state agencies to maintain such long network corridors may have an adverse effect on traffic volumes and revenues.

Disruptions to the roadways connecting to the toll roads, including as a result of construction or maintenance activities, is and will continue to be outside of our control. Any such construction or maintenance activities along the long network corridors of the toll roads may have a significant impact on the level of service offered to the users of such routes, particularly if there is a disruption to the flow of traffic, which may cause road users to take alternative routes to avoid such disruptions. Further, if the local or state agencies responsible for the maintenance of the long network corridors do not properly maintain the connecting roadways, or if such maintenance requires any material closure of such roadways, the toll roads may experience a decrease in traffic volume on the toll roads, which could adversely affect our toll collections and our ability to make distributions to the Ordinary Unitholders.

25. Decreases in demand for, or the production of, certain commodities and regulatory changes relating to certain commodities or the transportation thereof may adversely affect traffic volumes and our toll collections.

Traffic volume on our toll roads may be affected by the demand for certain commodities, including agricultural products, construction materials, coal and petroleum products and metals and alloys, which are produced in Uttar Pradesh, Bihar Tamil Nadu, Rajasthan, Kerala, West Bengal, Telangana, Andhra Pradesh and Jharkhand and transported to other states within India via national and state highway connections, including the toll roads. As a result, traffic volumes and our toll collections are susceptible to fluctuations in the demand for, or production of, such commodities. Any decrease in the demand for, or production of, such commodities in the future may result in a reduction in traffic volumes on the toll roads and a corresponding decrease in our toll collections. Further, any potential bans on sand, stone or iron ore mining in the future or other regulatory restrictions on the production or manufacturing of certain commodities, such as the restrictions on sand-mining in Rajasthan and Uttar Pradesh or other concerns may cause a reduction in traffic volumes on the toll roads and a consequential decrease in toll collections.

In addition, DATRPL, MBEL, WUPTL, WVEPL, NDEPL, MKTL, KETL, SMTL, NKTL, FRHL, JVTL and JLTL lie in close proximity to state borders and, as such, are exposed to any regulatory changes regarding interstate transit costs. Any future change in the regulations regarding the dynamics of interstate transit or transportation of commodities may cause a reduction in the flow of traffic by discouraging the transportation of commodities across state borders and prompting industries to source commodities from within their home state. Any such reduction in the demand for, or production of, certain commodities or any increase in the interstate transportation costs of such commodities may have a material adverse effect on our toll collections and our ability to make distributions to the Ordinary Unitholders.

26. Our operations could be adversely affected by strikes, work stoppages or wage increase demands by, or any other kind of disputes involving, our workforce or our contractors' work force or any labour unions.

Certain day-to-day operations of the toll roads are expected to be outsourced to external contractors. There can be no assurance that we will not experience business disruptions in the form of local or nationwide strikes or work stoppages due to disputes relating to wage increases or other problems with our workforce or our contractors' work force or any labour unions. Such labour disruptions may interfere with, or lead to the complete or partial shutdown of the operation of, the toll roads resulting in a loss of toll collections which may, as a result, adversely affect our business and results of operations.

27. The Project SPVs' financing agreements entail interest at variable rates, and any increase in interest rates may adversely affect our results of operations, financial condition and cash flows. Further, the Project SPVs are subject to restrictive covenants under their financing agreements that could limit our flexibility in managing our business or to use cash or other assets.

Certain third-party financing arrangements of the Project SPVs may remain in place after the initial offer of the Ordinary Units. These financing agreements typically entail interest at variable rates with a provision for the periodic reset of interest rates. Accordingly, the Project SPVs are susceptible to changes in interest rates and the risks arising therefrom. Any increase in interest rates may have an adverse effect on our results of operations, financial condition and cash flows.

Furthermore, the financing agreements entered into by the Project SPVs with certain banks and financial institutions contain certain restrictive covenants and cross default provisions. The financing agreements restrict the Project SPVs from, amongst other things, (i) incurring any indebtedness without prior approval of the lenders, other than certain specified and permitted indebtedness; (ii) making any investments other than investments in certain permissible instruments; (iii) effecting changes in its ownership or capital structure without prior approval of the lenders; (iv) making amendments to the constitutional documents; (v) repayment of amounts due to sponsors/promoters; and (vi) changes in management, subject to certain conditions. These may restrict our ability to conduct business and any breach thereof may adversely affect our results of operations and financial condition. In the event of any breach of any covenant contained in these financing agreements, apart from other consequences, the security trustee may enforce the security under the financing agreements which may adversely affect our business, financial condition and results of operations. We may also be required to immediately repay our borrowings either in whole or in part, together with any related costs.

In addition, our ability to meet the debt service obligations and repay the outstanding borrowings of the Project SPVs will depend primarily on the cash generated by our business. We cannot assure you that we will generate sufficient cash to service existing or proposed borrowings or fund other liquidity needs, which could have an adverse effect on our business, cash flows and results of operations. We may be required to refinance our outstanding borrowings in the future. There is no assurance that we will be able to obtain such financing, on favorable terms, or at all, which may have a material adverse effect on our business, financial condition and results of operations.

The debt financing proposed to be provided by the Trust to each of the Project SPVs comprises (i) unsecured subordinate loans ("**Subordinate Trust Financing**") and (ii) loans which, subject to the approval of the concessioning authority and the senior lenders, may be classified as debt owned to a senior lender and secured by a first-ranking exclusive charge, *pari passu* to the charge created to secure the debt owed to the other senior lenders on, *inter-alia* (a) the escrow account of such Project SPV; (b) the rights, title, interest, claims and demands of the relevant Project SPV in its concession agreement, other project agreements, insurance policies and project clearances; and (c) all other movable assets of the relevant Project SPVs ("**Senior Trust Financing**").

The Issue Proceeds are proposed to be utilized by the Trust to provide Subordinate Trust Financing to the Project SPVs. The payment obligations of the Project SPVs in relation to the Subordinate Trust Financing will be subordinated to all existing and future obligations of the Project SPVs towards any secured senior lenders. The Subordinate Trust Financing, would be serviced from the balance amounts remaining in the escrow accounts maintained by each Project SPV as mandated under the relevant concession agreements after the payment of, among other things, all taxes due, all expenses in connection with the construction of the project, operations and maintenance expenses, including fees collection expenses, expenses for repair works, payment of concession fees, debt service payments to senior lenders (as defined under the relevant concession agreements), additional concession fees or premium, negative grants payable to the concessioning authority, reimbursement of expenditure incurred by the concessioning authority, any payments and damages due and payable and any reserve requirements set forth in the financing agreements, as defined in the relevant concession agreements (the "**Surplus Cash Flows**").

Any reduction in the cash flows of the Project SPVs or any unanticipated increase in any of the payments to be made by the Project SPVs from the escrow accounts may result in a decrease in the Surplus Cash Flows, which may materially and adversely impact the ability of the Project SPVs to meet their payment obligations to the Trust in relation to the Subordinate Trust Financing.

Further, if the relevant concession agreement is terminated, the Surplus Cash Flows together with the termination payments deposited in the relevant escrow account will be applied towards the payment of the amounts outstanding to the senior lenders prior to the payment of the amounts outstanding under the Subordinate Trust Financing. Any inability on the part of any of the Project SPVs to meet their payment obligations to the Trust may adversely impact the ability of the Trust to make distributions to the Ordinary Unitholders in the manner described in this Final Placement Memorandum or at all.

Further, the Senior Trust Financing shall be disbursed by the Trust upon receipt of all approvals of the relevant concessioning authorities and the senior lenders of the Project SPVs in relation to re-financing of their existing loans. While certain Project SPVs have obtained such approvals, two of our Project SPVs have applied for the relevant approvals and are yet to receive the same. We cannot assure you the Project SPVs shall receive such approvals in a timely manner or that such approvals will not contain any unfavourable conditions.

Pursuant to the Trust Loan Agreements, the Trust will provide loans to the Project SPVs that will be utilized by the Project SPVs to, amongst other things, repay outstanding debt from the Cube Group, banks and financial institutions, including an affiliate of the Trustee.

For further details in relation to the financing arrangements entered into by the Project SPVs, please see the section entitled "*Financial Indebtedness and Deferred Payments*" on page 232.

28. The cost of implementing new technologies or refurbishing existing equipment for operating, maintaining and monitoring the toll roads could materially and adversely affect our ability to make distributions to the Ordinary Unitholders.

Our future success will depend in part on our ability to respond to technological advances and emerging standards and practices on a cost-effective and timely basis. In addition, rapid and frequent technology and market-demand changes can often render existing technologies and equipment obsolete, requiring substantial new capital expenditures or write-downs of assets. Any failure by us to successfully adopt such technologies in a cost-effective and timely manner could increase our costs. Additionally, governmental authorities may require adherence with certain technologies in the execution of projects and we might not be able to implement the same in a timely manner, or at all.

For example, recently, FASTag lanes on toll plazas is a policy initiative of the GoI in which there is an exclusive lane in the toll plaza for movement of vehicles fitted with FASTag. The FASTag is a device which is fitted on the front windscreen of vehicles to indicate online toll payment. The proper functioning of such technology infrastructure is essential to the conduct of our business.

In addition, some of the equipment to be used by us at the toll roads have pre-determined useful lives and we are required to replace or refurbish such equipment at periodic intervals. There can be no assurance that we would be able to replace or refurbish such equipment and further such replacement or refurbishment might not be undertaken in a cost-effective manner and any increased costs to us as a result of such replacement or refurbishment will adversely affect our profit margins and cash flows.

29. There may be interruptions in our information technology systems, including the operation of the automated toll accounting and administrative systems at the toll roads.

We have and will continue to rely on sophisticated information technology systems and infrastructure to support our businesses. Further, as the Project SPVs are reliant on an electronic toll collection system, our transaction-processing systems and reliable network infrastructure are critical for successful toll collections. In particular, the toll roads are managed, in part, by third-party hardware and software which account for and administer the collection of tolls. These information technology systems may be susceptible to outages due to fire, explosions, floods, power loss, telecommunications failures, cyberattacks, security breaches, and similar events. Information technology system failures, network disruptions and breaches of data security could disrupt our operations. Although we expect to take steps to protect our systems from security breaches and unauthorized access by third parties, such efforts may be unsuccessful due to software glitches, employee error or malfeasance, government surveillance, or other factors. Further, if our systems or software were to malfunction, the accuracy of our traffic data and our ability to correctly identify and classify vehicles would be adversely affected, which may lead to underreporting of toll revenue, among other things. Furthermore, the government is contemplating transitioning to a Global Navigation Satellite System ("**GNSS**")/ other similar system based tolling in India. Under the proposed GNSS technology-based tolling system/ similar system, the national highway stretch will be geo-fenced and shall consist of virtual tolling points. Whenever a vehicle fitted with GNSS (or an equivalent form of an on-board unit) shall pass through this virtual tolling points, information on distance travelled will be calculated based on satellite signals and applicable fee shall be computed by the central GNSS software system and deducted from the toll users' bank account linked to the vehicle/ on-board unit. The timeline and mechanics for implementation of this system including its impact on our business are unknown and still being deliberated amongst various stakeholders. However, successful implementation of this system, once applicable, would be essential for us to conduct our business and collect toll revenue.

If any unforeseen event were to render all or part of our information technology systems or toll collection computer systems non-operational, or in the event that these systems malfunction and are not able to be restored quickly, our business may be harmed and our ability to make distributions to the Ordinary Unitholders may be impaired. There can be no assurance that our business continuity plans will be completely effective during an information technology failure or interruption. Such failures could have an adverse effect on our business, financial condition and results of operations.

30. The business and financial performance of the Trust, the operations of the Project SPVs and any future assets that we may acquire, are significantly dependent on the policies of, and relationships with, various government entities in India and could be affected if there are adverse changes in such policies or relationships.

The operations of the Project SPVs and any future assets that we may acquire, are and will be significantly dependent on various central and state government entities, in terms of policies, incentives, budgetary allocations and other resources provided by these entities for the surface transportation industry, as well as the terms of the contractual arrangements, concessions and other incentives available from these government entities for the projects. Sustained increases in budgetary allocations by the GoI and various state governments for investments in the infrastructure sector, the development of structured and comprehensive infrastructure policies that encourage greater private sector participation

and increased funding by international and multilateral development financial institutions in infrastructure projects in India have resulted in, and are expected to continue to result in, an increase in the amount of transportation infrastructure projects undertaken in India. Any adverse change in the focus or policy framework regarding infrastructure development or the surface transportation industry, or change in the Trust's relationships with the GoI or various government entities in India, could adversely affect the Project SPVs, the opportunities for the Trust to secure new assets and our business, results of operations and financial condition.

In addition, the projects in which government entities participate may be subject to delays, extensive internal processes, policy changes, changes due to local, national and internal political pressures and changes in governmental or external budgetary allocation and insufficiency of funds. Since government entities are responsible for awarding concessions and are parties to the development and operations of projects, projects are directly and significantly dependent on their support. Any withdrawal of support or adverse changes in their policies may lead to the agreements being renegotiated and could also adversely affect the financing, capital expenditure, revenues, development or operations relating to the current and future assets of the Project SPVs.

31. We may be adversely affected by presently unidentified environmental matters or changes in environmental regulation that could give rise to potential liability in the future.

The operation of the toll roads is subject to various environmental laws and regulations, including those relating to the discharge of pollutants, the treatment, transport, storage and disposal of solid and hazardous wastes, and the remediation of soil and groundwater contamination. While we believe the toll roads are in material compliance with applicable environmental requirements, we cannot be certain that we have identified all environmental matters giving rise to potential liability, or that current environmental regulations will not materially change. Environmental approvals are typically subject to ongoing compliance in the form of monitoring, audit and reporting norms, under, *inter alia*, central and state-specific environmental regulations. For example, consent to operate under the Water (Prevention & Control of Pollution) Act 1974 and the Air (Prevention & Control of Pollution) Act, 1981 have not been obtained for one of our Project SPVs (GAEPL) as of the date of this Final Placement Memorandum and are proposed to be obtained as conditions subsequent, i.e., after the completion of the acquisition of such Project SPV by the Trust, under the relevant Share Purchase Agreement. Also see the section entitled "*Regulatory Approvals*" on page 294. We cannot assure you that such action may not be taken by the concerned authorities, which may adversely impact our ability to continue operating the relevant project in a profitable manner, or at all.

The past use of hazardous materials by the concessioning authority or its sub-contractors, new releases of hazardous substances, or more stringent future environmental requirements (or different methods of enforcing existing requirements) could result in additional or unforeseen expenditures or liabilities which could have an adverse effect on our business or financial condition.

32. We operate in a regulated environment and are required to maintain certain licenses, approvals, registrations, consents and permits in the ordinary course of business, and compliance with our obligations under the Concession Agreements may be affected by the development and application of regulations in India.

We operate in a regulated environment, and our toll road operations are regulated pursuant to the applicable environmental, labour, social security, public health, consumer protection, competition, operational and safety regulations, among others. If we fail to obtain, or renew, necessary approvals required to undertake our businesses, or if there is any delay in obtaining these approvals, our businesses and financial condition could be adversely affected. Further, government approvals and licenses are subject to numerous conditions, some of which are onerous and require us to incur substantial expenditure. We cannot assure you that we would be able to continuously meet such conditions or the approvals, licenses, registrations, consents and permits issued to us would not be suspended or revoked in the event of non-compliance with any terms or conditions thereof, or pursuant to any regulatory action. This may result in the interruption of our operations and may materially and adversely affect our business, financial condition and results of operations.

We were also required to obtain the approval of the NHAI for the transfer of the Project SPVs and related actions. As of the date of this Final Placement Memorandum, we have received approvals for the transfer of the Project SPVs, subject to completion of certain conditions prescribed under the relevant approval letter, including the completion of pending construction work within a specified timeline, execution of certain agreements in relation to outgoing promoters not having residual rights over accrued claims and submission of certain undertakings and certificates, including undertakings that the Sponsors and their associates would continue to hold at least 51% of the Units of the Trust until the completion of the construction period and for a period of two years thereafter for Project SPVs where construction has not been completed. Also see "*Regulatory Approvals*" on page 294. If we are unable to meet the conditions imposed by the NHAI, in a manner satisfactory to NHAI, the NHAI may, amongst other things, take certain actions against us (including withdrawal of the approvals). Further, we cannot assure you that the NHAI will not require us to execute any more agreements or fulfil any additional conditions.

Furthermore, regulatory changes in India may result in the requirement to allocate incremental costs that may adversely affect our operation of the toll roads, the performance obligations of the Project SPVs under the Concession Agreements and ultimately our toll collections. As an example, there have been declarations by state governments in Gujarat and Maharashtra, among others, in the past that all cars travelling on state highways are permitted to use such highways toll free. Any similar announcement in any states in which the toll roads are located may result in a diversion of traffic from tolled national highways to such state highways which have been declared toll free.

In addition, it is possible that governmental authorities could take enforcement action against us for our failure to comply with regulations applicable to us. Any failure by us to comply with applicable laws and regulations in a timely manner or at all may result in us being subject to administrative, civil and criminal proceedings by governmental authorities, as well as civil and criminal proceedings, which could have a material adverse effect on our operations or result in the imposition of fines or penalties against us, the suspension of operations, or the termination of the Concession Agreements. Penalties imposed by regulatory authorities on us or third parties upon whom we depend may also disrupt our business and operations. Further, we may become involved in future litigation, regulatory enforcement actions or other proceedings or be held responsible in any such future litigation or proceedings relating to breach of laws or regulations, including those relating to safety, health and environmental matters. Any damages, payment of fines or other penalties, clean-up or remediation costs, as well as other liabilities and related litigation, could materially and adversely affect our business, prospects, financial condition, cash flows and results of operations and ability to make distributions to the Ordinary Unitholders.

33. Our Project SPVs are subject to ongoing compliance requirements under various laws, and there have been certain past instances of non-compliance.

There have been instances in the past where the Project SPVs may not have been in compliance with a particular compliance or filing requirement under applicable regulatory requirements, or there may have been a delay in such compliance or filing requirement. For example, there have been instances of where approvals obtained or documentation in the old name of an entity has not been replaced with a revised approval or documentation in the new name. Certain documents for periods prior to the acquisition may not be available. There have also been instances in delay of filings in the past such as, *inter alia*, filings for issue or transfer of shares under the foreign exchange regulations for which such Project SPVs have obtained compounding orders and paid the relevant penalty or late submission fee to the regulatory authority. There have also been instances of non-filings by third-party sellers that transferred shares to the Sponsors (or their associates). Also, given that the Sponsors have historically acquired the Project SPVs from third parties, the third party sellers have provided indemnities in relation to various matters for periods prior to the acquisition under the relevant acquisition agreements.

Any non-compliance or delay in filing under applicable laws in the future will subject the relevant Project SPV to a penalty, which may have an impact on the results of operations of such Project SPV.

34. The outcome of any future actual or threatened legal, regulatory or other proceedings arising from our business operations could adversely affect our business, financial condition, result of operations and prospects.

From time to time, we or our directors, officers or employees or the Parties to the Trust may be involved in legal, regulatory and other proceedings concerning matters that arise in the ordinary course of our business operations, including as a result of disputes with the concessioning authority in relation to the provisions of the Concession Agreements, labour disputes with our employees or contract workers, and disputes with our contractual counterparties, local unions, or users of the toll roads. These disputes may lead to legal, criminal, civil, regulatory and other proceedings, and may cause us to incur significant costs, delays and other disruptions to our business and operations. In addition, regulatory actions and disputes with governmental authorities may result in fines, penalties and other administrative sanctions. There can be no assurance that the outcome of any future legal, regulatory or other proceedings that may be brought against us in the future will not adversely affect our reputation, business, financial condition, results of operations and prospects. For further details, please see the section entitled "*Legal and Other Information*" on page 301.

35. The Project SPVs are subject to force majeure risks, which may adversely affect our ability to make distributions to the Ordinary Unitholders.

If any Project SPV is unable to perform its obligations under the Concession Agreements as a result of a *force majeure* event, such as a war, strike, riot, act of terrorism, natural catastrophe or epidemic, although it would not be in breach of the Concession Agreements, its toll collections may be adversely affected. Upon the occurrence of any *force majeure* event prior to the commencement of the concession period, and subject to the concessioning authority's approval, the concession period commencement date may be extended by a period equal to the *force majeure* event, provided that the concerned Project SPV notifies the concessioning authority of such *force majeure* event. Any delay in the commencement of the concession period would cause a delay in our toll collections, which would have an adverse impact on our business and results of operations and, therefore our ability to make distributions to the Ordinary Unitholders. In the event that any

force majeure event, such as flooding, damage to the toll roads or the destruction of our toll-collection computer system, interrupts our ability to operate the toll roads, there may be a significant reduction in toll collections, which may adversely affect our ability to make distributions to the Ordinary Unitholders. In addition, we may not have sufficient insurance coverage to protect us against all resulting losses.

Upon the occurrence of certain indirect political events, such as war, strikes or industrial action and public agitation, we will be liable for the costs attributable to such events. If the costs exceed our insurance for such events, the concessioning authority will typically be obligated to reimburse us for one half of the excess amount of the costs over and above the insurance limit. Upon the occurrence of certain other political events, such as a change in law or compulsory acquisition or expropriation of any toll road, the concessioning authority will be obligated to reimburse us for all costs attributable to such events subject to the terms of the concession agreements. In certain circumstances, the term of the Concession Agreement may be extended by the length of the duration of the *force majeure* event or the length of the duration of the period during which we were prevented from collecting toll fees.

Notwithstanding the terms of the Concession Agreements, there can be no assurance that, if certain political events occur causing damage or other loss to us, the concessioning authority will reimburse us in a timely manner or at all. In the event the concessioning authority fails to meet its reimbursement obligations under the terms of the Concession Agreements, our business, financial position and results of operations may be significantly adversely affected and we may be unable to make distributions to the Ordinary Unitholders.

36. The Concession Agreements contain certain restrictive covenants and require that certain actions by the Project SPVs must receive the prior approval of the concessioning authority or the Independent Engineer, which may impose constraints on our flexibility to conduct our business.

The Concession Agreements contain restrictive covenants, including a provision that mandates the inclusion by the concerned Project SPV of a substitution clause in any project agreement relating to the toll roads, such as the operation and maintenance or tolling agreements. Such substitution provision must allow the concessioning authority to step into such project agreements in place of us in case of a suspension or termination of the Concession Agreements due to a breach or default by us.

Further, the Concession Agreements require the submission to the concessioning authority, for its review and comment, all project agreements, and any amendments or replacements of such agreements, to which any Project SPV is or will be a party prior to entry, amendment or replacement of such agreements, even if such agreements do not affect the financial liability or obligations of the concessioning authority. In addition, the Project SPVs are restricted from closing any lane of the toll roads in order to undertake maintenance or repair work without the prior written approval of the Independent Engineer. Any delay in conducting required maintenance or repair work, as a result of the need to obtain the prior written consent of the Independent Engineer, may result in additional maintenance costs to us. The restrictions described above, together with any other restrictive covenants or approval requirements set out in the Concession Agreements, may impose constraints on our and the Project SPVs flexibility to conduct business. If, as a result of these restrictions, we are unable to pursue a favorable course of action or to respond to an unfavorable event, condition or circumstance, our business, prospects, financial condition, cash flows and results of operations may be materially and adversely affected.

37. We may be required to pay additional stamp duty if any Concession Agreement is subject to payment of stamp duty as a deed creating leasehold rights, or as a development agreement.

For the purposes of stamp duty payment, concession agreements are generally considered to be agreements which are not lease deeds and stamp duty ranging between ₹ 100 and ₹ 500 is typically paid for such concession agreements. However, stamp duty authorities of certain states in India have issued notices to certain Project SPVs alleging inadequate stamp duty on the concession agreements executed between the concessionaires and the NHAI. For details, see "*Legal and Other Information"* on page 301. Certain stamp authorities have alleged that since concession agreements relate to the letting of tolls to the concessionaires in the form of leases, or as development agreements, such agreements may be required to be stamped as lease agreements or development agreements, as applicable. The stamp duty for a lease agreement or a development agreement ranges between 1.0% and 11.0% of the annual rent or premium payable or the market value of the property. Furthermore, stamp duty authorities may impose penalties for payment of inadequate stamp duty, which could extend up to 10 times the amount of the stamp duty payable. Accordingly, concession agreements that have not been stamped as such could be considered to be inadequately stamped.

If any of the Concession Agreements were determined to be inadequately stamped, then such agreements would be inadmissible as evidence in any legal action, until the deficient amount of stamp duty together with penalties, if any, was paid. Any deficiently stamped documents can also be impounded by any person having authority, by law or consent, to receive evidence or every person who is in-charge of a public office, and such impounded documents could be made subject to stamp duty and penalty. In addition, a person who signs an instrument chargeable with stamp duty will be subject to a fine if such instrument is not duly stamped.

While we have paid stamp duty of ₹ 100.00 on each of our Concession Agreements in accordance with advice received and in line with usual practice, if any demand for payment of a higher stamp duty or penalty is imposed which would increase the costs of the toll roads, then to the extent such additional costs are not recoverable from the concession authorities, such demand could adversely affect our business, results of operations and prospects. For details of such proceedings in relation to our stamp duty obligations, see "*Legal and Other Information*" on page 301 of this Final Placement Memorandum.

38. The Investment Manager may not be able to maintain adequate insurance to cover all losses that we may incur.

As of October 31, 2022, the aggregate coverage under insurance policies obtained by us were ₹ 193,113.12 million. The Investment Manager will maintain insurance cover on the properties and equipment required for the operations of the Initial Portfolio Assets in amounts believed to be consistent with the industry practice. Our insurance policies cover physical loss or damage to the property arising from a number of specified risks and includes, amongst others comprehensive or commercial general liability, employees' compensation insurance policies, group medical insurance policies and industrial all risk insurance.

Despite the insurance coverage, we may not be fully insured against some business risks and the occurrence of accidents that cause losses in excess of limits specified under the concerned policies, or losses arising from events not covered by the insurance policies, which could adversely affect our business and results of operations. For example, we may incur a loss of revenue on account of pandemics such as COVID-19 and such loss may not be covered by our insurance policies. Further, if a fire or natural disaster substantially damages or destroys some or all of the assets owned by the Initial Portfolio Assets, the proceeds of any insurance claim may be insufficient to cover any expenses faced by us, including rebuilding costs.

39. We may be subject to penalties and claims from the concessioning authorities and third parties during the course of operations of the Project SPVs and may not be able to recover all operational losses from the Project Manager and/ or other contractors providing operations and maintenance services to the Projects.

The Project SPVs may, from time to time, receive letters and notices from the concessioning authorities or other third parties imposing penalties and seeking claims for any deficiencies or non-compliance with the terms of the concession agreement or other project agreements or a claim or compensation under the terms of the concession agreements. The Project SPVs may contest such claims or invoke any indemnification provided by the Project Manager and/ or any O&M contractor it has appointed or may appoint. However, there may be limitations on the ability to claim such amounts from the Project Manager or the O&M contractors in terms of the agreements entered into with them. There would be an adverse effect on the Project SPV's operations and financial condition if a claim is decided against such Project SPV. Ongoing claims by the Project SPVs against the concessioning authorities, if any, have been disclosed in the section entitled "*Legal and Other Information*" on page 301.

Risks Related to the Structure of the Trust

40. We must maintain certain investment ratios, which may present additional risks to us.

Pursuant to the InvIT Regulations, we are required to invest not less than 80% of the value of our assets in eligible infrastructure projects as defined under the InvIT Regulations, such as the Initial Portfolio Assets. In addition, we must not invest more than 20% of the value of our assets in certain financial instruments prescribed under the InvIT Regulations. If these conditions are not fulfilled or breached on account of market movements of the price of the underlying assets or securities, the Investment Manager must inform the Trustee and ensure that these conditions are satisfied within six months of such breach (or within one year with the Ordinary Unitholder approval). Failure to comply with these conditions may present additional risks to us, including divestment of some or all of our assets, delisting of our Ordinary Units from the stock exchanges and other penalties, which could have a material adverse effect on our business, financial condition and results of operations.

41. We do not provide any assurance or guarantee of any distributions to the Ordinary Unitholders. Further, the level of distributions may fall.

The Trust's distributions will be based on the cash flows generated from the operations to be undertaken by the underlying Project SPVs held by the Trust and not on whether the Trust makes an accounting profit or loss. The InvIT Regulations provide that not less than 90% of net distributable cash flows of each Project SPV are required to be distributed to the Trust in proportion of the Trust's holding in the Project SPVs subject to applicable provisions of the Companies Act. Not less than 90% of distributable cash flows of the Trust shall be distributed to the Unitholders. Under the InvIT Regulations, such distributions are required to be declared and made not less than once in every year and shall be made not later than fifteen days from the date of such declaration. For more details, see the section headed "*Distribution*" on page 243 of this Final Placement Memorandum.

The Trust will also rely on the receipt of interest, dividends, and principal repayments (net of applicable taxes and expenses) from each Project SPV in order to make distributions to the Ordinary Unitholders. There is no assurance that the Trust will be able to make distributions to the Ordinary Unitholders or that distributions will be consistent across various periods. Further, the income earned by each of the Project SPVs may be affected by a number of factors including, among other things:

- the business and financial position of the Project SPVs;
- amount of income generated from toll receipts, default or delay in payment of annuity income to the Project SPVs, and the level of operating and other expenses incurred as a result of escalation in commodity prices and labour costs;
- ability of the Project SPVs to borrow funds and access debt capital markets;
- applicable laws and regulations, which may restrict the payment of distributions by the Project SPVs;
- fluctuations in the working capital needs of the Project SPVs;
- changes in accounting standards, taxation laws and regulations, laws and regulations in respect of foreign exchange repatriation of funds, corporation laws and regulations relating thereto; and
- the terms of agreements, including the Concession Agreements, project agreements or financing agreements, to which the Project SPVs are, or may become, a party.

The distributions from the SPVs to the Trust may also be subject to the requirement of creation of certain necessary reserves, such as a major maintenance reserve or a debt service reserve, as set out in the distribution policy of the Trust. For more details, see the section headed "*Distribution*" on page 243 of this Final Placement Memorandum.

Further, the methodology of computation of the net distributable cash flows may change subsequently due to regulatory changes which can impact the amount of cash flows available for distribution. Any change in applicable laws in India or elsewhere (including, for example, tax laws and foreign exchange controls) may limit our ability to pay or maintain distributions to our Ordinary Unitholders. Furthermore, no assurance can be given that we will be able to pay or maintain the levels of distributions at all, or that the level of distributions will increase over time, or that future acquisitions or rights in new assets will increase our distributable cash flow to our Ordinary Unitholders. Any reduction in, or delay/default in payments of distributions could materially and adversely affect the market price of our Ordinary Units.

In addition, the financing agreements entered into by any of the Project SPVs with banks, financial institutions or accessed through the debt capital markets may typically contain certain restrictive covenants, including, but not limited to, requirements that they obtain consent from the lenders prior to making any payments to the Trust. Any failure to obtain such consents in a timely manner or at all would impede our ability to make distributions to the Ordinary Unitholders on a regular basis or at all, which could materially and adversely affect the market price of the Ordinary Units. Additionally, following a default under our financing agreements if and when entered into, lenders may take coercive actions as per the rights available to them under applicable law, which may restrict our ability to conduct business and operations.

42. Distributions may be adversely impacted due to cash trapped in the Project SPVs.

Under the Companies Act, 2013, a company can declare dividends only after the mandatory transfer of profits to reserves. Further, amortisation and depreciation are non-cash expenditures and are charged to the profit and loss account. Consequently, a company may have surplus cash but no profit in the profit and loss account and thus will not be able to declare dividends, resulting in cash trapped in the company. In the event that cash is trapped in the Project SPVs, the Investment Manager and the Trustee may evaluate various options to extract the cash and make distributions to the Ordinary Unitholders. There is no assurance that any such options to extract the cash trapped in the Project SPVs would not have adverse tax implications or impact our distributions, business and results of operation adversely.

43. We are governed by the provisions of, amongst others, the InvIT Regulations and the Securities Contracts (Regulation) Act, 1956 ("SCRA"), the implementation and interpretation of which, is evolving. The evolving regulatory framework governing infrastructure investment trusts in India may impact the ability of certain categories of investors to invest in the Ordinary Units, our business, financial condition and results of operations and our ability to make distributions to the Ordinary Unitholders.

SEBI issued the InvIT Regulations with effect from September 26, 2014 which have been periodically amended and supplemented with additional guidelines, notifications and circulars. Recently, SEBI has issued amendments to the InvIT Regulations dated February 14, 2023. As the regulatory framework governing InvITs in India comprises of a separate set of regulations, interpretation and enforcement by regulators and courts involves uncertainties. Furthermore, regulations and processes with respect to certain aspects of infrastructure investment trusts, including, but not limited to, follow-on public offers and bonus issues, the liabilities of the Unitholders, and the procedure for dissolution and delisting of infrastructure investment trusts have not yet been issued. For example, infrastructure investment trusts are not "companies" or "bodies corporate" within the meaning of the Companies Act, 2013 and various SEBI regulations, including the Securities and Exchange Board of India (Buy-back of Securities) Regulations, 2018 and the Securities and

Exchange Board of India (Substantial Acquisition of Shares and Takeovers) Regulations, 2011. Further, SEBI has also released a consultation paper dated February 23, 2023 in relation to the unitholding of a sponsor in an InvIT and real estate investment trust. We cannot assure you that there will not be changes to the regulatory requirements applicable to the Trust and its Unitholders due to such consultation paper or any future consultation papers released by SEBI.

With effect from April 1, 2021, units and other instruments issued by an InvIT have been included in the definition of '*securities*' under section 2(h) of the SCRA and consequently, the implementation and interpretation of these amendments is untested and evolving. Accordingly, the applicability of several regulations (including regulations relating to intermediaries, underwriters, merchant bankers, insider trading, takeovers and fraudulent and unfair trade practices) to the Trust is subject to the interpretation and clarifications issued by regulatory bodies such as SEBI.

Furthermore, SEBI has the right to, with or without prior notice, order inspection of the books of accounts, records and other documents pertaining to our operations, either on its own or, upon receipt of complaint. Upon review of the inspection report, SEBI is entitled to, if it so deems appropriate (in the interest of the securities markets or our investors) (a) require us to surrender our certificate of registration; (b) wind-up our operations; (c) sell our assets; (d) cease our operations or restrict our ability to access the capital markets for a specified period; or (e) direct us to not do such things as SEBI may deem appropriate in the interest of our investors. Any such occurrence may have a material adverse effect on our business, result of operations, financial conditions and cash flows.

Further, it is unclear whether certain categories of investors that are currently permitted to invest in equity shares offered by Indian companies, may also invest in the Ordinary Units in the Offer. In addition, new costs may arise from audit, certification and/or self-assessment standards required to maintain compliance with new and existing InvIT Regulations. Such changes in regulation, interpretation and enforcement may render it economically unviable to continue conducting business as an InvIT or have a material, adverse effect on our business, financial condition and results of operations.

As we will be operating in a regulatory framework with uncertainties, it is difficult to forecast how any new laws, regulations or standards or future amendments to the InvIT Regulations, including new interpretations by courts or regulators of existing regulations or from stricter enforcement practices by regulatory authorities of existing regulations will affect infrastructure investment trusts and this could have any consequential impact on the infrastructure sector in India. There can be no assurance that the regulatory system will not change in a way that will impair our ability to comply with the regulations, conduct our business, compete effectively or make distributions. We may incur increased costs and other burdens relating to compliance with such new regulations, which may also require significant time and other resources, and any failure to comply with these changes may adversely affect our business, results of operations and prospects. Failure to comply with changes in laws, regulations and standards may have a material adverse effect on our business, financial condition, results of operations and prospects.

44. The transfer of the Project SPVs to the Trust under the Share Purchase Agreements may result in certain risks.

As a part of the Share Purchase Agreements, we have assumed existing liabilities of the Project SPVs. Although we have conducted due diligence on the Project SPVs with the objective of identifying any material existing liabilities, we may not have been able to identify all such liabilities prior to the completion of the Share Purchase Agreements. There can be no assurance that the Project SPVs or the Projects will not have defects or deficiencies that are unknown or unquantified and that may require additional capital expenditure or obligations to third parties, including to the relevant concessioning and statutory authorities, which may have an adverse effect on the Trust's earnings and cash flows and the distributions to the Ordinary Unitholders, upon acquisition. Further, the Sponsors and their affiliates have historically acquired the Project SPVs from third parties and may rely on the indemnities provided by such erstwhile sellers to cover for any losses suffered by the Sponsors and their affiliates or the Trust. The indemnities provided by the erstwhile sellers may be subject to certain limitations and the Trust may not be able to enforce such indemnities due to various factors, including the credit worthiness of the erstwhile sellers. Any losses or liabilities suffered by us in relation to the Project SPVs will materially adversely impact our results of operations, profitability, cash flows and our ability to make distributions to the Ordinary Unitholders. There is no assurance that in the event of any defects or deficiencies in the Project SPVs or any losses suffered by us in relation to the Project SPVs, we will be able to raise any claim or recover any losses from the Sponsors or their affiliates or the erstwhile sellers, as applicable, in a timely manner, or at all.

45. Parties to the Trust are required to maintain the eligibility conditions specified under Regulation 4 of the InvIT Regulations on an ongoing basis. Non-compliance by the Sponsors, the Investment Manager, the Project Manager and the Trustee, could result in the cancellation of the registration of the Trust.

Each of the Parties to the Trust are required to maintain the eligibility conditions specified under Regulation 4 of the InvIT Regulations on an ongoing basis. These eligibility conditions include, among other things, that (a) the Sponsors, Investment Manager and Trustee are separate entities, (b) the Sponsors have a net worth of not less than ₹ 1,000 million and has a sound track record in the development of infrastructure or fund management in the infrastructure sector, (c) the Investment Manager has a net worth of not less than ₹ 100 million and has not less than five years' experience in fund

management or advisory services or development in the infrastructure sector or the combined experience of the directors, partners and employees of the investment manager, each with at least five years of experience, in fund management or advisory services or development in the infrastructure sector is not less than 30 years, (d) the Trustee is registered with the SEBI under Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993 and is not an associate of the Sponsors or Investment Manager, and (e) each of the Trust, the Sponsors, Investment Manager, Project Manager and Trustee are "fit and proper persons" as defined under Schedule II of the Intermediaries Regulations on an ongoing basis. Any non-compliance by the Sponsors, the Investment Manager, the Project Manager and the Trustee, may result in the cancellation of the registration of the Trust.

46. The Sponsors, whose interests may be different from the other Unitholders, will be able to exercise significant influence over certain activities of the Trust, and under the InvIT Regulations, they have the ability to divest their entire holdings in the Ordinary Units three years following the Offer.

After the completion of the Offer, i.e. on a post-Offer basis, the Sponsors (who are also Selling Unitholders) will own an aggregate of not less than 15% of the issued and outstanding Ordinary Units and will be entitled to vote as an Ordinary Unitholder on all matters other than matters where it is a related party and not permitted to vote under the InvIT Regulations. Although the Investment Manager will have a board of directors which will include majority independent directors, the Sponsors may nonetheless be in a position to exercise significant influence in matters which require the approval of the Ordinary Unitholders by virtue of its ownership of Ordinary Units in the Trust. The interests of the Sponsors may be different from those of the other Unitholders. The Sponsors may also exercise influence over the Investment Manager and the Project Manager, which are associates of the Sponsors. Accordingly, the Investment Manager and Project Manager may also be subject to conflicts of interest with respect to the Trust.

In addition, under the InvIT Regulations, the Sponsors will be able to divest their entire holding in the Ordinary Units at any time three years subsequent to the Offer after completion of the lock-in period prescribed under the InvIT Regulations. Given the influence that the Sponsors exert on the Investment Manager and the Project Manager, and consequently the operations and credibility of the Trust, any material divestiture by the Sponsors in the Ordinary Units, or any conflict of interest that it has compared to that of other Unitholders, could have a material adverse impact on our business, financial condition and results of operations.

47. As a shareholder of the Project SPVs, the Trust's rights are subordinated to the rights of creditors, debt holders and other parties specified under Indian law in the event of insolvency or liquidation of the Project SPVs.

In the event of liquidation of any Project SPV, the secured and unsecured creditors of the relevant Project SPV will be entitled to payment from the liquidation proceeds in priority to us in our capacity as an equity shareholder of the Project SPVs. Under the Insolvency and Bankruptcy Code, 2016, in the event of winding-up of any Project SPV, workmen's dues and debts due to secured creditors which rank pari passu are required to be paid in priority over all other outstanding debt, followed by wages and salaries of employees, debts due to unsecured creditors, any amounts due to the central or state government, any other debts, preference shareholders and equity shareholders. Further, amounts payable to us in respect of any unsecured debt issued to the relevant Project SPV will be subordinated in the manner set forth above. Further, should the Trust be dissolved, depending on the circumstances and the terms upon which our assets are disposed of, there is no assurance that a Unitholder will recover all or any part of its investment. There may also be uncertainty around the interpretation and implementation of certain provisions in relation to insolvency of a trust under the Insolvency and Bankruptcy Code, 2016.

48. The InvIT Regulations allow for sponsors of listed InvITs to be declassified from the status of sponsors subject to certain conditions. There can be no assurance that our Sponsors will not exercise their ability to be declassified as the Sponsor(s) of the Trust.

The InvIT Regulations permit sponsors of listed infrastructure investment trusts to be declassified from the status of sponsors subject to compliance with the following conditions:

- the units of the relevant InvIT should have been listed on the stock exchanges for a period of three years;
- the unitholding of such sponsor and its associates taken together should not exceed 10% of the outstanding units of the relevant InvIT;
- the investment manager of the relevant InvIT is not an entity controlled by such sponsor or its associates; and
- approval of unitholders has been obtained in accordance with the InvIT Regulations.

There can be no assurance that in the future, all or any of our Sponsors, upon fulfilment of the aforementioned conditions or any other conditions that SEBI prescribes for declassifications of sponsors, will not exercise their ability to declassify themselves from the status of our Sponsor(s).

Risks Related to the Trust's Relationships with the Sponsors and the Investment Manager

49. We will depend on certain directors, executive officers and key employees of the Investment Manager, the Project Manager, and such entities may be unable to appoint, retain such personnel or to replace them with similarly qualified personnel, which could have a material adverse effect on the business, financial condition, results of operations and prospects of the Trust.

Our performance will depend, in part, upon the continued service and performance of certain directors, executive officers and key personnel of the Investment Manager and Project Manager. Once the Project SPVs are transferred to the Trust, the Investment Manager will rely on the Project Manager for its expertise in managing and operating road and highway projects. There can be no assurance that we will be able to satisfactorily operate the toll roads in the manner that they were operated to prior to the formation of the Trust. Furthermore, the continued operations and growth of our business will be dependent upon the Investment Manager and the Project Manager being able to attract and retain personnel who have the necessary and required experience and expertise. Competition for qualified and experienced personnel with relevant industry expertise in India is intense due to the scarcity of qualified individuals in the toll-road business, and the aforesaid entities may not be able to retain their executive officers and key employees or attract and retain fresh talent in the future. Furthermore, the Investment Manager and the Project Manager may not be able to adequately re-deploy and re-train their employees to keep pace with evolving industry standards and changing customer preferences. Any inability by the Investment Manager and/or the Project Manager to retain their directors, executive officers and key employees, or the inability to replace such individuals with similarly qualified personnel, could have a material, adverse effect on the business, financial condition, results of operations and prospects of the Trust.

50. The Trust and the Project SPVs have entered into certain related party transactions and expect to continue to enter into related party transactions and there can be no assurance that such transactions will not have an adverse effect on our results of operations and financial condition.

The Trust has entered and will in the future enter into certain transactions with related parties, including the Sponsors, the Project Manager and the Investment Manager. The Project SPVs have also entered into transactions with related parties. Such transactions or any future transactions with related parties may potentially involve conflicts of interest and impose certain liabilities on the Trust or the Project SPVs. There can be no assurance that previous related party transactions could not have been made on more favourable terms with unrelated parties, and there can be no assurance that such transactions or future transactions, individually or in the aggregate, will not have an adverse effect on our results of operations and financial condition. For detailed information on related party transactions, please see the section entitled "*Related Party Transactions*" on page 275.

51. The Investment Manager may not be able to implement our investment or corporate strategies. Further the fees payable to the Project Manager are dependent on various factors.

The Investment Manager's strategies focus on three main areas:

- managing the underlying assets of the Trust;
- managing the Trust's acquisitions and disposals; and
- managing the Trust's capital structure to maximize distributions.

The Investment Manager is a newly incorporated entity and does not have any operational history of similar investment management or other activities in the infrastructure sector. There is no assurance that the Investment Manager will be able to implement these strategies successfully or that it will be able to expand our portfolio at any specified rate or to any specified size or to maintain distributions at projected levels. The Investment Manager may not be able to make acquisitions or investments on favourable terms or within a desired time frame, and it may not be able to manage the operations of its underlying assets in a profitable manner. Factors that may affect this risk may include, but are not limited to, competition for assets, partial award of concessions or licenses favouring local or other competitors of the Trust, changes in the Indian regulatory or legal environment or macro-economic conditions. Also, past performance of other investments managed or advised by the key personnel of the Investment Manager cannot be relied upon as an indicator of our future performance.

Additionally, there exists the risk that the Management Fees payable to the Investment Manager may not create proper incentives or may induce the Investment Manager to make certain investments, including speculative investments that increase the risk of the Initial Portfolio Assets.

Further, the Investment Manager will also rely on the Sponsors to comply with their obligations under the various agreements with us including the Share Purchase Agreements. In addition, the Investment Manager expects to rely on the expertise of the Sponsors and/or the Project Manager in developing and managing road and highway projects in case of any additional work which we may be required to carry out for any of the Initial Portfolio Assets or other assets. If the Investment Manager is unable to implement these strategies successfully or expand our portfolio, we will nonetheless be

required to pay the Management Fee, in accordance with the terms of appointment of the Investment Manager as stipulated in the Investment Management Agreement.

The Investment Manager may delegate certain functions to third parties, subject to the InvIT Regulations and the Investment Management Agreement. Should the Investment Manager, or any third party to whom such functions are delegated, fail to perform its services, the value of our assets might be adversely affected, which could adversely affect our business, results of operations and financial condition.

Even if the Investment Manager is able to successfully grow the operating business of the underlying assets and to acquire toll roads and other eligible infrastructure projects in India as desired, there can be no assurance that the Investment Manager will achieve its intended return on such acquisitions and/ or capital investments. Furthermore, the Investment Manager's investment mandate involves a higher level of risk as compared to a portfolio which has a more diverse range of investments. The approval of the Ordinary Unitholders shall be required for removal of the Investment Manager in the event the votes cast in favour of the resolution are not less than one and a half times the votes cast against the resolution.

Further, the project management/ operating and maintenance expenses associated with a toll road asset are primarily based upon the actual wear-and-tear of the road, and depend upon a number of factors like climate conditions during the year, quantum of rainfall, ability of maintenance team to control and repair damages at an early stage, quality of construction, etc. While such operating and maintenance expenses may be estimated based on prevailing rates, as have been provided in the Valuation Report and Technical Consultant Reports that have been included as Annexure A and B to this Final Placement Memorandum, the actual operating and maintenance expenses for each Project SPV may vary each year based on actual wear-and-tear of the underlying toll road and other exigencies. The fee payable to the Project Manager ("**PM Fee**") varies for each Project SPV and is a percentage of the standalone revenue of such Project SPV, subject to certain limits as stipulated in the Project Implementation and Management Agreement. Any such payment of fees will be in the nature of a related party transaction and the approval of public Unitholders will be required prior to making such a payment to the Project Manager. For further information, please see "*Overview of the Trust*" on page 22 of this Final Placement Memorandum.

52. CH-I and CH-III are under no obligation to provide the Trust with access to future assets, and the Trust may be unable to bid effectively for them.

CH-I and CH-III, may consider offering in aggregate seven assets to the Trust (the "**Future Assets**"). In order to assess its ability and willingness to bid for and/or operate any Future Assets, terms of the concession agreement, along with technical and traffic reports may be offered to Trust, and the Trust may be granted a limited period within which it shall be expected to undertake its due diligence and make a binding offer to CH-I and CH-III in respect of the Future Assets. There can be no assurance that the Trust will be able to accurately or effectively assess the Future Assets on the basis of the information available to it or in the time available, and its bids may provide to be uncompetitive.

Furthermore, CH-I and CH-III may accept or reject any binding offer made by the Trust, based on its own internal estimate of the concession value of the Future Assets, regarding which the Trust will have no influence.

Access to future toll road assets sourced by the Sponsors or their existing or future subsidiaries will be an important source of growth in the future for the Trust, and any inability to bid competitively for Future Assets or the inability to win contracts from the Sponsors for their operation for any reason could have a material adverse effect on the Trust's operations, financial condition or prospects.

53. The Investment Manager is required to comply with certain ongoing reporting and management obligations in relation to the Trust.

The Investment Manager is required to comply with certain ongoing reporting and management obligations in relation to the Trust in accordance with the InvIT Regulations. These requirements include, among other things, (a) making investment decisions with respect to the underlying assets or projects of the Trust, (b) overseeing the activities of the Project Manager, (c) investing and declaring distributions in accordance with the InvIT Regulations, (d) submitting reports to the Trustee, and (e) ensuring the audit of the Trust's accounts. Non-compliance with such requirements in a timely manner or at all, could subject the Investment Manager, the other Parties to the Trust, the Trust or any person involved in the activity of the Trust to applicable penalties under the InvIT Regulations, and/or the SEBI Act or other applicable law. Under the InvIT Regulations, the SEBI also has the right to inspect documents, accounts and records relating to the activity of the Trust, Project SPVs or parties to the InvIT and may issue directions in the nature of, *inter alia*, (i) requiring the Trust to delist its Units and surrender its certificate of registration; (ii) requiring the Trust to wind-up; (iii) requiring the Trust to sell its assets; (iv) requiring the Trust or Parties to the Trust to take such action as may be in the interest of investors; or (v) prohibiting the Trust or Parties to the Trust from operating in the capital market or from accessing the capital market for a specified period. Any such failure to comply or the imposition of any penalty could have a material adverse effect on our business, financial condition and results of operations.

54. The Trust may be unable to dispose off its non-performing assets in a timely manner.

Due to the nature of its structure, the Trust may be unable to dispose off its non-performing or under-performing assets in a timely manner, or at all. For example, under the InvIT Regulations, any asset acquired by the Trust is required to be held for a period of at least three years from the date of acquisition. As a result, no assurance can be given that the Trust may be able to adapt to market developments, changes in asset quality, or adverse macroeconomic factors in a way comparable to, or competitive with, its competitors (whether InvITs or public/ private companies). Any ability to dispose off non-performing assets may in turn adversely affect the financial condition, business and prospects of the Trust, as well as distributions to the Ordinary Unitholders.

55. Unitholders would not be able to participate in the election or removal of directors in the Investment Manager and will be able to remove the Investment Manager and Trustee only pursuant to a majority resolution.

Pursuant to the InvIT Regulations, the Investment Manager has the responsibility of managing the Trust.

Unitholders would not be able to participate in the nomination, election or removal of directors in the Investment Manager. The recourse available to the Unitholders' is the removal of the Investment Manager by way of a resolution where Unitholders holding at least 60% of the Ordinary Units must vote in favour of the resolution. In comparison, the Companies Act, 2013 allows the removal of a director of a private limited company by way of an ordinary resolution.

Similarly, Ordinary Unitholders may remove the Trustee only if they believe that the acts of the Trustee are detrimental to the interests of the Unitholders and by way of a resolution where the votes cast in favour of the resolution must meet the required percentage as set out in the InvIT Regulations. Further, the Investment Manager and the Trustee cannot be discharged until a suitable replacement is appointed in their place, and there can be no guarantees that a suitable replacement will be appointed, or that appointment will take place in a timely manner, or at all.

Accordingly, as opposed to shareholders removing a director of a private limited company, it may not be possible for Unitholders to remove the Investment Manager or the Trustee.

56. We depend on the Investment Manager, the Project Manager and the Trustee to manage our business and assets, and our rights and the rights of the Unitholders to recover claims against them are limited.

The success of our business and growth strategy and the operational success of our assets will depend significantly upon the managers' satisfactory performance of these services. Our recourse against the Project Manager, the Trustee and Investment Manager is limited.

The aggregate maximum liability of the Project Manager under the Project Implementation and Management Agreement in each financial year is limited to the fees payable to the Project Manager in such financial year in accordance with the terms of the Project Implementation and Management Agreement. As the Project Manager is not a captive company of the Trust and is not bound by an exclusivity arrangement with the Trust, the Project Manager may fail to dedicate appropriate and adequate resources to us/ the Project SPVs at all times, which may affect their operations and performance.

Pursuant to the Trust Deed, the Trustee is not liable for anything done or omitted to be done or suffered by the Trustee in good faith and in accordance with, or in pursuance of any request or advice of the Investment Manager. Further, the Trustee and Investment Manager are not liable for any action or omission that results in any depletion in the value of the trust fund and consequent losses of the Unitholder, except in situations where such depletion is a result of the gross negligence or wilful default on the part of the Trustee and/ or Investment Manager, as applicable, or results from a breach by the Trustee of the Trust Deed, as determined by a court of competent jurisdiction. The liability of the Trustee shall be limited to the extent of the fees received by it, in all circumstances whatsoever except (a) in case of any negligence or misconduct or fraud on the part of the Trustee as may be determined by a court of competent jurisdiction, or (b) any failure on the part of the Trustee to protect the interests of the Unitholders.

Under the Investment Management Agreement, the Investment Manager is not liable for, among other things, any action taken or damage suffered by it, after exercising due care in accordance with customary industry standards. Further, it shall not incur any liability for any act or omission which may result in a loss to a Unitholder except in the event that such loss is a result of fraud or gross negligence or dishonest acts of commission or omission or wilful default on the part of the Investment Manager, or disregard of duty or breach of duties under the Investment Management Agreement or applicable law. The Investment Management Agreement and the Trust Deed further provide that the Investment Manager is entitled to be indemnified by the Trustee against any direct and actual claims, actions, losses, damages, liabilities, suits, proceedings and reasonable costs and expenses including legal fees ("**Losses**") incurred in connection with the Trust, unless arising out of fraud, gross negligence, dishonest acts of commissions or omissions or wilful default on the part of the Investment Manager or disregard of duty or breach of duties under the Investment Management Agreement or the applicable law. The Investment Manager's liability to Trustee, its directors, employees and officers for breach of its

obligations under the Investment Management Agreement in each financial year is limited to the aggregate fees paid to the Investment Manager for the immediately preceding financial year under the agreement, except in the event that such liability arises out of any gross negligence, wilful default or misconduct or fraud of the Investment Manager. As a result, the Trust's rights and the rights of the Unitholders to recover claims against the Investment Manager are limited. Furthermore, recourse to the Trustee may be limited under the Trust Deed.

Accordingly, the liability of the Investment Manager and the Trustee are limited under the terms of these agreements and the Unitholders may not be able to recover claims against the Trustee or the Investment Manager, including claims with respect to any offer documents relating to the Offer. Further, pursuant to the Trust Deed, the Trustee is not under any obligation to institute, acknowledge the service of, appear in, prosecute or defend any action, suit, proceeding or claim, which in its opinion might involve it in expense or liability that exceeds the value of the fund. The Trust (acting through the Trustee) and the Investment Manager intend to apply the proceeds of the Fresh Issue towards the objects set out in this Final Placement Memorandum. Accordingly, the Issue Proceeds may not be sufficient to recover claims, including claims with respect to any offer documents in relation to the Offer.

If the management agreements were to be terminated or if their terms were to be altered, our business could be adversely affected, as the Trustee may not be able to immediately replace such services, and even if replacement services were immediately available, the terms offered or obtained with the new managers could be less favourable than the ones currently offered by the Investment Manager and the Project Manager.

57. Conflicts of interest may arise out of common business objectives shared by the Investment Manager, the Sponsors, the Project Manager and us.

We have and will continue to rely on the resources of the Sponsors and the Cube Group including with respect to infrastructure, technical capabilities and human resources. We may compete with existing and future private and public investment vehicles established and/or managed by the Sponsors or the Cube Group, which may present various conflicts of interest. Certain of these divisions and entities have or may have an investment strategy similar to our investment strategy and therefore may compete with us. Conflicts of interest may arise in allocating or addressing business opportunities and strategies amongst the Sponsors, the Investment Manager, the Project Manager, the Cube Group and us, in circumstances where our interests differ from theirs.

In addition, the Trustee and/or Unitholders may not be aware of any such conflict, and even if made so aware, the Trustee and the Unitholders' ability to recover claims against the Investment Manager are limited. Moreover, the Investment Manager's liability is limited under the Investment Management Agreement and the Trustee has agreed to indemnify the Investment Manager out of our assets against certain liabilities. As a result, we could experience poor performance or losses for which the Investment Manager would not be liable. See "*— Our rights and the rights of the Unitholders to recover claims against the Investment Manager or the Trustee are limited.*".

Other present and future activities of the Cube Group, the Sponsors, the Investment Manager and the Trustee may also give rise to additional conflicts of interest relating to us and our investment activities. In the event that any such conflict of interest arises, we will attempt to resolve such conflicts in a fair and reasonable manner; however, investors should be aware that conflicts will not necessarily be resolved in favour of our interests.

Risks related to India

58. We are exposed to risks associated with the roads sector in India.

We derive and expect to continue to derive in the foreseeable future, almost all of our revenues and operating profits from the roads sector in India. Changes in macroeconomic conditions generally impact the road industry and could negatively impact our business. Accordingly, our business is highly dependent on the state of development of the Indian economy and the macroeconomic environment prevailing in India. The use of our toll roads, our expansion plans and future projects depend or will depend on macroeconomic factors that may negatively impact demand the development of road infrastructure projects in India, or the timely commencement of their operations which could in turn have a material adverse effect on our growth prospects, business and cash flows. In addition, access to financing may be more expensive or not available on commercially acceptable terms during economic downturns. We may also face risks in relation to the regulated environment we operate in (the road sector). For instance, we face risks in relation to non-collection of overload penalty under National Highway Fee (Determination of Rates and Collection) Rules, 2008. Any of these factors and other factors beyond our control could have a material adverse effect on our business, prospects, financial condition, results of operations and cash flows.

59. Changing laws, rules and regulations and legal uncertainties may materially and adversely affect our business, financial condition and results of operations.

Our business, financial condition and results of operations could be materially and adversely affected by any change in laws or interpretations of existing, or the promulgation of new, laws, rules and regulations applicable to us and our business. There can be no assurance that the Government or State Governments will not implement new regulations and policies which will require the Trust to obtain additional approvals and licenses from governmental and other regulatory bodies or impose onerous requirements and conditions on our operations. The Investment Manager cannot predict the terms of any new policy, and there can be no assurance that such policy will not be onerous.

60. Significant increases in the price or shortages in the supply of crude oil and products derived therefrom, including petrol and diesel fuel, could materially and adversely affect the volume of traffic at the projects operated by the Project SPVs and the Indian economy in general, including the infrastructure sector.

India imports a significant majority of its crude oil requirements. Crude oil prices are volatile and are subject to a number of factors, including the level of global production and political factors, such as war and other conflicts, particularly in the Middle East, where a substantial proportion of the world's oil reserves are located. The ongoing Russia-Ukraine conflict has caused a significant increase and volatility in the price of crude oil and impacted fuel prices in India. Further increases in the price of or shortages in the supply of crude oil could materially and adversely affect the volume of traffic at the projects operated by the Project SPVs and materially and adversely affect the Indian economy in general, including the infrastructure sector, which could have a material, adverse effect on our business, financial condition and results of operations.

61. We may be affected by competition law in India and any adverse application or interpretation of the Competition Act could materially and adversely affect our business.

The Competition Act, 2002, as amended (the "**Competition Act**"), regulates practices having an appreciable adverse effect on competition in the relevant market in India. Under the Competition Act, any formal or informal arrangement, understanding or action in concert, which causes or is likely to cause an appreciable adverse effect on competition is considered void and results in the imposition of substantial monetary penalties. Further, any agreement among competitors which directly or indirectly involves the determination of purchase or sale prices, limits or controls production, supply, markets, technical development, investment or provision of services, shares the market or source of production or provision of services by way of allocation of geographical area, type of goods or services or number of customers in the relevant market or directly or indirectly results in bid-rigging or collusive bidding is presumed to have an appreciable adverse effect on competition. The Competition Act also prohibits abuse of a dominant position by any enterprise in a relevant market.

The Competition Act aims to, among other things, prohibit all agreements and transactions which may have an appreciable adverse effect on competition in India. Further, the CCI has extra-territorial powers and can investigate any agreements, abusive conduct or combination occurring outside India if such agreement, conduct or combination has an appreciable adverse effect on competition in India.

In the event, the Project SPVs or the Trust enters into any agreements or transactions that have an appreciable adverse effect on competition in the relevant market in India, the provisions of the Competition Act will be applicable. Consents may also be required from the CCI in relation to the Offer. Any prohibition or substantial penalties levied under the Competition Act could materially and adversely affect our financial condition and results of operations. Any adverse impact on our financial condition or operations due to the Competition Act may have a material adverse impact on our business, financial condition, results of operations and prospects and our ability to make distributions to the Ordinary Unitholders.

62. Our business is dependent on economic growth in India and financial stability in Indian markets, and any slowdown in the Indian economy or in Indian financial markets could have an adverse effect on our business, results of operations, financial condition and the price of our Ordinary Units.

Our Investment Manager and we are registered in India, and the Initial Portfolio Assets and our Investment Manager are located in India. As a result, we are highly dependent on the prevailing economic conditions in India and our results of operations are significantly affected by factors influencing the Indian economy. Factors that may adversely affect the Indian economy, and hence our results of operations, may include:

- any increase in interest rates or inflation in India;
- any exchange rate fluctuations;
- any scarcity of credit or other financing in India;
- prevailing income, consumption and savings conditions among consumers and corporations in India;
- the intensification of the adverse effects of the ongoing COVID-19 pandemic including new waves or the occurrence or other epidemics or pandemics;
- volatility in, and actual or perceived trends in trading activity on, India's principal stock exchanges;

- changes in India's tax, trade, fiscal or monetary policies and which may impact India's foreign exchange reserves;
- civil unrest, riots, protests, acts of violence, terrorist attacks, political instability, terrorism or military conflict in India, including increased tensions on the Indian borders, or in countries in the region or globally, including in India's various neighbouring countries;
- the occurrence of force majeure events under the contractual arrangements of the Project SPVs;
- the occurrence of natural or man-made disasters;
- prevailing regional or global economic conditions;
- balance of trade movements, including export demand and movements in key imports, including oil and oil products;
- annual rainfall which affects agricultural production; and
- other significant regulatory, policy or economic developments in or affecting India or its infrastructure sector.

Inflation rates in India have been volatile in recent years, and such volatility may continue. High fluctuations in inflation rates may make it more difficult for us to accurately estimate or control our costs. Any increase in inflation in India can increase our expenses, whether entirely or in part, and may adversely affect our business and financial condition. If we are unable to increase our revenues sufficiently to offset our increased costs due to inflation, it could have an adverse effect on our business, prospects, financial condition, results of operations and cash flows.

Any slowdown or perceived slowdown in the Indian economy, or in specific sectors of the Indian economy, could have an adverse effect on our business, results of operations, financial condition and the price of our Ordinary Units.

Furthermore, the Indian economy and Indian financial markets are influenced by economic and market conditions in other countries. Financial turmoil in Asia, Europe, the United States and elsewhere in the world in past years has affected the Indian economy. Although economic conditions are different in each country, investors' reactions to developments in one country can have an adverse effect on the securities of entities in other countries, including India. A loss in investor confidence in the financial systems of other emerging markets may cause increased volatility in Indian financial markets and, indirectly, in the Indian economy in general. Any global financial instability could also have a negative impact on the Indian economy. Financial disruptions may occur and could harm our results of operations and financial condition.

63. Financial instability in other countries may cause increased volatility in Indian financial markets.

The Indian market and the Indian economy are influenced by economic and market conditions in other countries, including conditions in the United States, Europe and certain emerging economies in Asia. Financial turmoil in Asia, Russia and elsewhere in the world in recent years has adversely affected the Indian economy. Any worldwide financial instability may cause increased volatility in the Indian financial markets and, directly or indirectly, adversely affect the Indian economy and financial sector and us.

Although economic conditions vary across markets, loss of investor confidence in one emerging economy may cause increased volatility across other economies, including India. Financial instability in other parts of the world could have a global influence and thereby negatively affect the Indian economy. Financial disruptions could materially and adversely affect our business, prospects, financial condition, results of operations and cash flows.

Further, economic developments globally can have a significant impact on our principal markets. Concerns related to a trade war between large economies may lead to increased risk aversion and volatility in global capital markets and consequently have an impact on the Indian economy. The imposition of sanctions on Russia have also impacted economic conditions in various parts of the world, including Europe.

In addition, China is one of India's major trading partners and there are rising concerns of a possible slowdown in the Chinese economy as well as a strained relationship with India, which could have an adverse impact on the trade relations between the two countries. In recent years, tensions have been rising between India and China over a disputed border in the Himalayan region which has led to military clashes.

Legislators and financial regulators in the United States and other jurisdictions, including India, implement a number of policy measures designed to add stability to the financial markets from time to time. However, the overall long-term effect of such legislative and regulatory efforts on the global financial markets is uncertain, and they may not have the intended stabilizing effects. Any significant financial disruption could have a material adverse effect on our business, financial condition and results of operation.

These developments, or the perception that any of them could occur, have had and may continue to have a material adverse effect on global economic conditions and the stability of global financial markets and may significantly reduce global market liquidity, restrict the ability of key market participants to operate in certain financial markets or restrict our access to capital. This could have a material adverse effect on our business, financial condition and results of operations and reduce the trading price of the Ordinary Units.

64. Any downgrading of India's debt rating by rating agencies could have a negative impact on our business.

India's sovereign rating is Baa3 with a "stable" outlook by Moody's, BBB- with a "stable" outlook by Fitch and BBB- (Stable) by S&P. India's sovereign rating could be downgraded due to various factors, including changes in tax or fiscal policy or a decline in India's foreign exchange reserves, which are outside our control. Any adverse revisions to India's credit ratings by rating agencies may adversely affect our ability to raise additional financing, and the interest rates and other terms at which such additional financing is available. This could materially and adversely affect our ability to obtain financing for capital expenditure, which could in turn materially and adversely affect our business, prospects, financial condition, results of operations and cash flows. India's sovereign debt rating could be downgraded due to various factors, including changes in tax or fiscal policy or a decline in India's foreign exchange resources, which are outside our control.

65. Significant differences exist between Ind AS and other accounting principles, such as IFRS and U.S. GAAP, which may be material to your assessment of our results of operations, financial condition and cash flows.

The Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum are prepared and presented in conformity with Ind AS, consistently applied during the periods stated in those reports. Ind AS differs from accounting principles with which persons from other countries may be familiar, such as IFRS and U.S. GAAP. Accordingly, the degree to which the Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum provide meaningful information is entirely dependent on your level of familiarity with Indian accounting practices. Ind AS has certain differences with IFRS and U.S. GAAP. In addition, as the transition to Ind AS is recent, there is no significant body of established practice that we can draw on, in forming judgments regarding the implementation and application of Ind AS, as compared to other established principles generally, or in respect of specific industries, such as the industry in which we operate.

66. We have in this Final Placement Memorandum included certain Non-GAAP Measures that may not be comparable with financial or industry related statistical information of similar nomenclature computed and presented by other infrastructure trusts.

Certain Non-GAAP Measures and certain other industry measures relating to our operations and financial performance have been included in this Final Placement Memorandum. We have computed and disclosed such Non-GAAP Measures as we consider such information to be useful measures of the Project SPVs' business and financial performance. Such supplemental financial and operational information is therefore of limited utility as an analytical tool, and investors are cautioned against considering such information either in isolation or as a substitute for an analysis of our Audited Special Purpose Combined Financial Statements as reported under applicable accounting standards disclosed elsewhere in this Final Placement Memorandum. These Non-GAAP Measures are not measures of operating performance or liquidity defined by generally accepted accounting principles, and therefore may not be comparable to financial measures and industry related statistical information of similar nomenclature that may be computed and presented by other infrastructure trusts.

67. Fluctuations in the exchange rate of the Indian Rupee with respect to the U.S. Dollar or other currencies will affect the foreign currency equivalent of the value of the Ordinary Units and any distributions.

Fluctuations in the exchange rates between the Indian Rupee and other currencies will affect the foreign currency equivalent of the Indian Rupee price of the Ordinary Units. In particular, the Indian Rupee has declined significantly against the U.S. dollar recently. Such fluctuations will also affect the amount that holders of the Ordinary Units will receive in foreign currency upon conversion of any cash distributions or other distributions paid in Indian Rupees by us on the Ordinary Units, and any proceeds paid in Indian Rupees from any sale of the Ordinary Units in the secondary trading market. Further, a decline in India's foreign exchange reserves may reduce liquidity and increase interest rates in India, which could have an adverse impact on us.

68. Unitholders may not be able to enforce a judgment of a foreign court against us.

The enforcement of civil liabilities by overseas investors in the Ordinary Units, including the ability to effect service of process and to enforce judgments obtained in courts outside of India, may be adversely affected by the fact that (i) the Trust is constituted under the laws of the Republic of India, (ii) the Investment Manager and the Trustee are limited liability companies incorporated under the laws of the Republic of India, (iii) the directors and key personnel of the Investment Manager reside in India, and (iv) all of the assets of the Trust, the Project SPVs and the Investment Manager are located in India. As a result, it may be difficult to serve process upon the Trust, the Investment Manager, the Trustee or any of these persons outside of India or to enforce in India judgments obtained against such persons in courts outside of India.

India is not a party to any international treaty in relation to the recognition or enforcement of foreign judgments. Recognition and enforcement of foreign judgments are provided for under Section 13, Section 14 and Section 44A of the Civil Procedure Code, 1908. The GoI has, under Section 44A of the Civil Procedure Code, notified certain countries as

reciprocating countries. Section 13 of the Civil Procedure Code provides that a foreign judgment will be conclusive regarding any matter directly adjudicated upon, between the same parties or between the parties whom they or any of them claim are litigating under the same title, except: (i) where the judgment has not been pronounced by a court of competent jurisdiction; (ii) where the judgment has not been given on the merits of the case; (iii) where it appears on the face of the proceedings that the judgment is founded on an incorrect view of international law or a refusal to recognise the law of India in cases in which such law is applicable; (iv) where the proceedings in which the judgment was obtained were opposed to natural justice; (v) where the judgment has been obtained by fraud; or (vi) where the judgment sustains a claim founded on a breach of any law in force then in India. Section 44A of the Civil Procedure Code provides that where a foreign judgment has been rendered by a superior court in any country or territory outside India, which the GoI has, by notification, declared to be a reciprocating territory, it may be enforced in India by proceedings in execution as if the judgment had been rendered by the relevant court in India. However, Section 44A of the Civil Procedure Code is applicable only to monetary decrees not being in the nature of any amounts payable in respect of taxes or other charges of a similar nature or in respect of a fine or other penalties and does not include arbitration awards.

There may be considerable delays in the disposal of suits by Indian courts. It may be unlikely that a court in India would award damages on the same basis as a foreign court if an action is brought in India. Furthermore, it may be unlikely that an Indian court would enforce foreign judgments if it viewed the amount of damages awarded as excessive or inconsistent with the public policy in India. A party seeking to enforce a foreign judgment in India is required to obtain prior approval from the RBI to repatriate any amount recovered pursuant to execution and any such amount may be subject to income tax in accordance with applicable laws. Any judgment or award in a foreign currency would be converted into Indian Rupees on the date of the judgment or award and not on the date of the payment which could be subject to foreign exchange risk. Generally, there are considerable delays in the processing of legal actions to enforce a civil liability in India, and therefore it is uncertain whether a suit brought in an Indian court will be disposed of in a timely manner or subject to considerable delays.

Furthermore, the Sponsors are incorporated in Singapore and accordingly, the enforcement of civil liabilities by overseas investors in the Units including the ability to effect service of process and to enforce judgments, against the Sponsors, will be subject to the applicable laws of Singapore.

Risks Related to Ownership of the Units

69. The Trust has issued the Initial Tranche Subordinate Units as part of the Formation Transactions. Such issuance may be subject to certain regulatory and taxation risks.

Pursuant to the Formation Transactions, the Trust has issued the Initial Tranche Subordinate Units to the Sponsors. In accordance with the terms of the Initial Tranche Subordinate Units, such Initial Tranche Subordinate Units shall be entitled to the same rights as the Ordinary Units and be reclassified as Ordinary Units upon achievement of certain entitlement events by certain Project SPVs. For further details in relation to the Initial Tranche Subordinate Units, please see, "*Information Concerning the Units*" on page 226. Upon reclassification of the Initial Tranche Subordinate Units as Ordinary Units, the Sponsors' Ordinary Unitholding in the Trust may increase and the unitholding of the other investors may be diluted. Further, if the Sponsors divests from its unitholding after three years from the Listing Date, this may have an adverse effect on the trading price and liquidity of the Ordinary Units. Further, as the issuance of Subordinate Units and their subsequent reclassification is previously untested, we cannot assure you that there will be no implication of stamp duty upon the issuance, entitlement of rights of reclassification of the Initial Tranche Subordinate Units. Further, there is also no assurance that the tax authorities will take the same position as the Trust with regard to the tax treatment of the Subordinate Units and that any tax implications of the issuance and reclassification of the Initial Tranche Subordinate Units will not have an adverse effect on the business, prospects, financial condition and results of operations of the Trust and its ability to make distributions to the Ordinary Unitholders.

70. The Trust may be dissolved, and the proceeds from the dissolution thereof may be less than the amount invested by the Unitholders.

The Trust is an irrevocable trust registered under the Registration Act and it may only be extinguished (i) if it is impossible to continue with the Trust or if the Trustee, on the advice of the Investment Manager, deems it impracticable to continue with the Trust; (ii) on the written recommendation of the Investment Manager and upon obtaining the prior written consent of such number of the Ordinary Unitholders as is required under the InvIT Regulations; (iii) if the Ordinary Units of the Trust are delisted from the Stock Exchanges; (iv) if the SEBI passes a direction for the winding up of the Trust or the delisting of the Ordinary Units; or (v) in the event the Trust becomes illegal. Under the Trust Deed, in the event of dissolution, the net assets of the Trust, remaining after settlement of all liabilities, and the retention of any reserves which the Trustee deems to be necessary to discharge contingent or unforeseen liabilities, shall be paid to the Unitholders. Should the Trust be dissolved, depending on the circumstances and the terms upon which assets of the Trust are disposed of, there is no assurance that a Unitholder will recover all or any part of their investment.

If a default is triggered under the financing documents the Trust is a party to, the Trustee/ Investment Manager will take steps to cure such default and/or to repay the affected lender by appropriate means, including divesting or liquidating the assets of the Trust or raising additional financing, in accordance with such financing documents and applicable laws. If such default is not cured, and the affected lender initiates proceedings against the Trust, the Trust may be terminated subject to applicable laws. In the event of a termination of the Trust, the net assets which will be paid to the Unitholders will take into account the debt, liabilities and obligations of the Trust. There is no assurance that Unitholders will recover all or any part of their investments.

71. The reporting requirements and other obligations of infrastructure investment trusts post-listing are still evolving. Accordingly, the level of ongoing disclosures/ information made to and the protection granted to Unitholders may be more limited than those made to or available to the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India.

The InvIT Regulations, along with the guidelines and circulars issued by the SEBI from time to time, govern the affairs of infrastructure investment trusts in India. However, as compared to the statutory and regulatory framework governing companies that have listed their equity shares upon a recognized stock exchanges in India, the regulatory framework applicable to infrastructure investment trusts is relatively nascent and thus, still evolving. Pursuant to a circular dated November 29, 2016, the SEBI has prescribed certain continuous disclosure requirements that will be applicable to the InvIT after listing.

Accordingly, the ongoing disclosures made to Unitholders under the InvIT Regulations may differ from those made to the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India. Further, the rights of the Ordinary Unitholders may not be as extensive as the rights of the shareholders of a company that has listed its equity shares upon a recognized stock exchange in India, and accordingly, the protection available to the Ordinary Unitholders may be more limited than those available to such shareholders.

The InvIT Regulations were amended on February 14, 2023 to incorporate certain provisions of the SEBI Listing Regulations, along with, *inter-alia*, additional requirements in relation to the governance of InvITs. These governance norms are applicable to all InvITs registered with the SEBI, with effect from April 1, 2023.

Furthermore, the Trust Deed and various provisions of Indian law govern our corporate affairs. Legal principles relating to these matters and the validity of corporate procedures, fiduciary duties and liabilities, and Unitholders' rights may differ from those that would apply to a company in India or a trust in another jurisdiction. Unitholders' rights and disclosure standards under Indian law may also differ from the laws of other countries or jurisdictions. See the section headed "*Rights of Unitholders*" on page 317 of this Final Placement Memorandum.

72. Any additional debt financing or issuance of additional Units may have a material, adverse effect on the Trust's distributions, and your ability to participate in future rights offerings may be limited.

The Investment Manager, on behalf of the Trust may require additional debt financing or the issuance of additional Units in order to support the operating business or to make acquisitions and investments. If obtained, any such additional debt financing may decrease distributable income, and any issuance of additional Units may dilute existing Ordinary Unitholders' entitlement to distributions and their unitholding.

We are not required to offer pre-emptive rights to existing Unitholders when issuing new Units. Compliance with securities laws or other regulatory provisions in some jurisdictions may prevent certain investors from participating in any future rights issuances and thereby result in dilution of their existing holdings in Units.

73. Unitholders are unable to require the redemption of their Ordinary Units. Further, under Indian law, foreign investors are subject to restrictions that limit their ability to transfer or redeem Ordinary Units, which may adversely impact the value of the Ordinary Units.

Unitholders will not have the right to redeem Ordinary Units or request or require the redemption of Ordinary Units by the Investment Manager while the Ordinary Units are listed on the Stock Exchanges, although the Trust Deed provides that the Investment Manager may repurchase Ordinary Units at its sole discretion if it has obtained the prior approval of Ordinary Unitholders in a general meeting by passing an ordinary resolution in accordance with the Trust Deed but subject to other requirements of the relevant laws, regulations and guidelines imposed by authorities in India.

Under foreign exchange regulations currently in force in India, transfers of units between non-residents and residents are permitted, subject to certain exceptions and if they comply with the pricing and reporting requirements specified by RBI. If a transfer of units is not compliant with such pricing or reporting requirements and does not fall under any of the exceptions specified by RBI, then RBI's prior approval is required.

Additionally, Unitholders who seek to convert Indian rupee proceeds from a sale of units in India into foreign currency and repatriate that foreign currency from India require a no-objection or a tax clearance certificate from the Indian income tax authorities. We cannot assure you that any required approval from RBI or any other Governmental agency can be obtained on any particular terms or in a timely manner, or at all.

Furthermore, in terms of the InvIT Regulations, an infrastructure investment trust may redeem units only by way of a buyback and may be subject to additional conditions and restrictions under Indian regulations.

74. The Ordinary Units have never been traded and the listing of the Ordinary Units on the Stock Exchanges may not result in an active or liquid market for the Ordinary Units.

There is no market for the Ordinary Units prior to the Offer and an active market for the Ordinary Units may not develop or be sustained after the Listing Date. Listing and quotation does not guarantee that a trading market for the Ordinary Units will develop or, if a market does develop, that there will be liquidity of that market for the Ordinary Units. Accordingly, prospective Ordinary Unitholders should view the Ordinary Units as illiquid and must be prepared to hold their Ordinary Units for an indefinite length of time.

75. Any future issuance of Units by us or sales of Ordinary Units by the Sponsors or any of other significant Unitholders may materially and adversely affect the trading price of the Ordinary Units.

Any future issuance of Units by us could dilute investors' holdings of Units. Any such future issuance of Ordinary Units may also materially and adversely affect the trading price of the Ordinary Units, and could impact our ability to raise capital through an offering of our securities. There can be no assurance that we will not issue further Units. In addition, any perception by investors that such issuances might occur could also affect the trading price of the Ordinary Units.

Ordinary Units will be tradable on the Stock Exchanges. If the Sponsors (following the lapse of their lock-up arrangements), directly or indirectly, sell or pledge or encumber or otherwise dispose or are perceived as intending to sell or pledge or encumber or otherwise dispose a substantial number of Ordinary Units, or if a secondary offering of the Ordinary Units is undertaken, the market price for the Ordinary Units could be materially and adversely affected. These sales may also make it more difficult for us to raise capital through the issue of new units at a time and at a price we deem appropriate.

76. The price of the Ordinary Units may decline after Listing.

The Offer Price has been determined by the Investment Manager in consultation with the Placement Agents. The Offer Price may not be indicative of the market price of the Ordinary Units upon completion of the Listing. The market price of the Ordinary Units may also be highly volatile and could be subject to wide fluctuations. If the market price of the Ordinary Units declines significantly, investors may be unable to resell their Ordinary Units at or above their purchase price, if at all. There can be no assurance that the market price of the Ordinary Units will not fluctuate or decline significantly in the future. The market price of the Ordinary Units will depend on many factors, including, among others:

- the perceived prospects of our business and investments and the market for toll roads and other infrastructure projects;
- differences between our actual financial and operating results and those expected by investors and analysts;
- the perceived prospects of future toll roads and other infrastructure projects that may be added to our portfolio in accordance with our investment mandate;
- changes in research analysts' recommendations or projections;
- changes in general economic or market conditions;
- the market value of our assets;
- the perceived attractiveness of the Ordinary Units against those of other business trusts, equity or debt securities;
- the balance of buyers and sellers of the Ordinary Units;
- the size and liquidity of the Indian business trusts market;
- any changes to the regulatory system, including the tax system, both generally and specifically in relation to India business trusts;
- the ability of the Investment Manager to implement successfully its investment and growth strategies;
- foreign exchange rates;
- broad market fluctuations, including increases in interest rates and weakness of the equity and debt markets;
- variations in our quarterly operating results;
- difficulty in assessing our performance against either domestic or international benchmarks, as there are few listed comparables;
- publication of research reports about us, our affiliates, other road businesses, the road industry in general or other relevant sectors, or the failure of securities analysts to cover the Ordinary Units after the Offer;
- additions or departures of key management personnel of the Investment Manager and/or the Trust Group;

- changes in the amounts of our distributions, if any, and changes in the distribution payment policy or failure to execute the existing distribution policy;
- actions by Unitholders;
- changes in market valuations of similar business entities or companies;
- announcements by us or our competitors of significant contracts, acquisitions, disposals, strategic partnerships, joint ventures or capital commitments;
- speculation in the press or investment community; and
- changes or proposed changes in laws or regulations affecting the road industry and infrastructure development in India or enforcement of these laws and regulations, or announcements relating to these matters.

To the extent that we retain operating cash flow for investment purposes, working capital reserves or other purposes, these retained funds, while increasing the value of our underlying assets, may not correspondingly increase the market price of the Ordinary Units. Our failure to meet market expectations with regard to future earnings and cash distributions may materially and adversely affect the market price of the Ordinary Units.

Where new Ordinary Units are issued at less than the market price of the Ordinary Units, the value of an investment in the Ordinary Units may be affected. In addition, Unitholders who do not, or are not able to, participate in the new issuance of Ordinary Units may experience a dilution of their interest in the Trust. In addition, the Ordinary Units are not capital-safe products and there is no guarantee that Unitholders can regain the amount invested, in full or in part. If the Trust is extinguished, it is possible that investors may lose a part or all of their investment in the Ordinary Units.

77. No investors were permitted to withdraw or lower their Bids (in terms of quantity of Ordinary Units or the Bid Amount) at any stage after submitting a Bid.

Pursuant to the InvIT Regulations and SEBI guidelines, investors were required to pay the Bid Amount on submission of the Bid, and were not permitted to withdraw or lower their Bids (in terms of quantity of Ordinary Units or the Bid Amount) at any stage after submitting a Bid, notwithstanding adverse developments in international or national monetary policy, financial, political or economic conditions, our business, results of operations, or otherwise, at any stage after the submission of their Bids.

78. The Trust will not receive any proceeds from the Offer for Sale portion, and the Selling Unitholders shall be entitled to the Offer proceeds to the extent of the Ordinary Units offered by them in the Offer for Sale.

The Offer includes an offer for sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million by the Selling Unitholders. The Selling Unitholders are, therefore, interested in the Offer proceeds to the extent of the Ordinary Units offered by them in the Offer for Sale. The entire proceeds (net of their relevant portion of the Offer expenses) from the Offer for Sale will be paid to the Selling Unitholders in proportion to their respective portions of the Ordinary Units transferred pursuant to the Offer for Sale, and the Trust will not receive any such proceeds. See the section headed "*Offer Structure*" on page 321 of this Final Placement Memorandum.

Risks Related to Tax

79. Changes in legislation or the rules relating to tax regimes could materially and adversely affect our business, prospects and results of operations.

The GoI announced the union budget for the Fiscal Year 2024 and the Finance Act, 2023 ("**Finance Act 2023**") was notified with effect from April 1, 2023.

The Finance Act 2023, provides for tax on the unitholders for such portion of distribution received by them that is not covered under section 10(23FC) or 10(23FCA) of the IT Act and that which is not chargeable to tax under section 115UA(2) of the IT Act. Any distribution not covered under the aforementioned clauses will be taxed in the hands of the unitholders as 'income' under section 56(2)(xii) of the IT Act, provided the amount received (including similar distributions in earlier years to the same unitholder or any other unitholder) is in excess of the amount at which units were issued by the InvIT, as reduced by the amount which would have been charged to tax earlier under this provision. The aforementioned amounts received by a unitholder being a specified person covered under section 10(23FE) of the IT Act shall not be subject to taxes upon the fulfilment of certain conditions set out in the IT Act. Further, any such distribution received by a unitholder to the extent not chargeable to tax under section 56(2)(xii) and not covered under sections 10(23FC), 10(23FCA) or 115UA(2) shall be reduced from the cost of units. We cannot assure you that there will be no adverse impact on the tax incidence to the unitholders pursuant to the Finance Act 2023. For details, please see section entitled "*Statement of Tax Benefits*" on page 331.

Further, by way of the Finance Act, 2021 the GoI, amongst others, amended the Securities Contracts (Regulation) Act, 1956 ("**SCRA**") to recognise pooled investment vehicles and recognise the units, debentures, other marketable securities

and other instruments issued by InvITs as "*securities*". The Finance Act, 2021 exempted the payment of tax deducted at source on dividends paid to InvITs. For further details, please see the sections entitled "*Risk Factors – Investors may be subject to Indian taxes arising out of capital gains on the sale of Ordinary Units and on any dividend or interest component of any returns from the Ordinary Units*" and "*Risk Factors – We are governed by the provisions of, amongst others, the InvIT Regulations and the Securities Contracts (Regulation) Act, 1956 ("SCRA"), the implementation and interpretation of which, is evolving. The evolving regulatory framework governing infrastructure investment trusts in India may have a material adverse effect on the ability of certain categories of investors to invest in the Ordinary Units, our business, financial condition and results of operations and our ability to make distributions to the Ordinary Unitholders*" on pages 100 and 84.

There have been two key major reforms in Indian tax laws, namely the introduction of the Goods and Services Tax ("**GST**") and provisions relating to general anti-avoidance rules ("**GAAR**"). The GST regime came into effect on July 1, 2017, combining taxes and levies by the Government and State Governments into a unified rate structure.

Additionally, there is limited clarity on the availability of input tax credit, and any unfavourable orders in this regard may have a material adverse impact on our financial position and cash flows. Further, any application of existing law or future amendments may affect our overall tax efficiency, and may result in significant additional taxes becoming payable.

Tax laws and regulations are subject to differing interpretations by tax authorities. Differing interpretations of tax and other fiscal laws and regulations may exist within governmental ministries, including tax administrations and appellate authorities, thus creating uncertainty and potential unexpected results. The degree of uncertainty in tax laws and regulations, combined with significant penalties for default and a risk of aggressive action by the governmental or tax authorities, may result in tax risks being significantly higher than expected.

The GAAR regime came into effect on April 1, 2017. The GAAR regime is a broad set of provisions which grant powers to India tax authorities to invalidate any arrangement for tax purposes in the event, the main purpose of entering into the transaction by the taxpayer is to obtain a tax benefit. Besides the "tax benefit", the transaction should meet any one of the following specified additional tests: (i) creates rights, or obligations, which are not ordinarily created between persons dealing at arm's length; (ii) results, directly or indirectly, in the misuse, or abuse, of the provisions of the IT Act; (iii) lacks commercial substance or is deemed to lack commercial substance as prescribed under the IT Act in whole or in part; and (iv) is entered into, or carried out, by means which are, or in a manner which is, not ordinarily employed for bona fide purposes. Such transactions are declared as impermissible avoidance arrangements. The tax consequences of the GAAR provisions being applied to an arrangement could result in denial of tax benefit, amongst other consequences, including on the interest paid by the SPVs on the debt from the Trust. In the absence of any precedents on the subject, the application of these provisions is uncertain. If the GAAR provisions are made applicable to the Trust, it may have an adverse effect on the Trust.

The rules notified with respect to GAAR prescribe that these shall not be applicable to FIIs in accordance with the SEBI (Foreign Institutional Investors) Regulations, 1995 subject to the fulfilment of certain conditions. GAAR may have a material adverse tax impact on the Trust, the Sponsors and the Unitholders.

Further, pursuant to amendments introduced by Finance Act, 2022, the applicability of section 94(7) of the IT Act has been extended to the units of business trust (with effect from Financial Year 2022-23), which provides in certain situation, loss, if any, arising from the sale and purchase of securities and units, to the extent of dividend or income received or receivable on such securities or unit, shall be ignored for computing income chargeable to tax. The Finance Act, 2022 extended the applicability of section 94(8) of the IT Act (commonly known as bonus stripping) to the units of business trusts (with effect from Financial Year 2022-23), which provides certain other situations where loss, if any, arising from the sale and purchase of all or any of the units shall be ignored for computing income chargeable to tax and notwithstanding anything contained in any other provision of the IT Act, the amount of loss so ignored shall be deemed to be the cost of purchase or acquisition of additional/ bonus units as are held on the date of such sale or transfer.

The Investment Manager has not determined the impact of such existing or proposed legislations on our business. We may incur increased costs relating to compliance with any new requirements, which may also require management time and other resources, and any failure to comply may adversely affect our business, results of operations and prospects.

Uncertainty in the applicability, interpretation or implementation of any amendment to, or change in, governing law, regulation or policy, including by reason of an absence, or a limited body, of administrative or judicial precedent may be time consuming as well as costly for us to resolve, and may impact the viability of our current business or restrict our ability to grow our business in the future.

80. Some of our road assets enjoy certain benefits under Section 80-IA of the IT Act and any change in these tax benefits applicable to us may materially and adversely affect our results of operations.

Currently, surface transport infrastructure development projects, including toll-road concession projects, enjoy certain benefits under Section 80-IA of the IT Act. In accordance with and subject to the condition specified in this section, the Project SPVs are entitled to certain benefits for all of the operational infrastructure projects and would be entitled to a deduction of 100% of the profits derived from the development or operation and maintenance or development, operation and maintenance of the toll roads for any 10 consecutive tax assessment years out of 20 years, beginning from the year in which the concerned Project SPV develops and begins to operate the infrastructure facility. Any other taxable income (for example, interest income, profit on sale of mutual funds) from deployment of temporary funds or otherwise could also be taxable under the terms of the IT Act. The incentives for Section 80-IA of the IT Act are available for a period of 10 consecutive tax years out of a block of 20 years from the year of commencement of operations. Any Project SPV will only be subject to minimum alternate tax ("**MAT**") if the concerned Project SPV has a book profit as required to be computed under section 115JB of the IT Act. When the tax incentives expire or terminate, our tax liability may increase, thereby impacting our profitability. Further, the India tax authorities may disallow the deduction availed if the conditions specified are not complied with or the computation of the profits and gains of the eligible business is not in accordance with the manner prescribed and there is no assurance that such projects will continue to enjoy the tax benefits. This may affect the overall tax liabilities of the Project SPVs and result in significant additional taxes becoming payable thereby resulting in a material, adverse effect on our business, financial condition, cash flows and results of operations and consequently may have a material, adverse impact on our distributions.

Benefits under section 80-IA of the IT Act shall not be available to Project SPVs in case they have opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the IT Act. Further, in such case, provisions of MAT shall not be applicable.

81. Tax laws are subject to changes and differing interpretations, which may materially and adversely affect our operations.

Tax laws and regulations are subject to differing interpretations by tax authorities. Differing interpretations of tax and other fiscal laws and regulations may exist within governmental ministries, including tax administrations and appellate authorities, thus creating uncertainty and potential unexpected results. The degree of uncertainty in tax laws and regulations, combined with significant penalties for default and a risk of aggressive action by the governmental or tax authorities, may result in tax risks in the jurisdictions in which we operate being significantly higher than expected. For instance, while the Investment Manager intends to take measures to ensure that it is in compliance with all relevant tax laws, there is no assurance that the tax authorities will not take a position that differs from the position taken by us with regard to our tax treatment of various items. Any of the above events may result in a material, adverse effect on our business, financial condition, results of operations and/or prospects and our ability to make distributions to the Ordinary Unitholders.

82. The Ministry of Finance, GoI, has constituted a task force to draft new direct tax legislation, the provisions of which may have an unfavourable implication for us.

The Ministry of Finance, GoI, has set up a panel to review the IT Act and to draft a new direct tax legislation ("**Panel**"). The Panel has been tasked with drafting appropriate direct tax legislation aimed at (i) aligning India's domestic direct tax regime in line with international best practices; and (ii) ensuring and encouraging compliance. The implications of the report by the Panel, including findings and recommendations in their report and the provisions of the proposed direct tax legislation may have an unfavourable impact on us. Since the Panel and its report, including their recommendations and the draft of the new direct tax legislation has not been released yet, the possible impact on us cannot be determined at this point in time.

83. Investors may be subject to Indian taxes arising out of capital gains on the sale of Ordinary Units, on any dividend or interest component of any returns from the Ordinary Units or on certain distributions from the Trust.

Under current Indian income tax laws, units of a business trust held for more than 36 months are considered as long term capital assets. In case of sale of such units through a recognised stock exchange in India and payment of securities transaction tax ("**STT**"), any gain arising in excess of ₹ 0.10 million is subject to long term capital gains tax at a concessional rate of 10% (plus applicable surcharge and cess). However, if the said units are sold in any other manner, the same shall be subject to long term capital gains tax at the rate of 20% with indexation benefit (plus applicable surcharge and cess).

In case the units are held for less than or up to 36 months, the same shall be regarded as short term capital asset. Any gain arising in case of sale of such units through a recognised stock exchange in India and subject to payment of STT, is subject to short term capital gains tax at concessional rate of 15% (plus applicable surcharge and cess). However, if the said units are sold in any other manner, the same shall be subject to short term capital gains tax at applicable tax rates of the holder (plus applicable surcharge and cess).

The aforesaid taxability in India is subject to tax treaty benefits in the case of a non-resident holder. Further, the applicable taxes on the sale of Ordinary Units and on any dividend or interest component of any returns from the Unit will also be subject to the category of investor holding or selling the Ordinary Units.

The Finance Act, 2020 amended the IT Act to abolish the dividend distribution tax regime and shift the incidence of taxation of dividend (declared or distributed on or after April 1, 2020) to shareholder. Under the Finance Act, 2020, a distribution made by a business trust, being in nature dividend income received from a special purpose vehicle, will not be subject to tax in the hands of a unitholder, so long as the special purpose vehicle has not opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the IT Act. Similarly, a business trust (which includes an infrastructure investment trust) will not be required to withhold tax on any distributions which are in the nature of dividend income received from a special purpose vehicle, so long as such special purpose vehicle has not opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the IT Act. However, where the special purpose vehicle opts to pay tax under Section 115BAA of the IT Act, dividend income distributed by the business trust would be taxed in the hands of a non-resident unitholder at 20% (plus applicable surcharge and cess) or the applicable treaty rate and at the ordinary rate for a resident unitholder. Further, the business trust would be required to withhold tax on such distributions made from dividend received from the special purpose vehicle. Thus, the taxability of dividends distributed by the Trust will depend on the taxation regime opted by the Project SPVs. It may also be noted that in terms of Section 194LBA (1) of the IT Act, any distributable income in the nature of interest income and dividend income (where the Project SPV has opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the IT Act) in the hands of a resident investor is subject to deduction of tax at the rate of 10%. Similarly, in terms of Section 194LBA (2) of the IT Act, any distributable income in the nature of interest income and dividend income (where the SPV has opted to pay corporate tax under the beneficial regime introduced under Section 115BAA of the IT Act) in the hands of a non-resident is subject to deduction of tax at the rate of 5% (plus applicable surcharge and cess) and 10% (plus applicable surcharge and cess) respectively. The ultimate tax liability in the hands of the Unitholder may depend on various factors/ considerations.

Further, the Finance Act, has included a definition of "pooled investment vehicle" which comprises business trusts as defined under the IT Act. The IT Act defines business trusts as trusts registered with SEBI as an InvIT. This amendment has come into effect from April 1, 2021. The Finance Act recognises units, debentures and other instruments issued by infrastructure investment trusts as "securities" under the Securities Contracts (Regulation) Act, 1956. This may have further implications under various regulations issued by SEBI, governing securities, including under the Securities and Exchange Board of India (Listing Obligations and Disclosure Requirements) Regulations, 2015 and the Securities and Exchange Board of India (Prohibition of Insider Trading) Regulations, 2015. As announced in previous budgets, the dividend distribution tax applicable on InvITs was abolished and replaced with dividend withholding tax. The Finance Act has also exempted payment of tax deducted at source on dividend paid to InvITs, with effect from April 1, 2020.

The Finance Bill, as amended, proposes to tax the unitholders for such portion of distribution received by them that is not covered under section 10(23FC) or 10(23FCA) of the IT Act and that which is not chargeable to tax under section 115UA(2) of the IT Act. Any distribution not covered under the aforementioned clauses is proposed to be taxed in the hands of the unitholders as 'income' under section 56(2)(xii) of the IT Act, provided the amount received (including similar distributions in earlier years to the same unitholder or any other unitholder) is in excess of the amount at which units were issued by the InvIT, as reduced by the amount which would have been charged to tax earlier under this provision. The aforementioned amounts received by a unitholder being a specified person covered under section 10(23FE) of the IT Act shall not be subject to taxes upon the fulfilment of certain conditions set out in the IT Act. Further, any such distribution received by a unitholder to the extent not chargeable to tax under section 56(2)(xii) and not covered under sections 10(23FC), 10(23FCA) or 115UA(2) is proposed to be reduced from the cost of units.

Furthermore, the Trust might not be able to pay or maintain the levels of distributions or ensure that the level of distributions will increase over time, or that future acquisitions will increase the Trust's distributable free cash flow to the Ordinary Unitholders. Any reduction in, or elimination or taxation of, payments of distributions could materially and adversely affect the market price of the Ordinary Units.

84. The Trust and the Project SPVs may be subject to certain tax related risks under the provisions of the IT Act.

Shortfall in the determination of fair market value of the equity shares at the time of transfer of the Project SPVs to the Trust may be subject to taxation in the hands of the acquirer. The equity shares of the Project SPVs have been transferred to the Trust. Under the provisions of section 56(2)(x) of the IT Act, where a purchase of shares is undertaken at a value which is lower than the fair market value of the shares, such shortfall in value is subject to be taxed as income from other sources in the hands of the acquirer. The manner of determination of fair market value as provided under the Income Tax Rules, 1962, includes the value determined by net asset method, subject to the prescribed adjustments.

The Trust is under an obligation to distribute to the Ordinary Unitholders, the surplus of the income earned from receipt of cash flows from the interest and dividend received from the Project SPVs, after the deduction of the various expenses

incurred in connection with earning such income and general-purpose expenses. The provisions of the IT Act provide that the Trust should disclose the nature of the amount distributed to the Ordinary Unitholders, i.e., whether from dividends received from the Project SPVs, interest income earned, etc. However, there is lack of clarity on the method to be adopted by the Trust for the allocation of various expenses incurred towards earning each specific stream of income by the Trust.

85. The income of the Trust in relation to which pass through status is not granted under the IT Act may be chargeable to Indian taxes.

Under the provisions of the IT Act, the total income of the Trust other than capital gains, interest and dividend income from the Project SPVs would be taxable at the maximum marginal rate ("**MMR**"). MMR is defined under the provisions of the IT Act to mean the rate of income-tax (including surcharge on income-tax, if any) applicable in relation to the highest slab of income. In accordance with Section 115UA of the IT Act, the MMR applicable to the Trust, a separately assessable resident entity, is 30.0% (plus applicable surcharge and cess). However, the tax authorities may view the Trust as a "pass through" entity and the applicable tax rate will be the MMR applicable to its beneficiaries. If any beneficiary is chargeable to MMR at a rate higher than the rate applicable to other beneficiaries, the income of the Trust attributable to the share of such beneficiary will be taxed at a higher applicable rate. For example, if any Unitholder is a non-resident, the MMR of 40.0% (plus applicable surcharge and cess) would apply. As there are divergent views, there is a possibility that the matter may be litigated if the tax authorities subscribe to the latter view.

GENERAL INFORMATION

The Trust

The Trust has been settled on December 7, 2021 by Cube Highways and Transportation Assets Advisors Private Limited (acting as the settlor) on the instructions of the Sponsors as a contributory irrevocable trust under the provisions of the Indian Trusts Act, 1882. The Trust was registered as an infrastructure investment trust under the InvIT Regulations on April 5, 2022 having registration number IN/InvIT/22-23/0022. For information on the background of the Trust and the description of the Initial Portfolio Assets, please see the sections entitled "*Overview of the Trust*" and "*Business*" on pages 22 and 172, respectively.

Compliance Officer of the Trust

The compliance officer of the Trust is Mridul Gupta. His contact details are as follows:

Mridul Gupta

Unit No. 1901, 19th Floor, Tower B
World Trade Tower, Plot No. C-1
Sector-16, Noida 201 301
Uttar Pradesh
Tel: +91 95600 64070
Fax: N.A.
E-mail: mridul.gupta@cubehighways.com / compliance.officer@cubehighways.com

Bidders can contact the Compliance Officer, Registrar or the Placement Agents in case of any pre-Offer or post-Offer related problems, non-credit of Allotted Ordinary Units in the respective beneficiary account of Bidders after Allocation or non-receipt of refund orders.

The Sponsors

Sponsor 1 – Cube Highways and Infrastructure Pte. Ltd.

Registered office and address for correspondence:

OCBC Centre
65 Chulia Street
#21-05, Singapore 049 513
Tel: +65 6206 6977
Fax: N.A.
E-mail: CubeHighways-I@cubehighways.com
Website: www.cubehighways.com

Sponsor 2 – Cube Highways and Infrastructure III Pte. Ltd.

Registered office and address for correspondence:

OCBC Centre
65 Chulia Street
#21-05, Singapore 049 513
Tel: +65 6206 6977
Fax: N.A.
E-mail: CubeHighways-III@cubehighways.com
Website: www.cubehighways.com

Contact Person of the Sponsors:

George Crawford Currie is a director and is the contact person of the Sponsors. His contact details are as follows:

George Crawford Currie
OCBC Centre
65 Chulia Street
#21-05, Singapore 049 513
Tel: +65 6206 6973
E-mail: george.currie@isquaredcapital.com

The Investment Manager – Cube Highways Fund Advisors Private Limited

Registered office:

B-376
UGF, Nirman Vihar
New Delhi 110 092

Address for correspondence:

19th Floor, Unit No. 1901
Tower-B, World Trade Tower, Plot No. C-1
Sector 16, Noida, Uttar Pradesh 201 301
Tel: +91 0120-4868300
Fax: N.A.
E-mail: vinay.sekar@cubehighways.com
Contact person: Vinay Sekar

The Project Manager – Cube Highways and Transportation Assets Advisors Private Limited

Registered office:

B-376
UGF, Nirman Vihar
New Delhi 110 092

Address for correspondence:
19th Floor, Unit No. 1901
Tower-B, World Trade Tower, Plot No. C-1
Sec-16, Noida, U.P. 201 301
Tel: +91 0120-4868300
Fax: N.A.
E-mail: gaurav.malhotra@cubehighways.com
Contact person: Gaurav Malhotra

The Trustee – Axis Trustee Services Limited

Registered Office:

Axis House
Bombay Dyeing Mills Compound
Pandurang Budhkar Marg
Worli, Mumbai 400 025
Tel: +91 22623 00451
Fax: +91 22 6230 0700
E-mail: debenturetrustee@axistrustee.com, anil.grover@axistrustee.com
Contact Person: Anil Grover
Website: www.axistrustee.com

Corporate Office/Correspondence Address:

The Ruby, 2nd Floor, SW29
Senapati Bapat Marg, Dadar West
Mumbai 400 028
Tel: +91 22 6230 0451
Fax: +91 22 6230 0700

Other Parties involved in the Trust

Auditors

S.B. Billimoria & Co. LLP
7th floor, Building 10, Tower B
DLF Cyber City Complex

DLF City Phase II,
Gurugram 122 002
Tel: +91 124 679 2000
Firm Registration No.: 101496W/W100774
E-mail: pramodshukla@deloitte.com
Peer review certificate no.: 014032

Valuer

Ernst & Young Merchant Banking Services LLP
14th Floor, The Ruby
29 Senapati Bapat Marg
Dadar (West)
Mumbai 400 028, India
Tel: +91 22 61920000
Fax Number: +91 22 6192 0000
E-mail: jain.nilesh@in.ey.com
Contact person: Nilesh Jain

Technical Consultant

AECOM India Private Limited
3rd Floor, Building No. 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122 002
Tel: 0124 487 1503
E-mail: shankar.lohani@aecom.com
Contact Person: Shankar Raj Lohani

Traffic Study Consultant

Steer Davies Gleave India Private Limited
S3, Vatika Business Centre
Vatika Triangle, MG Road
Gurgaon, Haryana 122 002
Tel: +91 124 4418650
Fax: +44 20791 05001
E-mail: Serbjeet.kohli@steergroup.com
Firm Registration No: U74999HR2016FTC064993
Contact Person: Serbjeet Kohli
Website: www.steergroup.com

Placement Agents to the Offer

Citigroup Global Markets India Private Limited
1202, 12th Floor
First International Financial Centre
G Block, Bandra Kurla Complex
Bandra – East
Mumbai 400 098
Tel: +91 22 6175 9999
Fax: +91 22 6175 9898
E-mail: cubehighways.invit@citi.com
Investor grievance E-mail: investors.cgmib@citi.com
Website: www.online.citibank.co.in/rhtm/citigroupglobalscreen1.htm
Contact Person: Abhishek Mawandiya
SEBI Registration No.: INM000010718

J. P. Morgan India Private Limited
J.P. Morgan Tower
Off C.S.T. Road, Kalina
Santacruz (East)
Mumbai 400 098
Tel: +91 22 6157 3000

Fax: +91 22 6157 3990
E-mail: cubehighways_invit@jpmorgan.com
Investor grievance E-mail: investorsmb.jpmipl@jpmorgan.com
Website: www.jpmipl.com
Contact Person: Aanchal Mittal
SEBI Registration No.: INM000002970

Escrow Collection Bank

Axis Bank Limited
B-2 & 3, Sector 16
Noida 201 301
Uttar Pradesh, India
Tel: +91 95828 00221
Fax: N.A.
Email: noida.branchhead@axisbank.com
Website: www.axisbank.com
Contact Person: Somnath Sharma
SEBI Registration No.: INBI00000017

Legal Counsels to the Trust and the Sponsors as to Indian law

Cyril Amarchand Mangaldas
5th Floor, Peninsula Chambers
Peninsula Corporate Park
Ganpatrao Kadam Marg
Lower Parel
Mumbai 400 013
Maharashtra, India
Tel: +91 22 2496 4455
Fax: +91 22 2496 3666

Legal Counsel to the Placement Agents as to Indian law

S&R Associates
1403, Tower 2 B
One World Center
841 Senapati Bapat Marg
Lower Parel
Mumbai 400 013
Tel: +91 22 4302 8000

International Legal Counsel to the Placement Agents

Linklaters Singapore Pte. Ltd.
One George Street #17-01
Singapore 049145
Tel: +65 6692 5891

Registrar and Unit Transfer Agent

KFin Technologies Limited
Selenium, Tower B
Plot No- 31 & 32, Financial District
Nanakramguda, Serilingampally
Hyderabad, Rangareddi 500 032
Telangana, India
Tel.: +91 40 6716 2222
Toll free number: 1800 309 4001
E-mail: cube.invit@kfintech.com
Investor Grievance E-mail: einward.ris@kfintech.com
Website: www.kfintech.com
Contact Person: M. Murali Krishna
SEBI Registration No.: INR000000221

CIN: U72400TG2017PLC117649

Credit ratings

The Trust has been given a rating of (i) Ind AAA/Stable by India Ratings & Research Private Limited on November 18, 2022 for proposed rupee term loan of ₹ 10,000 million, the rationale for which is available at its website https://www.indiaratings.co.in/pressrelease/60043; (ii) Provisional [ICRA] AAA (Stable) by ICRA Limited on May 10, 2022 for proposed term loan of ₹ 15,000 million, the rationale for which is available at its website, www.icra.in; and (iii) Provisional CRISIL AAA/Stable by CRISIL Ratings Limited assigned to the proposed long term bank facilities of ₹ 100,000 million pursuant to its letter dated January 9, 2023, the rationale for which is available at its website, https://www.crisilratings.com/mnt/winshare/Ratings/RatingList/RatingDocs/CubeHighwaysTrust_January%2006,%202023_RR_308741.html. The Trust proposes to obtain revised credit ratings in relation to the InvIT Loan closer to the date of availing such InvIT Loan.

It is clarified that the details available on these websites do not form a part of this Final Placement Memorandum.

Disclaimer by CRISIL Ratings

"*CRISIL Ratings Limited (CRISIL Ratings) has taken due care and caution in preparing the Material based on the information provided by its client and / or obtained by CRISIL Ratings from sources which it considers reliable (Information). A rating by CRISIL Ratings reflects its current opinion on the likelihood of timely payment of the obligations under the rated instrument and does not constitute an audit of the rated entity by CRISIL Ratings. CRISIL Ratings does not guarantee the completeness or accuracy of the information on which the rating is based. A rating by CRISIL Ratings is not a recommendation to buy, sell, or hold the rated instrument; it does not comment on the market price or suitability for a particular investor. The Rating is not a recommendation to invest / disinvest in any entity covered in the Material and no part of the Material should be construed as an expert advice or investment advice or any form of investment banking within the meaning of any law or regulation. CRISIL Ratings especially states that it has no liability whatsoever to the subscribers / users / transmitters/ distributors of the Material. Without limiting the generality of the foregoing, nothing in the Material is to be construed as CRISIL Ratings providing or intending to provide any services in jurisdictions where CRISIL Ratings does not have the necessary permission and/or registration to carry out its business activities in this regard. Cube Highways Trust will be responsible for ensuring compliances and consequences of non-compliances for use of the Material or part thereof outside India. Current rating status and CRISIL Ratings' rating criteria are available without charge to the public on the website, www.crisilratings.com. For the latest rating information on any instrument of any company rated by CRISIL Ratings, please contact Customer Service Helpdesk at 1800-267-1301.*"

PARTIES TO THE TRUST

A. The Sponsors

Sponsor 1 – Cube Highways and Infrastructure Pte. Ltd. ("CH-I")

History and Certain Corporate Matters

CH-I was originally incorporated as 'ISQ Asia Infrastructure I-A Pte. Ltd.' on March 27, 2014 as a private company limited by shares under laws of Singapore. The name of the company was changed to 'Cube Highways and Infrastructure Pte. Ltd.' with effect from September 22, 2015. The registration number of CH-I is 201408750N.

The registered office of CH-I is situated at OCBC Centre, 65 Chulia Street, #21-05, Singapore 049 513. For further details, please see the section entitled "*General Information*" on page 102.

Background of CH-I

CH-I, is a Singapore-based company that carries out investments in road and highway projects along with other select infrastructure sectors in India. CH-I owned and operated five Project SPVs in India, being, JMTL, MBEL, WUPTL, APEL and GAEPL. For details of the acquisition of the Initial Portfolio Assets from CH-I, please see the section entitled "*Formation Transactions in relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and Acquisition of Subordinate Units by the Sponsors*" on page 30.

In accordance with the eligibility criteria specified under InvIT Regulations, CH-I has more than seven years of experience in fund management in the infrastructure sector. It acquired JMTL, its first highway SPV, in March 2015. CH-I has completed acquisition of six projects, as on May 31, 2022. For further details, please see the section entitled "*Business*" on page 172.

In accordance with the eligibility criteria specified under the InvIT Regulations, CH-I has a standalone net worth of ₹48,941.72 million as on December 31, 2022.*
**The reference rate published by Reserve Bank of India as on December 31, 2022 is 1 USD = ₹ 82.75.*

Further, neither CH-I nor any of the promoters or directors of CH-I: (i) are or have been debarred from accessing the securities market by SEBI; (ii) are or have been promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/or (iii) are or have been in the list of wilful defaulters published by the RBI.

Board of Directors of CH-I

The board of directors of CH-I is entrusted with the overall management of CH-I. Please see below the details in relation to the directors on the board of CH-I:

1. Kenichi Yoshihara;
2. Marcus Christopher Hill;
3. Heng Hock Kiong;
4. Spyros John Mantzavinatos;
5. George Crawford Currie;
6. Harsh Agrawal; and
7. Siew Hean Meng.

Sponsor 2 – Cube Highways and Infrastructure III Pte. Ltd. ("CH-III")

History and Certain Corporate Matters

CH-III was originally incorporated on September 22, 2017 as 'Indian Highways Developers Pte. Ltd.', a private company limited by shares under laws of Singapore. The name of the company was changed to 'Cube Highways and Infrastructure III Pte. Ltd.' with effect from September 22, 2017. The registration number of CH-III is 201727089Z.

The registered office of CH-III is situated at OCBC Centre, 65 Chulia Street, #21-05, Singapore 049 513. For further details, please see the section entitled "*General Information*" on page 102.

Background of CH-III

CH-III, is a Singapore-based company that carries out investments in road and highway projects along with other select infrastructure sectors in India. CH-III owned and operated two of the Initial Portfolio Assets in India, being, DATRPL and WVEPL. For details of the acquisition of the Initial Portfolio Assets from CH-III, please see the section entitled "*Formation Transactions in relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and Acquisition of Subordinate Units by the Sponsors*" on page 30. Further, CH-I and CH-III own the ROFO SPVs.

In accordance with the eligibility criteria specified under InvIT Regulations, CH-III is relying on the experience of its associate, being, CH-I. For details of CH-I's experience, please see the section entitled "*Parties to the Trust – The Sponsors - Sponsor 1 – Cube Highways and Infrastructure Pte. Ltd. ("CH-I") – Background of CH-I*" on page 107.

In accordance with the eligibility criteria specified under the InvIT Regulations, CH-III has a standalone net worth of ₹ 62,735.34 million as on December 31, 2022.*
**The reference rate published by Reserve Bank of India as on December 31, 2022 is 1 USD = ₹ 82.75.*

Further, neither CH-III nor any of the promoters or directors of CH-III: (i) are or have been debarred from accessing the securities market by SEBI; (ii) are or have been promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/or (iii) are or have been in the list of wilful defaulters published by the RBI.

Board of Directors of the Sponsors

The board of directors of CH-III is entrusted with the overall management of CH-III. Please see below the names of the directors on the board of CH-III:

1. Marcus Christopher Hill;
2. Heng Hock Kiong;
3. George Crawford Currie;
4. Harsh Agrawal; and
5. Kunal Agarwal.

B. The Trustee – Axis Trustee Services Limited

Axis Trustee Services Limited is the Trustee in respect of the Trust. The Trustee is a debenture trustee registered with SEBI under the Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993, having registration number IND000000494, which is valid until suspended or cancelled by SEBI. The Trustee's registered office is situated at Axis House, Bombay Dyeing Mills Compound, Pandurang Budhkar Marg, Worli, Mumbai 400 025. The Trustee's address for correspondence and principal place of business is situated at The Ruby, 2nd Floor, SW, 29, Senapati Bapat Marg, Dadar West, Mumbai 400 028. The Trustee is promoted by Axis Bank Limited for providing corporate and other trusteeship services.

Background of the Trustee

The Trustee's services are aimed at catering to the individual needs of the client and enhancing client satisfaction. As Trustee, it ensures compliance with all statutory requirements and believes in the highest ethical standards and best practices in corporate governance. It aims to provide the best services in the industry with its well trained and professionally qualified staff with a sound legal acumen. The Trustee is involved in varied facets of debenture and bond trusteeships, including, advisory functions and management functions. The Trustee also acts as a security trustee and is involved in providing services in relation to security creation, compliance and holding security on behalf of lenders.

The Trustee is also involved in providing services such as: (i) a facility agent for complex structured transactions; (ii) an escrow agent; (iii) a trustee to alternative investment funds; (iv) custodian of documents as a safekeeper; and (v) a trustee to real estate investment funds.

The Trustee has been engaged in the activity of providing trusteeship services since 2008 and has a customer base of over 500 corporate clients. The Trustee is currently the trustee to one of the first publicly offered infrastructure investment trusts in India, India Grid Trust.

The Trustee is not an Associate of the Sponsors or the Investment Manager or the Project Manager to the Trust. Further, neither the Trustee nor the settlors of the Trustee (i) are or have been debarred from accessing the securities market by SEBI; (ii) are or have been promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/or (iii) are or have been declared a

wilful defaulter by any bank or a financial institution or consortium thereof in accordance with the guidelines on 'wilful defaulters' published by the RBI.

Board of Directors of the Trustee

The Board of Directors of the Trustee is entrusted with the responsibility for the overall management of the Trustee. Please see below the details in relation of the board of directors of the Trustee:

Sr. No.	Name	DIN
1.	Deepa Rath	09163254
2.	Rajesh Kumar Dahiya	07508488
3.	Ganesh Sankaran	07580955

Brief profiles of the Directors of the Trustee

1. **Deepa Rath** is the Managing Director and Chief Executive Officer of Axis Trustee Services Limited.

2. **Rajesh Kumar Dahiya** is a non- executive director on the board of Axis Trustee Services Limited.

3. **Ganesh Sankaran** is a non-executive director on the board of Axis Trustee Services Limited.

Key Terms of the Trust Deed

The Trustee, the Sponsors and the Settlor have entered into the original trust deed dated December 7, 2021, in terms of the InvIT Regulations, which was registered under the provisions of the Indian Registration Act, 1908 on December 7, 2021 ("**Original Trust Deed**"). Subsequently, the parties to the Original Trust Deed entered into an amended and restated trust deed ("**Trust Deed**") on July 8, 2022, the key terms of which, are provided below:

1. *Powers of the Trustee*

The Trustee has been provided with various powers under the Trust Deed in accordance with the Indian Trusts Act, 1882 and the InvIT Regulations, including but not limited to:

(i). the Trustee shall, in relation to the Trust, have every and all powers that a person competent to contract and acting as a legal and beneficial owner of such property;

(ii). the Trustee shall make distributions to Unitholders in accordance with the InvIT Documents and in compliance with the InvIT Regulations and applicable law;

(iii). the Trustee shall oversee voting of Unitholders in accordance with the InvIT Regulations;

(iv). the Trustee shall have the power to do the following, in accordance with the InvIT Regulations, which power may be delegated to the Investment Manager in terms of the Investment Management Agreement:

a) cause the offering of the Units through any offer document;

b) cause any offer document to be provided to the investors;

c) issue and allot Units or other securities, obligations or instruments of the Trust;

d) summon and conduct meetings of the Unitholders in accordance with the relevant InvIT Documents and the InvIT Regulations; and

e) subject to, and only in accordance with, the terms of the InvIT Documents and the InvIT Regulations, approve transfer of the Units;

(v). the Trustee shall invest and hold the InvIT Assets in the name of the Trust for the benefit of the Unitholders in accordance with the provisions of the InvIT Regulations, InvIT Documents, Trust Deed and the Investment Objective. The Trustee shall be empowered to make investment decisions with respect to the underlying assets or projects of the Trust including any further investments or divestments, subject to InvIT Regulations and the InvIT Documents;

(vi). Subject to the provisions of the InvIT Regulations and the distribution policy adopted by the Investment

Manager, the Trustee, in consultation with the Investment Manager, shall have the power to make such reserves out of the income or capital as the Trustee may deem proper in order to, amongst other things, meet the expenses, liabilities or contingent liabilities of the Trust and any decisions of the Trustee whether made in writing or implied from its acts, so far as the applicable law may permit, shall be conclusive and binding on the Unitholders;

(vii). the Trustee, subject to the recommendations of the Investment Manager, shall have the power to employ and pay at the expense of the Trust, any agent in any jurisdiction whether attorneys, solicitors, brokers, banks, trust companies or other agents whether associated or connected in any way with the Trustee or not, without being responsible for the default of any agent if employed in good faith to transact any business, including without limitation, the power to appoint agents to raise funds, or do any act required to be transacted or done in the execution of the trusts including the receipt and payment of moneys and the execution of documents;

(viii). the Trustee shall, on behalf of the Trust, within a reasonable time from the date of execution of the Original Trust Deed, appoint the Investment Manager as the investment manager to the Trust, by execution of the Investment Management Agreement, on behalf of the Trust, to manage the assets and investments of the Trust and undertake activities of the Trust;

(ix). the Trustee shall oversee the activities of the Investment Manager in the interest of the Unitholders, ensure that the Investment Manager complies with the InvIT Regulations and applicable law and shall obtain a compliance certificate from the Investment Manager on a quarterly basis or such other time period as prescribed by applicable law, in the form prescribed by SEBI, if any;

(x). the Trustee shall, on behalf of the Trust, either through itself or through the Investment Manager, within a reasonable time from the date of execution of the Original Trust Deed, appoint the Project Manager as the project manager for the Trust, by execution of the Project Implementation and Management Agreement, for the operation and management of the InvIT Assets;

(xi). the Trustee shall oversee activities of the Project Manager in terms of the InvIT Regulations, other applicable law and the Project Implementation and Management Agreement and shall obtain a compliance certificate from the Project Manager on a quarterly basis or such other time period as prescribed by applicable law, in the form prescribed by SEBI, if any;

(xii). the Trustee may, in consultation with the Investment Manager, appoint any custodian in order to provide custodian services, and may permit any property comprised in the Trust to be and remain deposited with a custodian or with any person or persons in India or in any other jurisdiction subject to such deposit being permissible under the applicable law;

(xiii). in the event of any capital gains tax, income tax, stamp duty or other duties, fees or taxes (and any interest or penalty chargeable thereon) whatsoever becoming payable in any jurisdiction in respect of the Trust or in respect of documents issued or executed in pursuance of the Trust Deed in any circumstances whatsoever, the Trustee shall have the power and duty to pay all such duties, fees or taxes (and any interest or penalty chargeable thereon) as well as to create any reserves for future potential tax liability out of the Trust or InvIT Assets or the income thereof, or to the extent of the amount invested in the Units by the Unitholders, as may be permitted under applicable law and as the Trustee may reasonably deem proper, and the Trustee may pay such duties, fees or taxes (and any such interest or penalty) on behalf of the Trust;

(xiv). the Trustee shall, subject to the advice of the Investment Manager, have the power to pay expenses of the Trust out of the funds held by the Trust;

(xv). the Trustee shall, in discharge of its duties, have the power to take the opinion of legal or tax counsel in any jurisdiction concerning any disputes or differences arising under the Trust Deed or any matter relating to the Trust and the fees of such counsel shall be paid out of the funds held in the Trust;

(xvi). the Trustee may, in execution of the Trust in terms of the Original Trust Deed, or in exercise of any of the powers stipulated in the Trust Deed or by law given to the Trustee sell, rent or buy any property, or borrow property from or carry out any other transaction with the trustees of any other trust or the executors or administrators of any estate;

(xvii). the Trustee (on behalf of the Trust) shall have the power to:

a) accept any property before the time at which it is transferable or payable;

b) pay or allow any claim on any evidence that it thinks sufficient;

c) accept any security movable or immovable in lieu of any amounts payable to it;

d) alter the dates for payment of any amounts payable to it; and

e) compromise, compound, abandon or otherwise settle any claim or thing whatsoever relating to the Trust or the Trust Deed;

(xviii). the Trustee shall, subject to the advice of the Investment Manager, have the power to borrow funds including any subordinated equity, long term loans, short term loans, bonds or other loans or funds from any person or authority (whether Government or otherwise, whether Indian or overseas) for the purpose of the Trust on such terms and conditions and for such periods and subject to approval of the Unitholders in accordance with and as may be required in terms of the InvIT Regulations and applicable law. The Trustee shall, subject to the advice of the Investment Manager, also have the power to create encumbrances of any kind on the InvIT Assets as collateral security for any such borrowings;

(xix). the Trustee may, subject to the conditions stipulated in the Trust Deed and any other InvIT Documents, InvIT Regulations, applicable law and any advice of the Investment Manager, retain any proceeds received by the Trust from any InvIT Assets, Holding Companies or SPVs, including through the sale of any Holding Company or SPV, for the purpose of re-investment;

(xx). the Trustee may, make rules to give effect to, and carry out the investment objectives, subject to applicable law and relevant provisions of the Trust Deed. In particular, and without prejudice to the generality of such power, the Trustee may provide the (a) manner of maintaining of the records and particulars of the Unitholders; (b) norms of investment by the Trust in accordance with the investment objectives of the InvIT and in accordance with the powers and authorities of the Trustee as set out herein; (c) matters relating to entrustment / deposit or handing over of any securities or shares of the SPVs of the Trust to any one or more custodians and the procedure relating to the holding thereof by the custodian; (d) such other administrative, procedural or other matters relating to the administration or management of the affairs of the Trust and which matters are not by the very nature required to be included or provided for in the Trust Deed or by the management thereof and which matters are not inconsistent with the provisions thereof; (e) procedure for seeking the vote of the Unitholders either by calling a meeting or through postal ballot or otherwise; and (f) procedure for summoning and conducting meetings of Unitholders.

(xxi). the Trustee shall cause the depository to maintain the depository register;

(xxii). the Trustee shall advise the Investment Manager in relation to the appointment of Valuer, Auditors, Registrar, merchant bankers, custodian, Credit Rating Agency and any other intermediary or service provider or agent as may be applicable with respect to the activities pertaining to the Trust, in a timely manner;

(xxiii). the Trustee shall review the reports required in terms of InvIT Regulations and applicable law, as submitted by the Investment Manager. In the event such reports are not submitted in a timely manner, the Trustee, after due follow-up, shall intimate the same to SEBI;

(xxiv). the Trustee shall have the power to open one or more bank accounts and/or demat accounts for the purposes of the Trust, to deposit and withdraw money and/or securities and fully operate the same;

(xxv). the Trustee shall have the power to take up with SEBI or with the designated stock exchange(s) as applicable, any matter which has been approved in any meeting of Unitholders, if the matter requires such action;

(xxvi). the Trustee shall have the power to exercise all rights of the Trust in the SPVs, including voting rights, rights to appoint directors, whether pursuant to securities held by it, or otherwise, in such manner as it deems to be in the best interest of the Trust, and in accordance with the InvIT Regulations and applicable law. Additionally, if the Trust has invested in infrastructure projects through the Holding Company or SPVs, then the Investment Manager, in consultation with the Trustee, shall appoint the majority of the directors of the Holding Company(ies) and/or the SPV(s), in accordance with the applicable law, as well as ensure that in every general meeting including the annual general meeting of any SPV or Holding Company, the voting of the Trust is exercised, in accordance with the InvIT Regulations and applicable law;

(xxvii). the Trustee shall have the power to, in consultation with the Investment Manager (except where such action relates to the Investment Manager), institute, conduct, compromise, compound, or abandon any legal proceedings for or on behalf of or in the name of the Trust or the Trustee, and to defend, compound or

otherwise deal with any such proceedings against or by the Trust or Trustee or its officers or concerning the affairs of the Trust, and also to compound and allow time for payment or satisfaction of any equity due and of any claims or demands by or against the Trust and observe and perform any decisions thereof;

(xxviii). the Trustee can make and give receipts, releases and other discharges for moneys payable to the Trust and for the claims and demands of the Trust;

(xxix). the Trustee can enter into all such negotiations and contracts, and, execute and do all such acts, deeds and things for or on behalf of or in the name of the Trust as the Trustee may consider expedient for or in relation to any of the matters or otherwise for the purposes of the Trust;

(xxx). the Trustee can sign, seal, execute, deliver and register according to law all deeds, documents, agreements, and assurances in respect of the Trust;

(xxxi). the Trustee can take into its custody and/or control all the capital, assets, property of the Trust and hold the same in trust for the Unitholders in accordance with the Trust Deed, the InvIT Regulations and applicable law;

(xxxii). the Trustee may at any time, buy back the Units from the Unitholders in accordance with the policy formulated by the Investment Manager and subject to applicable law;

(xxxiii). the Trustee may cause the Trust to pay, prepay or repay any and all debt raised from any Person in accordance with the terms therein and to redeem any debt securities or other securities, obligations or instruments in accordance with the terms thereof issued to such Persons;

(xxxiv). the Trustee can generally exercise all such powers as it may be required to exercise under the InvIT Regulations and applicable law for the time being in force and do all such matters and things as may promote the Trust or as may be incidental to or consequential upon the discharge of its functions and the exercise and enforcement of all or any of the powers and rights under the Trust Deed and applicable law; and

(xxxv). the Trustee may, delegate to the Investment Manager or the Project Manager, any powers set out above.

2. *Duties of the Trustee*

(i). The Trustee shall use best endeavours to carry on and conduct the business of the Trust in a proper and efficient manner in the best interest of the Unitholders.

(ii). The Trustee, on behalf of the Trust, shall appoint an Investment Manager and Project Manager in accordance with the InvIT Regulations and other applicable law.

(iii). The Trustee shall, on behalf of the Trust, within a reasonable time from the date of execution of the Trust Deed, enter into the Investment Management Agreement with the Investment Manager.

(iv). The Trustee shall ensure that the Investment Manager performs its obligations under the Investment Management Agreement, InvIT Regulations and other applicable law, including the following:

(a) The Trustee shall ensure that the Investment Manager complies with reporting and disclosure requirements in accordance with InvIT Regulations and in case of any delay or discrepancy, require the Investment Manager to rectify such delay or discrepancy on an urgent basis.

(b) The Trustee shall review the transactions carried out between the Investment Manager and its associates and where the Investment Manager has advised that there may be a conflict of interest, it shall obtain a certificate from a practising chartered accountant or valuer, as applicable, that such transaction is on arm's length basis.

(c) The Trustee shall review the Valuation Report submitted by the Investment Manager.

(d) The Trustee shall require the Investment Manager to set up such systems and procedures and submit such reports to the Trustee, as may be necessary for effective monitoring of the functioning of the Trust.

(e) The Trustee shall ensure that the Investment Manager convenes meetings of the Unitholders in accordance with the InvIT Regulations and oversee the voting by Unitholders and declaration of such results of such meetings, provided that where there is (i) a change or removal of the Investment Manager, or a change in control of the Investment Manager, and the Trustee will be required to obtain approval of

the Unitholders the Trustee shall be responsible for convening and conducting of the meeting of the Unitholders; and (ii) any issue pertaining to the Trustee, such as change in the Trustee, the Trustee shall not be involved in any manner in the conduct of the meetings of the Unitholders. The Trustee shall ensure that the Investment Manager convenes meetings of Unitholders not less than once every year and the period between such meetings shall not exceed 15 (fifteen) months.

(v). The Trustee shall either by itself or through the Investment Manager, provide SEBI and the stock exchange(s), where applicable, such information as may be sought by SEBI or by the stock exchange(s), as applicable, pertaining to the activity of the Trust. The Trustee shall comply with intimation requirements under the InvIT Regulations and applicable law, including in relation to intimating SEBI in case of any discrepancy in the operation of the Trust with the Trust Deed, the InvIT Regulations and any offer document. The Trustee shall also immediately inform SEBI in case any act which is detrimental to the interest of the Unitholders is noted or if the Investment Manager fails to submit to the Trustee the information or reports as specified under the InvIT Regulations, in a timely fashion.

(vi). The Trustee shall at all times exercise due diligence in carrying out its duties and protecting the interests of the Unitholders. The Trustee shall, through the Investment Manager, from time to time provide such documents and information to the Unitholders, as may be required by the SEBI, the stock exchange(s), where applicable, or other governmental agency, with respect to the activities carried on by the Trust.

(vii). The Trustee shall delegate all such powers to the Investment Manager as may be required by the Investment Manager to carry out its obligations under the Investment Management Agreement and under applicable law. Further, it shall delegate all such powers to the Project Manager as may be required by the Project Manager to carry out its obligations under the Project Implementation and Management Agreement and under applicable law.

(viii). The Trustee shall obtain prior approval from the Unitholders in accordance with the InvIT Regulations and InvIT Documents before any change in, or change in control of, the Investment Manager due to removal or otherwise. In this regard, the Trustee shall also obtain prior approval from SEBI and any concessioning authority or other authorities as may be required, prior to any change in, or change in control of, the Investment Manager, in the event that such approval is required in terms of the InvIT Regulations or other applicable law or InvIT Documents. In case of change in Investment Manager due to removal or otherwise, the Trustee shall, appoint a new investment manager in accordance with the InvIT Documents, InvIT Regulations and applicable law. The Trustee shall appoint a new investment manager within the time period prescribed under the InvIT Regulations. The previous investment manager shall continue to act as such at the discretion of the Trustee until such time as the new investment manager is appointed. The Trustee shall ensure that the new investment manager shall stand substituted as a party in all the documents to which the earlier Investment Manager was a party. The Trustee shall also ensure that the earlier Investment Manager continues to be liable for all its acts of omission and commission for the period during which it served as investment manager, notwithstanding its termination.

(ix). In case of change in Project Manager due to removal or otherwise, the Trustee shall appoint a new project manager in accordance with the InvIT Regulations, Applicable Law and the InvIT Documents. The Trustee shall appoint a new project manager within the time period prescribed under the InvIT Regulations. The Trustee may, either *suo moto* or based on the advice of the concessioning authority(ies) appoint an administrator in connection with an infrastructure project for such terms and on such conditions as it deems fit. The previous project manager shall continue to act as the project manager till such time as a new project manager is appointed. All costs and expenses in this regard will be borne by the new project manager. The Trustee shall ensure that the new project manager shall stand substituted as a party in all the documents to which the earlier Project Manager was a party. The Trustee shall also ensure that the earlier Project Manager continues to be liable for all its acts of omission and commission for the period during which it served as project manager, notwithstanding its termination. The Trustee shall ensure that in case of change in the Project Manager, written consent is obtained from the concessioning authority(ies) in terms of the concession agreement(s), prior to such change, if applicable.

(x). The Trustee shall ensure that in case of change in control of the Project Manager, written consent is obtained from the concessioning authority(ies) in terms of the concession agreement(s), prior to such change, if applicable.

(xi). The Trustee shall ensure that subscription amount is kept in a separate no lien, no interest bearing bank account in name of the Trust and is only utilised for adjustment against allotment of Units or refund of money to the applicant till the time such Units are allotted or listed and the same will be utilised for objectives of the offering as will be mentioned in the relevant offer document.

(xii). The Trustee shall cause the books of accounts of the Trust to be maintained in accordance with Article 15 of the Trust Deed.

(xiii). The Trustee shall ensure that all acts, deeds and things are done for the attainment of the investment objectives of the Trust and in compliance with the InvIT Documents, the InvIT Regulations, applicable law and relevant concession agreements, as applicable, and to secure the best interests of the Unitholders.

(xiv). The Trustee shall either by itself or through the Investment Manager file such reports as may be required by SEBI or any other regulatory authority or as required under the InvIT Documents, InvIT Regulations and applicable law with regard to the activities carried on by the Trust.

(xv). The Trustee shall periodically review the status of the Unitholders' complaints and their redressal undertaken by the Investment Manager, in accordance with the InvIT Regulations.

(xvi). The Trustee and its directors, officers, employees and agents shall at all times maintain the greatest amount of confidentiality as regards the activities and assets of the Trust and such other matter connected with them and the Trust generally and shall not disclose any confidential information to any other person, other than the Investment Manager, or the Project Manager, unless such information is required to be disclosed to some regulatory authority, court or any other person under any order of court or any law in force in India.

(xvii). The Trustee shall ensure that the assets and liabilities of the Trust shall at all times be segregated from the assets and liabilities of the Trustee and the assets and liabilities of other trusts or funds managed by the Trustee. The assets held under the Trust shall be held for the exclusive benefit of the Unitholders and such assets shall not be subject to the claims of any creditor or any person claiming under any other fund or trust administered by the Trustee or by the Investment Manager respectively.

(xviii). The Trustee shall ensure that the Investment Manager shall ensure that a detailed valuation is undertaken of the InvIT Assets by a Valuer at such intervals and in the manner as may be prescribed under the InvIT Regulations and applicable law. The Trustee shall ensure that the remuneration of the Valuer is not linked to or based on the value of the asset being valued.

(xix). The Trustee of the Trust shall not invest in Units of the Trust.

(xx). The Trustee shall fulfil its duties and obligations in terms of the InvIT Regulations.

(xxi). The Trustee shall ensure that the activities of the Trust are being operated in accordance with the provisions of the Trust Deed, the InvIT Regulations, applicable law and the InvIT Documents and in case of any discrepancy, it shall inform SEBI immediately in writing.

(xxii). The Trustee shall ensure that the Trust, the Investment Manager, the Project Manager, the Holding Companies and the Initial Portfolio Assets adopt, policies, including corporate governance policies, policies in relation to acquisition of assets from the Sponsors and third parties, policies in relation to the net distributable cash flows, policies in relation to anti-bribery and anti-corruption, policies in relation to the investments by the Trust, policies in relation to environment, safety and health, policies in relation to anti-money laundering, policy on related party transactions and any other policies in relation to their activities related to the Trust, as may be required and applicable, prior to filing of the relevant initial offer document for the initial offer. The terms, such as, manner or requirement of Unitholders' approval for each of these policies, applicability, amendment and termination, of the respective policies shall be set out in each of the policies.

(xxiii). The Trustee shall maintain records in relation to the Trust in accordance with the InvIT Regulations and other applicable law.

(xxiv). The Trustee shall wind up the Trust in accordance with the InvIT Regulations and applicable law. Upon winding up of the Trust, the Trustee shall surrender the certificate of registration to SEBI.

(xxv). The Trustee shall, promptly on occurrence, inform the Sponsors and the Settlor of a cancellation, revocation, suspension, non-renewal of its registration to act as a trustee under Applicable Law or a breach of the terms of such registration that will materially impair its ability to perform its obligations and exercise its powers under the Trust Deed.

(xxvi). The Trustee (either by itself or through the Investment Manager) shall ensure that all related party transactions in relation to the Trust are entered into on an arm's length basis and in accordance with the InvIT Documents and applicable law (including the InvIT Regulations).

3. *Rights of the Trustee*

The Trustee shall have the following rights:

(i). The Trustee may, in consultation with the Investment Manager, in the discharge of its duties, act upon any advice obtained in writing from any bankers, accountants, brokers, lawyers, professionals, consultants, or other experts acting as advisers to the Trustee;

(ii). Subject to the applicable law, no Unitholder shall be entitled to inspect or examine the Trust's premises or properties (including any Holding Company and SPVs) without the permission of the Trustee, who shall give such permission, if necessary, in consultation with the Investment Manager. Further, no Unitholder shall be entitled to require discovery of any information in respect of any detail of the Trust's activities or any matter which may relate to the conduct of the business of the Trust and which information may, in the opinion of the Trustee and the Investment Manager adversely affect the interest of other Unitholders;

(iii). The Trustee shall be entitled to reimburse itself and shall be entitled to charge the Trust, and shall be entitled to be indemnified and be kept indemnified from the Trust with the expenses, outgoings, taxes, levies, and liabilities (including indemnity obligations of the Trust, if any) as set out in the Trust Deed;

(iv). The Trustee may accept as sufficient evidence for the value of any investment or for the cost price or sale price thereof or for any other fact within its competence, a certificate by a Valuer or any other professional person appointed by the Investment Manager for such purpose.

4. *Liabilities of the Trustee*

The liabilities of the Trustee in terms of the Trust Deed are as follows:

(i). The Trustee shall only be chargeable for such monies, stocks, funds, shares, assets, investment, property and securities as the Trustee shall have actually received and shall not be liable or responsible for any banker, broker, custodian or other person in whose hands the same may be deposited or placed, nor for the deficiency or insufficiency in the value of any investments of the Trust nor otherwise for any involuntary loss. Any receipt signed by the Trustee for any monies, stocks, funds, shares, assets, securities, investment or property, paid, delivered or transferred to the Trustee under or by virtue of the Trust Deed or in exercise of the duties, functions and powers of the Trustee shall effectively discharge the Trustee or the person or persons paying, delivering or transferring the same therefrom or from being bound to see to the application thereof, or being answerable for the loss or misapplication thereof provided that the Trustee and such persons shall have acted in good faith, without negligence and shall have used their best efforts in connection with such dealings and matters;

(ii). The Trustee shall not be under any liability on account of anything done or omitted to be done or suffered by the Trustee in good faith in accordance with, or in pursuance of any request or advice of the Investment Manager;

(iii). The Trustee shall not be under any obligation to institute, acknowledge the service of, appear in, prosecute or defend any action, suit, proceedings or claim in respect of the provisions hereof or in respect of the InvIT Assets or any part thereof or any corporate action which in its opinion would or might involve it in expense or liability unless the Investment Manager shall so request in writing and the Trustee is satisfied that the value of the investment is sufficient to provide adequate indemnity against costs, claims, damages, expenses or demands to which it may be put as Trustee as a result thereof. The costs in relation to such action, suit, proceedings or claims (whether undertaken upon request of Investment Manager or otherwise) incurred by the Trustee in connection with or arising out of the Trust, shall be borne by the Trust;

(iv). The Trustee shall not be liable in respect of any action taken or damage suffered by it on reliance upon any notice, resolution, direction, consent, certificate, affidavit, statement, certificate of stock, plan of reorganization or (without being limited in any way by the foregoing) other paper or document believed to be genuine and to have been passed, sealed or signed by appropriate authorities or entities;

(v). The Trustee shall not be liable to the Unitholders for doing or failing to do any act or thing which by reason of any provision of any present or future law or regulation made pursuant thereto, or of any decree, order or judgment of any court, or by reason of any request announcement or similar action (whether of binding legal effect or not) which may be taken or made by any person or body acting with or purporting to exercise the authority of any government (which legally or otherwise) it shall be directed or requested to do or perform or to forbear from doing or performing. If for any reason it becomes impossible or impracticable (as

determined by the Trustee and the Investment Manager) to carry out any of the provisions of these presents the Trustee shall not be under any liability therefore or thereby;

(vi). The Trustee shall not be responsible to any Unitholder for the authenticity of any signature affixed to any document or be, in any way, liable for any forged or unauthorized signature on or for acting upon or giving effect to any such forged or unauthorized signature. The Trustee shall be entitled but not bound to require that the signature of any Unitholder to any document required to be signed by him under or in connection with these presents shall be verified to the Trustee's reasonable satisfaction;

(vii). If the Trustee is required by the InvIT Regulations or any other applicable law to provide information regarding the Trust or the Sponsors or the Unitholders, the investments made by the Trust and income therefrom and provisions of these presents and complies with such request in good faith, whether or not it was in fact enforceable, the Trustee shall not be liable to the Unitholders or to any other party as a result of such compliance or in connection with such compliance;

(viii). The Trustee shall not incur any liability for any act or omission or (as the case may be) failing to do any act or thing which may result in a loss to a Unitholder (by reason of any depletion in the value of the InvIT assets or otherwise), except in the event that such loss is a direct result of fraud, gross negligence, dishonest acts of commissions or omissions or wilful default on the part of the Trustee, where the Trustee fails to exercise due care in relation to its obligations under the Trust Deed, or disregard of duty or breach of duties under the Trust Deed or applicable law by the Trustee;

(ix). If the Trustee engages any external advisors or experts to discharge its obligations under the Trust Deed, or undertakes any work (in consultation with the Investment Manager, in the interest of the Unitholders) which is not covered within the scope of work of the Trustee under the Trust Deed and such additional work is beyond the obligations of the Trustee under applicable law, the Trustee shall be entitled to recover such costs, charges and expenses which the Trustee may incur in this regard, from the funds of the Trust. Further, it is clarified that, the Trustee will not be required to utilize funds held by the Trustee for any other trust for which, Axis Trustee Services Limited is appointed as a trustee, for discharging its obligations as the Trustee under the Trust Deed; and

(x). The liability of the Trustee shall be limited to the extent of the fees received by it, except (a) in case of any fraud, gross negligence, dishonest acts of commissions or omissions or willful default on the part of the Trustee, where the Trustee fails to exercise due care in relation to its obligations under the Trust Deed, or disregard of duty or breach of duties under the Trust Deed or Applicable Law by the Trustee, or (b) any failure on the part of the Trustee to protect the interests of the Unitholders, other than as specified in the Trust Deed.

5. *Issue, Listing and Delisting of Units*

(i). The Trust may issue Ordinary Units or Subordinate Units in accordance with and subject to the requirements of applicable law.

(ii). There shall not be multiple classes of Units of the Trust other (i) the Ordinary Units; and (ii) the Subordinate Units (that may be issued to the Sponsors and their Associates only).

(iii). The Subordinate Units shall be issued in compliance with the following requirements:

(a) the Subordinate Units shall be issued either to the Sponsors or their respective Associates only on a private placement basis;

(b) the Subordinate Units cannot be held by, and shall not be transferable to any person except the Sponsors or their respective Associates;

(c) the Subordinate Units shall not be listed, except if mandated under applicable law or if required to be by any regulatory or statutory authority;

(d) subject to compliance with statutory and regulatory requirements, the lock-in prescribed by the InvIT Regulations in relation to the unitholding of the Sponsors, shall not be applicable to the Subordinate Units; and

(e) the terms of the Subordinate Units may allow such Subordinate Units to be reclassified as Ordinary Units and receive all rights and benefits available to the holders of the Ordinary Units upon meeting conditions and parameters prescribed thereof under the terms.

(iv). The Trust may issue Subordinate Units:

(a) simultaneously with the initial offer of Ordinary Units as part of the formation transactions of the Trust ("**Initial Tranche Subordinate Units**"). The maximum number of Initial Tranche Subordinate Units that can be issued by the Trust shall be 157,500 lakhs divided by the price per Unit at the time of allotment. For details in relation to the terms and conditions of the Initial Tranche Subordinate Units please see the section entitled "*Information Concerning the Units*" on page 226; and

(b) at any other time subsequent to the initial offer of Ordinary Units, subject to the approval of the board of the Investment Manager and the Unitholders holding Ordinary Units in accordance with Regulation 22(5)(d) of the InvIT Regulations. The terms and conditions for any other Subordinate Units shall be determined by the board of the Investment Manager.

(v). The Trustee shall ensure that the Units are offered and issued in accordance with and within the time period specified under Applicable Law. The Trust shall also comply with the minimum public holding for the Units and minimum number of Unitholders as prescribed under the InvIT Regulations.

(vi). In the event the Units of the Trust are proposed to be delisted, the Trustee shall ensure that the Investment Manager applies for delisting of the Units, as applicable, to SEBI and the designated stock exchanges in accordance with the provisions of Applicable Law. In the event of mandatory delisting of the units, the Investment Manager shall ensure that such delisting is undertaken in accordance with the InvIT Regulations and Applicable Law.

(vii). The Trustee shall cause the depository to effect the book entry of Units to be issued to a depositor into such depositor's securities account.

(viii). The Trust shall redeem Units only by way of a buy back or at the time of delisting of Units, as applicable, in accordance with applicable law or pursuant to any other method prescribed under applicable law.

6. *Term, discharge and removal of the Trustee and appointment of new Trustee*

(i). The Trustee shall hold the office of the Trustee until the dissolution of the Trust or the discharge of the Trustee, whichever is earlier.

(ii). The Trustee shall stand discharged as the Trustee of the Trust on the happening of any of the following events:

a. The Board passes a resolution for the Trustee to be voluntarily wound up or any order of winding up against the Trustee is passed by any court of competent jurisdiction, in which case the Sponsors shall, within 90 (ninety) Business Days of the notice cause the appointment of a new trustee;

b. In the event that the Trustee desires to resign, it may submit its resignation to the Investment Manager and all the Unitholders setting out reasons for the same and may nominate a new trustee, which has consented in writing to serve as the new trustee. The Unitholders with required majority (as set out in the InvIT Regulations) may approve the aforesaid resignation. A new trustee may be appointed in its place by execution of a deed of appointment between the Investment Manager (acting on behalf of the Unitholders) and the new trustee, to hold office in its place from the date of acceptance of the resignation. The date of acceptance of the Trustee's resignation shall be deemed to be the date of discharge of the Trustee. On such appointment, the Trust shall vest with the new trustee;

c. If SEBI or any other governmental or regulatory authority passes a direction to remove the Trustee; or

d. Removal of the Trustee in accordance with the Trust Deed.

Provided that the Trustee shall, upon it becoming aware, promptly intimate the Trust of any event or potential event which may result in any of the foregoing events set out above. In any event, the Trustee shall not be discharged unless a new trustee is appointed in its place and on such appointment of a new trustee the Trustee shall be deemed to have vacated office as Trustee of the InvIT. Further, notwithstanding the discharge of the Trustee in accordance with articles of the Trust Deed, the Trustee shall continue to be responsible and liable for all its past acts and deeds, whether by way of commission or omission, subject to the indemnity of the Trustee as provided in the Trust Deed, during its tenure as Trustee.

(iii). Post allotment or listing of the Ordinary Units, as the case may be, the Unitholders may by passing a

resolution with required majority as set out in the InvIT Regulations, remove the Trustee if the Unitholders have sufficient reason to believe that the acts of the Trustee are detrimental to the interests of the Unitholders. Upon such removal, a new trustee may be appointed as the trustee of the InvIT as prescribed in the InvIT Regulations.

7. *Provisions relating to Unitholders*

(i). The aggregate liability of each Unitholder in the Trust shall be limited to making the capital contribution payable by it in respect of the Units subscribed by it. For the avoidance of doubt, the Unitholders shall not be responsible or liable, directly or indirectly, for acts, omissions or commissions of the Trustee, the Investment Manager, the Sponsors, or any other person, whether or not such act, omission or commission, has been approved by the Unitholders in accordance with the InvIT Regulations or not;

(ii). Each Ordinary Unit allotted to the Unitholders shall have one vote for any decisions requiring a vote of Unitholders;

(iii). No Unitholder shall enjoy superior voting or any other rights over another Unitholder subject to any Subordinate Units being issued to the Sponsors and their associates, where such Subordinate Units shall carry only inferior voting or any other rights compared to other Ordinary Units, in accordance with their terms;

(iv). In no event shall the Trustee or the Investment Manager be bound to make payment to any Unitholder, except out of the funds held by it for that purpose under the provisions of the Trust Deed and the InvIT Documents;

(v). A Unitholder whose name and account details are entered in the depository register shall be the only person entitled to be recognised by the Trustee as having a right, title, interest in or to the Units registered in his name and the Trustee shall recognise such holder as an absolute owner and shall not be bound by any notice to the contrary and shall also not be bound to take notice of or to see to the execution of any trust, express or implied, save as expressly provided or as required by any court of competent jurisdiction to recognise any trust or equity or interest affecting the title of the Units;

(vi). The Unitholders shall not give any directions to the Trustee or the Investment Manager (whether in a meeting of Unitholders or otherwise) if it would require the Trustee or the Investment Manager to do or omit doing anything which may result in:

(a) the Trust or the Trustee, in its capacity as the trustee of the Trust or the Investment Manager, in its capacity as the investment manager of the Trust ceasing to comply with Applicable Law;

(b) interference with the exercise of any discretion expressly conferred on the Trustee by the Trust Deed or the Investment Manager by the Investment Management Agreement provided that nothing provided herein shall limit (i) the right of the Unitholder to require the due administration of the Trust in accordance with the Trust Deed, the InvIT Documents and Applicable Law and/or (ii) the right of the Unitholders in accordance with Regulation 22(5)(f) of the InvIT Regulations to give directions to the Trustee or the Investment Manager in relation to any issue which is detrimental to the Unitholders (in the sole opinion of the Unitholders), provided that the Unitholders holding Subordinate Units shall not be entitled to such rights with respect to the Subordinate Units held by them.

(vii). The depository register shall (save in case of manifest error) be conclusive evidence of the number of Units held by each depositor and in the event of any discrepancy between the entries of the depository register and any statement issued by the depository, the entries in the depository register shall prevail unless the Depositor proves to the satisfaction of the Trustee and the depository that the depository register is incorrect.

(viii). The Unitholders holding Ordinary Units shall have the right to call for certain matters to be subject to their consent, in accordance with the InvIT Regulations and other applicable law.

(ix). The Unitholders holding Ordinary Units may, in accordance with the provisions of the InvIT Documents and applicable law, transfer any of the Units to an investor where such investor accepts all the rights and obligations of the transferor and the Trustee or the Investment Manager shall give effect to such transfer in accordance with applicable law.

(x). No person, other than the Sponsors, their related parties and associates ("**Investor**") shall acquire Units, which when taken together with Units held by the Investor and by persons acting in concert with the Investor exceeds 25% (twenty five percent) of the value of the outstanding Units, unless prior approval of the

Unitholders holding Ordinary Units is obtained in accordance with the InvIT Regulations. In the event such approval is not received, the Investor shall provide an exit option to the dissenting Unitholders in terms of the InvIT Regulations and in the manner specified by SEBI.

(xi). The Trustee shall ensure that the Investment Manager obtains the consent of the Unitholders holding Ordinary Units for the matters prescribed under the InvIT Regulations in accordance with the provisions of the InvIT Regulations and the InvIT Documents.

(xii). In relation to items that require the approval of Unitholders, a meeting of the Unitholders holding Ordinary Units may be called after giving shorter notice if consent is given in writing or by electronic mode by not less than 95% (ninety five percent) of the Unitholders holding Ordinary Units entitled to vote at such meeting.

8. *Fees and Right to Reimbursement of Expenses of the Trust Deed*

For acting as the Trustee and discharging its functions and responsibilities as the Trustee, the Trustee shall be entitled to receive from the Trust, during its tenure as Trustee, annual trusteeship fees as agreed in terms of the letter (Ref No. ATSL/CO/2020-21/122) dated August 21, 2020 amended by way of an addendum (Ref No. ATSL/CO/2021-2022/5427) dated November 25, 2021. In addition, the Trustee shall be entitled to recover from the InvIT (i) any legitimate out of pocket expenses incurred by it in relation to its trusteeship of the InvIT, and (ii) any tax or duty including goods and services tax (other than income tax) which is, or has become as on the date of collection of such tax or duty, leviable under the Applicable Law on the fee payable to the Trustee by the InvIT.

9. *Indemnity*

In addition to the fees, distributions and expense reimbursements as described in the Trust Deed, the InvIT Assets shall be utilized to indemnify and hold harmless the Trustee from and against any claims, losses, costs, damages, liabilities including legal fees ("**Losses**") suffered or incurred by them by reason of their activities on behalf of the InvIT, unless such Losses resulted from fraud, gross negligence, or dishonest acts of commission or omission of the Trustee, or wilful default (in the case of the Trustee) where the Trustee fails to exercise due care in relation to its obligations under the Trust Deed, or (in the case of the Trustee) disregard of duty or breach of duties under the Trust Deed or Applicable Law by the Trustee.

10. *Term and Termination*

The Trust is subject to dissolution and termination in accordance with and subject to the InvIT Regulations and applicable law:

(i). if the Trust fails to make any offer of the Ordinary Units, whether by way of public issue or private placement, within the time period stipulated in the InvIT Regulations or any other time period as specified by SEBI, the Trust shall surrender its certificate to SEBI and cease to operate as an investment infrastructure trust, unless the period is extended by SEBI;

(ii). upon the liquidation of all or substantially all of the InvIT Assets;

(iii). if there are no projects remaining under the Trust and the Trust does not invest in any project for six months thereafter;

(iv). delisting of the Units in accordance with the InvIT Regulations unless such delisting is done for purposes of conversion of a listed trust to an unlisted trust in accordance with the InvIT Regulations and the Trust retains its certificate of registration and continues to undertake the activity of a privately placed and unlisted Trust; or

(v). illegality of the Trust.

11. *Amendment*

The Trust Deed shall not be amended unless approved by the Unitholders holding Ordinary Units as required under applicable law and approval of relevant regulatory authorities as may be required under Applicable Law; provided however that from the date of execution of the Trust Deed until the Ordinary Units are issued and allotted to Unitholders, amendment of the Trust Deed or any of its terms or provisions shall be valid or binding provided that such amendment is set forth in writing and duly executed by the parties to the Trust Deed.

C. The Investment Manager – Cube Highways Fund Advisors Private Limited

History and Certain Corporate Matters

Cube Highways Fund Advisors Private Limited is the Investment Manager for the Trust. The Investment Manager is a private company limited by shares incorporated on April 12, 2021 at New Delhi under the Companies Act, 2013 having CIN U74999DL2021FTC379941. The Investment Manager's registered office is situated at B-376, UGF, Nirman Vihar, New Delhi 110 092.

Background of the Investment Manager

The authorised share capital of the Investment Manager is ₹ 15,00,00,000 divided into 1,50,00,000 Equity Shares of ₹ 10 each and the paid up share capital is ₹ 146,500,000 divided into 14,650,000 Equity Shares of ₹ 10 each. Cube Highways Advisory Pte. Ltd. and its nominee hold 100% of the equity share capital of the Investment Manager.

The principal business of the Investment Manager in terms of its memorandum of association is to:

(a). To act as the investment manager of or for any infrastructure investment trusts or any other portfolio of securities, properties and/or assets of any kind, established in India or in any other country by the Investment Manager or by any other person including bodies corporate, limited liability partnerships, partnerships, trusts, societies, associations of persons (whether incorporated or not) of any other agency or organization with respect to any class of assets, and to thereby settle, administer, manage and deploy funds, acquire, take up, manage, invest, hold, sell, deal or dispose of all or any property, investments, securities or other assets of any kind whatsoever; and

(b). To provide advisory, investment management and business consultancy services on projects relating to highways, logistics and other infrastructure assets and to render all allied services as are usually rendered by investment managers and business consultants whether directly or through third parties in India and abroad.

The cumulative experience of the key personnel (i.e. directors/ partners or employees, as applicable) of the Investment Manager in fund management or advisory services or development in the infrastructure sector is above 30 years. Accordingly, the Investment Manager is qualified to act as such, in terms of Regulation 4(2)(e)(ii) of the InvIT Regulations.

Further, neither the Investment Manager nor any of the promoters or directors of the Investment Manager: (i) are debarred from accessing the securities market by SEBI; (ii) are promoters, directors or persons in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; or (iii) are in the list of wilful defaulters published by the RBI.

Board of Directors of the Investment Manager

The board of directors of the Investment Manager is entrusted with the responsibility for the overall management of the Investment Manager. Please see below the details in relation to the board of directors of the Investment Manager:

Sr. No.	Name	DIN
1.	Jayesh Ramniklal Desai	00038123
2.	Upendra Kumar Sinha	00010336
3.	Surinder Chawla	09605209
4.	Sandeep Lakhanpal	07171147
5.	Harikishan Reddy Koppula	01386693
6.	Fereshte Dhunjishaw Sethna	00284941

Brief Biographies of the Directors of the Investment Manager

Please see below brief biographies of the directors of the Investment Manager:

1. **Jayesh Ramniklal Desai** is an independent director on the board of the Investment Manager since January 25, 2022. He holds a bachelor's degree in commerce from University of Bombay. He is a chartered accountant and admitted as an associate of the Institute of Chartered Accountants of India. He has been associated with Ernst & Young Private Limited and Coca-Cola India. He was also employed with Piramal Enterprises Limited from April 2012 to January 2017. He has also served as a director on the boards of,

amongst others, TruBoard Private Limited, Ayana Renewable Power Private Limited, Piramal Investment Advisory Services Private Limited and Ernst and Young Private Limited.

2. **Upendra Kumar Sinha** is an independent director on the board of the Investment Manager since January 25, 2022. He has served as the chairman of SEBI. Prior to being the chairman at SEBI, he was the chairman and managing director of UTI Asset Management Company Limited, chairman of Association of Mutual Funds in India and chairman of the Working Group on Foreign Investment in India formed by the GoI. He is also a retired officer of the Indian Administrative Service and has held several government positions in state and central governments including as Joint Secretary (Banking) and Joint Secretary (Capital Markets) in the Ministry of Finance; GoI. He has also been the chairman of the working group on foreign investment in India; and a member of committees set up by the government including those on liquidity management, foreign institutional investors, corporate bond market and investor protection.

3. **Surinder Chawla** is an independent director on the board of the Investment Manager since May 20, 2022. He holds a bachelor's degree in technology in chemical engineering from Indian Institute of Technology, Delhi. He also holds a post-graduate diploma in management from the Indian Institute of Management, Calcutta. Prior to joining the Investment Manager, he has worked at International Finance Corporation ("**IFC**"), World Bank as its chief investment officer. He has over 33 years of experience.

4. **Sandeep Lakhanpal** is a non-executive director on the board of the Investment Manager since June 30, 2022. He holds a bachelors' degree in technology electrical engineering from Punjab Technical University, Punjab and also holds a masters' degree in business administration in finance from Narsee Monjee Institute of Management Studies, Mumbai. He has over fourteen years of experience. He had been associated with Cube Highways and Transportation Assets Advisors (P) Ltd. for 6 years as Head – Business Development – M&A and prior to joining the Investment Manager, he has worked with CRISIL as the manager in its infrastructure advisory – PPP group and Ernst and Young as a vice president.

5. **Harikishan Reddy Koppula** is a non-executive director on the board of the Investment Manager since August 24, 2021. He holds a Ph. D. in civil engineering from Indian Institute of Technology, Kanpur. He also holds a masters' degree in technology in transportation engineering from Kakatiya University, Warangal. He was also a director on the board of VR TECHNICHE Consultants Private Limited, a consulting company in the infrastructure sector.

6. **Fereshte Dhunjishaw Sethna** is an independent director on the board of the Investment Manager since March 16, 2023. She holds a bachelor's degree in commerce and a bachelor's degree in law from the University of Bombay. She also holds a master's degree in law from the University of Bombay. She is enrolled on roll of advocates maintained by the Bar Council of Maharashtra and Goa in 1990. She is also a director on the board of Morrisett Agro Forestry Ventures Private Limited, Morrisett One Harvests Private Limited, Morrisett Agro Plantations Private Limited, Morrisett Litigators Private Limited and Lexnovum Consultaire Private Limited.

Brief profiles of the Key Personnel of the Investment Manager

Please see below brief biographies of the key personnel of the Investment Manager:

1. **Vinay Chandramouli Sekar** is the Chief Executive Officer of the Investment Manager since July 11, 2022. He holds a bachelors' degree in technology in mechanical engineering from Indian Institute of Technology, Madras and a post-graduate diploma in management from Indian Institute of Management, Ahmedabad. He has over 12 years of experience in infrastructure financing and advisory services. Prior to joining the Investment Manager, he has worked with Cube Highways and Transportation Asset Advisors Private Limited, IndusInd Bank Limited and IFCI Limited.

2. **Pankaj Vasani** is the Chief Financial Officer of the Investment Manager since July 11, 2022. He holds a bachelors' degree in commerce and a LL.B. degree from the University of Delhi. He is a chartered accountant and a member of the Institute of Chartered Accountants of India. He is also an associate of the Institute of Chartered Accountants of England and Wales and an associate Certified Public Accountant from CPA, Australia. He has experience in sectors such as telecom, media/advertising and beverages. Prior to joining the Investment Manager, he worked with the Publicis Groupe and the Vodafone group. He has also served as a director on the boards of various companies in India.

3. **Mridul Gupta** is the Company Secretary of the Investment Manager from May 20, 2022 and Compliance Officer of the Trust. He holds a bachelor's degree in commerce from DAV (PG) College, Dehradun and in law from Reliable Institute of Law, Ghaziabad. He is also a member of the Institute of Company Secretaries of India. He has over 12 years of experience in leading the corporate secretarial functions of various

companies. Prior to this, he has worked with Bharti Realty Limited from December 2014 to January 2022 as its Company Secretary and has also been associated with Nirala Developers Private Limited and Uppal Housing Private Limited.

4. **Saurabh Bansal** is the Vice President – Project Finance of the Investment Manager since November 2021. He holds a bachelors' degree in technology in electronics and communication engineering from Malaviya National Institute of Technology, Jaipur and a post graduate diploma in industrial management from National Institute of Industrial Engineering, Mumbai and is a chartered financial analyst from CFA Institute, India. He has over 8 years of experience and prior to joining the Investment Manager, he has worked with Cube Highways and Transportation Asset Advisors Private Limited, Yes Bank Limited, L&T Fincorp Limited and Northern Arc Capital Limited.

5. **Abhijit Saukhyashil Sathe** is the Senior Vice President – Finance & Accounts of the Investment Manager since November 16, 2022. He holds a bachelor's degree in commerce from University of Pune. He is a chartered accountant and a member of the Institute of Chartered Accountants of India. He has over 18 years of experience and prior to joining the Investment Manager, he has worked with Vodafone India Services Private Limited, HSBC Software Development (India) Private Limited and TML Business Services Limited. He has also served as the chief financial officer of Cable and Wireless Global India Private Limited, within the Vodafone group.

6. **Nilesh Shukla** is the Vice President – Finance & Accounts of the Investment Manager since November 2021. He is a commerce graduate from Nagpur University and a Chartered Accountant, being an associate member of the Institute of Chartered Accountants of India. He has over 14 years of experience. Prior to joining the Investment Manager, he has worked with Cube Highways and Transportation Asset Advisors Private Limited, Deloitte Haskins & Sells, KPMG Fakhro and Price Waterhouse Chartered Accountants.

7. **Deepan Shah** is the Assistant Vice-President – Legal of the Investment Manager since November 2021. He holds a B.A. LLB (Hons.) degree from National Law University, Delhi. He has more than six years of experience and prior to joining the Investment Manager, he has worked with Cube Highways and Transportation Asset Advisors Private Limited and Trilegal.

Key Terms of the Investment Management Agreement

The Investment Manager has entered into the Investment Management Agreement, in terms of the InvIT Regulations, the key terms of which, are provided below.

1. *Powers of the Investment Manager*

The Investment Manager has been provided with various powers under the Investment Management Agreement in accordance with the InvIT Regulations, including but not limited to:

(i). The Investment Manager shall take all decisions in relation to the management and administration of InvIT Assets and the investments of the Trust as may be incidental or necessary for the advancement or fulfilment of the investment objectives of the Trust in accordance with the InvIT Regulations and other applicable law.

(ii). The Investment Manager shall, subject to such approval as may be required from the Unitholders, make the investment decisions with respect to the underlying assets or projects of the Trust, including any further investments or divestments, subject to the InvIT Regulations, the InvIT Documents and in accordance with the offer document, and in this regard is also empowered to do the following acts, through and on behalf of the Trust, including:

(a). acquire, hold, manage, trade and dispose of shares, stocks, convertibles, debentures, bonds and other equity or equity-related securities and other debt or mezzanine securities of all kinds issued by any holding company or any SPV or any infrastructure projects in India, whether in physical or dematerialised form, including power to hypothecate, pledge or create encumbrances of any kind on such securities held by the Trust in such holding companies and/or SPVs, or infrastructure projects to be used as collateral security for any borrowings by the Trust;

(b). avail commercial loans, including the power to hypothecate, pledge or create encumbrances of any kind on the InvIT Assets as collateral security for any such loans availed by the Trust, in accordance with the InvIT Regulations and applicable law;

(c). keep the capital and monies of the Trust in deposit with banks or other institutions, whatsoever, provided that such institutions shall not be a related party or parties to the Trust (as defined in the InvIT

Regulations);

(d). accept contributions made to the Trust;

(e). collect and receive the profit, interest, repayment of principal of debt or debt like, or equity or equity like, mezzanine securities, dividend, return of capital of any type by the holding companies, or SPVs, or infrastructure projects and income of the Trust as and when the same may become due and receivable;

(f). invest in securities or in units of mutual funds in accordance with the InvIT Regulations and other applicable law;

(g). invest in money market instruments including government securities, treasury bills, certificates of deposit and commercial papers in accordance with applicable law;

(h). to give, provide and agree to provide to any holding companies, or SPVs financial assistance in the form of investment in the debt securities or share capital of any class including ordinary, preference, participating, non-participating, voting, non-voting or other class, and in the form of investment in securities convertible into share capital; and

(i). to invest, acquire, purchase, hold, divest, sale, hypothecate, pledge or otherwise transfer land and building and immovable property of any kind including any rights and interest therein.

(iii). The Investment Manager along with the Trustee shall within a reasonable time from the date of execution hereof, appoint a Project Manager for the Trust, by execution of the Project Implementation and Management Agreement.

(iv). The Investment Manager shall oversee activities of the Project Manager with respect to compliance with the InvIT Regulations and the Project Implementation and Management Agreement and in terms of the InvIT Regulations and applicable law. The Investment Manager shall obtain a compliance certificate from the Project Manager in the form as may be specified by SEBI, on a quarterly basis or such other intervals as may be prescribed under applicable law.

(v). The Trustee authorizes the Investment Manager to do all such other acts, deeds and things as may be incidental or necessary for the advancement or fulfilment of the investment objectives of the Trust, as set out in the offer document in accordance with the InvIT Regulations and the InvIT Documents.

(vi). The Investment Manager shall have the power to issue and allot Units or other securities, obligations or instruments in accordance with the InvIT Regulations and within such time period as may be prescribed under applicable law. The Investment Manager shall have the power to accept subscriptions to Units of the Trust and issue and allot Units to Unitholders or such other Persons and undertake all related activities under applicable law. The Investment Manager shall also have the power to refund subscription money and pay necessary interest thereon, in accordance with applicable law. Further, the Investment Manager shall, subject to and only in accordance with the terms of the InvIT Documents and applicable law, have the power to transfer the Units. The power of the Investment Manager is subject to the condition that, after the initial offer, no person, other than the Sponsors, its related parties and associates (the "**Investor**") shall acquire or receive Units, which when taken together with Units held by the Investor and by persons acting in concert with the Investor exceeds 25% (twenty five percent) of the value of the outstanding Units unless prior approval of the Unitholders is obtained in accordance with the InvIT Regulations. In the event such approval is not received, the Investor shall provide an exit option to the dissenting Unitholders in terms of the InvIT Regulations and in the manner specified by SEBI.

(vii). The Investment Manager shall cause the depository to maintain a depository register.

(viii). In accordance with the provisions of the InvIT Regulations and the relevant policies adopted by the Investment Manager, if any, the Investment Manager, shall make such reserves out of the income or capital as it may deem proper, in order to, amongst other things, meet the expenses, liabilities or contingent liabilities of the Trust and any directions of the Trustee in this behalf whether made in writing or implied from their acts shall, so far as the applicable law may permit, be conclusive and binding. Any distribution made from such reserves shall be in accordance with the InvIT Regulations and the InvIT Documents.

(ix). The Investment Manager may cause the Trust to borrow for the purposes of the Trust and the InvIT Assets subject to any approval of the Unitholders in accordance with the InvIT Regulations and applicable law. The Investment Manager shall also have the power to cause the Trust to create encumbrances of any kind on the

InvIT Assets as collateral security for any such borrowings.

(x). The Investment Manager may cause the Trust to pay, prepay or repay any and all debt raised from any person in accordance with the terms therein and to redeem any debt securities or other securities, obligations or instruments in accordance with the terms thereof issued to persons in compliance with the InvIT Regulations and other applicable law

(xi). The Investment Manager shall have the power to exercise all rights of the Trust in the Project SPVs, including voting rights, rights to appoint directors, whether pursuant to securities held by it, or otherwise, in such manner as it deems to be in the best interest of the Trust, and in accordance with the InvIT Regulations, the InvIT Documents and applicable law. Additionally, if the Trust has invested in infrastructure projects through the holding company or SPVs, then the Investment Manager, in consultation with the Trustee, shall appoint the majority of the directors of the holding company(ies) and/or the SPV(s), in accordance with the applicable law, as well as ensure that in every general meeting including the annual general meeting of any SPV or holding company, the voting of the Trust is exercised, in accordance with the InvIT Regulations and applicable law.

(xii). The Investment Manager may use the services of external advisors and rely on the information provided in the due diligence process of assessing investment proposals as it deems necessary in its sole discretion.

(xiii). The Investment Manager, along with the Trustee, shall have the power to employ and pay at the expense of the Trust, any agent in any jurisdiction whether attorneys, solicitors, brokers, banks, trust, companies or other agents, without being responsible for the default of any agent if employed in good faith to transact any business, including without limitation, the power to appoint agents to raise funds, or do any act required to be transacted or done in the execution of the responsibilities in accordance with the Investment Management Agreement including the receipt and payment of moneys and the execution of documents.

(xiv). The Investment Manager may appoint any custodian in order to provide custodian services, and may permit any property comprised in the Trust to be and remain deposited with a custodian or with any person or persons in India or in any other jurisdiction subject to such deposit as authorised by the Trustee and permissible under the applicable law.

(xv). The Investment Manager, in consultation with the Trustee, shall appoint and have the power to appoint, determine the remuneration and enter into, execute, deliver and/to terminate all documents and agreements, any contracts, agreements, including share purchase agreement, deed of right of first offer and refusal, escrow agreements, debt documentation, underwriting agreements and other InvIT documents, any investment pooling agreement, agreement relating to strategic investments, co-investment agreements and other any and all documents and instruments containing customary terms including contractual indemnity with valuers, auditors, registrar and transfer agent, merchant banker, credit rating agency, or any other intermediary or service provider or agent including any amendments or supplements thereto as may be applicable with respect to the activities pertaining to the Trust in a timely manner as per the provisions of the InvIT Regulations and applicable law. The Investment Manager shall appoint an auditor for a period of not more than five consecutive years as provided in the InvIT Regulations. The Investment Manager shall have the power to determine the remuneration of the auditors in consultation with the Trustee. Provided that in the event the Investment Manager is required to take any approval of the Unitholders for approval of remuneration of the auditors or appointment of the auditors, the same shall be obtained in accordance with the requirements as set out in the InvIT Regulations. The Investment Manager shall also have the power to determine the remuneration of the valuer. The remuneration of the valuer shall not be linked to or based on the value of the InvIT Assets being valued.

(xvi). In the event of any capital gains tax, income tax, stamp duty or other duties, fees or taxes (and any interest or penalty chargeable thereon) whatsoever becoming payable in any jurisdiction in respect of the Trust or any part thereof or in respect of documents issued or executed in pursuance of the Trust Deed in any circumstances whatsoever, the Investment Manager shall have the power and duty to pay all such duties, fees or taxes (and any interest or penalty chargeable thereon) as well as to create any reserves for future potential tax liability (and any such interest or penalty) out of the Trust's income (and any such interest or penalty), in accordance with applicable law and as the Investment Manager may deem proper. For avoidance of doubt, it is clarified that (i) pursuant to this clause no Unitholder will be required to make a contribution as a capital commitment to the Trust (other than the issue price for Units allotted); and (ii) nothing in this clause pertains to the capital gains tax, income tax, stamp duty or other duties, fees or taxes (and any interest or penalty chargeable thereon) whatsoever becoming payable by the Unitholders, in their respective jurisdictions. The Investment Manager shall exercise due care and prudence in payment of duties and taxes of the Trust and shall endeavour to ensure that there are no material outstanding dues in that behalf, except for any claim or demand made by any tax department or authority subsequently, or any amounts disputed in good faith.

(xvii). The Investment Manager shall have the power to pay InvIT Expenses (as defined in the Investment Management Agreement) out of the funds of the Trust, or from any or all of the Portfolio Assets (as defined in the Investment Management Agreement), in such proportion as may be determined from time to time, and the Investment Manager shall be entitled to reimbursement of any such expenditure duly incurred by the Investment Manager and that is not paid out of the funds of the Trust, subject to the conditions set out in the Investment Management Agreement.

(xviii). The Investment Manager shall have the power to take the opinion of legal / tax counsel in any jurisdiction concerning any difference arising under the Investment Management Agreement or any matter in any way relating to the Investment Management Agreement or to its duties in connection with the Investment Management Agreement, provided that the cost of such opinion shall not be borne by the Trust.

(xix). Subject to applicable law, the Investment Manager shall have the power to:

(a). accept any property before the time at which it is transferable or payable;

(b). pay or allow any equity or claim on any evidence that it thinks sufficient;

(c). accept any composition or any security movable or immovable for any equity or other property;

(d). allow any time of payment of any equity; and

(e). subject to such approval as may be required from the Unitholders, compromise, compound, abandon, submit to arbitration or otherwise settle any equity account, claim or thing whatsoever relating to the Trust or the Investment Management Agreement.

(xx). Subject to the conditions laid down in any offer document, InvIT Documents and applicable law, the Investment Manager may retain the invested capital portion of any proceeds received by the Trust from any holding company or SPV, including through the sale of or any holding company or SPV for the purpose of re-investment.

(xxi). The Investment Manager may make rules to give effect to, and carry out the investment objectives, subject to applicable law. In particular, and without prejudice to the generality of such power, the Investment Manager may provide, in a manner not inconsistent with the provisions of the Investment Management Agreement, the Trust Deed, the InvIT Regulations and other applicable laws, for all or any of the following matters, namely:

(a). manner of maintaining of the records and particulars of Unitholders;

(b). norms of investment by the Trust in accordance with the investment objectives of the Trust and in accordance with the powers and authorities of the Trustee as set out in the Trust Deed and those delegated to the Investment Manager;

(c). matters relating to entrustment, deposit or handing over of any securities or SPVs of the Trust to any one or more custodians and the procedure relating to the holding thereof by the custodian;

(d). such other administrative, procedural or other matters relating to the administration or management of the affairs of the Trust and which matters are not, by their very nature, required to be included or provided for in the Trust Deed or the Investment Management Agreement by the management thereof and which matters are not inconsistent with the provisions thereof;

(e). procedure for seeking the vote of the Unitholders either by calling a meeting or through postal ballot or otherwise; and

(f). procedure for summoning and conducting of meetings of Unitholders.

(xxii). Subject to applicable law, no Unitholder shall be entitled to inspect or examine the Trust's premises or properties without the prior permission of the Investment Manager, who shall not unreasonably withhold such permission. Further, no Unitholder shall be entitled to require discovery of any information with respect to any detail of the Trust's activities or any matter which may be related to the conduct of the business of the Trust and which information may, in the opinion of the Investment Manager, adversely affect the interest of other Unitholders.

(xxiii). The Investment Manager may cause the Trust to buyback the Units from the Unitholders at the end of the

term of the Trust or any other time or in any other manner in accordance with applicable law and any policies formulated by the Investment Manager in this regard, if so directed by the Trustee.

(xxiv). The Investment Manager shall provide the Trustee with advice and recommendations regarding the extension of loans from the Trust to the holding company and/or the SPVs and also subscription to debt securities or quasi-debt securities or any similar kind of securities issued by the holding company and/or SPVs to the Trust or extension of loans from the Trust in compliance with applicable law.

(xxv). The Investment Manager, in accordance with the InvIT Regulations and the Investment Management Agreement, shall have the power to exercise all rights of the Trust in the Project SPVs, including voting rights, rights to appoint directors, whether pursuant to securities held by it, or otherwise, in such manner as it deems to be in the best interest of the Trust, and in accordance with the InvIT Regulations and applicable law. Additionally, if the Trust has invested in infrastructure projects through the Holding Company or SPVs, then the Investment Manager, in consultation with the Trustee, shall appoint the majority of the directors of the Holding Company(ies) and/or the SPV(s), in accordance with the applicable law, as well as ensure that in every general meeting including the annual general meeting of any SPV or Holding Company, the voting of the Trust is exercised, in accordance with the InvIT Regulations and applicable law.

(xxvi). The Investment Manager shall also have the following powers and authorities, subject to the InvIT Regulations, applicable law and the InvIT Documents:

(a). to institute, conduct, compromise, compound, or abandon any legal proceedings for or on behalf of or in the name of the Trust, and to defend, compound or otherwise deal with any such proceedings against the Trust or the Investment Manager or the officers of the Investment Manager or concerning the affairs of the Trust, and also to compound and allow time for payment or satisfaction of any equity due and of any claims or demands by or against the Trust and to refer any differences to arbitration and observe and perform any awards thereof;

(b). to make and give receipts, releases and other discharges for moneys payable to the Trust and for the claims and demands of the Trust;

(c). to enter into all such negotiations and contracts, and, execute or terminate and do all such acts, deeds and things for or on behalf of or in the name of the Trust as it may consider expedient for or in relation to any of the matters or otherwise for the purposes of the Trust;

(d). to ascertain, appropriate, declare and distribute or reinvest the surplus generally or under the Trust, to determine and allocate income, profits, expenses and gains in respect of the Trust to and amongst the Unitholders, to carry forward, reinvest or otherwise deal with any surplus and to transfer such sums, as it may deem fit, to one or more reserve funds which may be established by it, in each case in accordance with the InvIT Documents and the InvIT Regulations;

(e). to open one or more bank accounts and demat accounts for the purposes of the Trust, to deposit and withdraw money and/or securities, and fully operate and manage any such accounts fully;

(f). to sign, seal, execute, deliver and register according to applicable law all deeds, documents, and assurances in respect of the Trust;

(g). to ascertain, assess and calculate the net distributable cash flows of the Trust in accordance with the Trust Deed, the distribution policy adopted by the Trust, the InvIT Regulations, InvIT Documents, and applicable law;

(h). pay out of the income of the Trust, after deducting all expenses, the income and other distributions in accordance with the Trust Deed, InvIT Regulations and applicable law;

(i). take into their custody or control all the capital, assets, property of the Trust and hold the same in trust for the Unitholders in accordance with the Trust Deed, applicable law and the InvIT Regulations;

(j). generally to exercise all such powers as it may be required to exercise under the InvIT Regulations and applicable law for the time being in force and do all such matters and things as may promote the investment objectives of the Trust or as may be incidental to or consequential upon the discharge of its functions and the exercise and enforcement of all or any of the powers and rights under the Investment Management Agreement, applicable Law, InvIT Documents and the InvIT Regulations;

(k). together with the Trustee, initiate, prosecute or defend any action or other proceedings in any court of

law or through arbitration or in any other manner for recovery of debts or sums of money, right, title or interest, property, claim, matter or thing whatsoever now or hereafter to become due or payable or in any way and belonging to the Trust by any means or on any account whatsoever in respect of and pertaining to the investments made by it and the same actions or proceedings or suits to discontinue or settle, as it shall in its best judgment or discretion deem fit;

(l). to issue statement of accounts or Unit certificates (if requested) to the Unitholders on behalf of the Trustee in accordance with applicable law. To submit Units for dematerialisation and to make all applications and execute all documents with the depositories and depository participants as may be necessary in this regard;

(m). to set up such systems and procedures, and submit such reports, as may be required by the Trustee and/or Unitholders as necessary for effective monitoring of the functioning of the Trust.

2. *Duties of the Investment Manager*

The Investment Manager shall perform its duties as required under the Investment Management Agreement in accordance with the InvIT Regulations, including but not limited to:

(i). The Investment Manager shall carry out and conduct its business in a proper and efficient manner in the best interest of the Unitholders. Further, it shall at all times exercise due diligence in carrying out its duties and protecting the interest of the Unitholders.

(ii). The Investment Manager shall coordinate with the Trustee, as may be necessary, with respect to the operations of the Trust.

(iii). The Investment Manager shall ensure that the valuation of the InvIT Assets is done by the valuer(s) in accordance with Regulation 21 of the InvIT Regulations.

(iv). The Investment Manager shall arrange for adequate insurance coverage for the InvIT Assets in accordance with the InvIT Regulations. The Investment Manager shall ensure that assets held by the Holding Companies and the Project SPVs are adequately insured in accordance with the InvIT Regulations.

(v). The Investment Manager shall maintain proper books of accounts, documents and records with respect to the Trust, in the manner set out in the Trust Deed, to give a true, fair and accurate account of the investments, expenses, earnings, profits etc. of the Trust. The financial year of the Trust shall begin from the date of the Trust Deed and shall end on the immediately succeeding 31st of March and on the anniversary thereof in each succeeding year, unless otherwise determined. The Investment Manager shall ensure that audit of the accounts of the Trust by the auditors is undertaken in accordance with and in the frequency mentioned in the InvIT Regulations and such report is submitted to the stock exchange(s) within the time stipulated by the stock exchange(s), if any, and in accordance with the InvIT Regulations.

(vi). The Investment Manager shall declare distributions to Unitholders in accordance with the InvIT Regulations and InvIT Documents. Subject to applicable law, such percentage of the net distributable cash flows of the Holding Companies and SPVs, shall be distributed to the Trust, in terms of the InvIT Documents and InvIT Regulations. Such declared distributions shall be made within the time period prescribed by the InvIT Regulations. The Investment Manager shall maintain a record (for such periods as may be prescribed by the InvIT Regulations) of the distributions declared and made to the Unitholders.

(vii). The Investment Manager shall convene meetings of the Unitholders and maintain records pertaining to the meetings in accordance with the InvIT Regulations. The Investment Manager shall be responsible for all the activities pertaining to conducting of meeting of the Unitholders, subject to oversight by the Trustee in all cases other than where the meetings are on issues pertaining to the Trustee. Provided that, for Unitholder meeting related to issues related to Investment Manager such as change, removal or change in control of the Investment Manager, the Trustee shall be required to obtain approval of the Unitholders and consequently, the Unitholder meetings shall be convened and conducted by the Trustee.

(viii). The Investment Manager shall intimate the Trustee prior to any change in control of the Investment Manager to enable the Trustee to seek prior approval from the Unitholders and SEBI or any other authorities in accordance with the InvIT Documents, InvIT Regulations and applicable law, in this regard and shall ensure that no such change is given effect to, until the approval of the Unitholders and SEBI has been obtained, or the Investment Management Agreement is terminated and a new investment manager has been appointed in accordance with the terms of the Investment Management Agreement, or in compliance with any other requirement under the InvIT Documents, InvIT Regulations and applicable law.

(ix). The Investment Manager will monitor the Trust, including monitoring current and projected financial position of the Trust and the Project SPVs. The Investment Manager shall place before its board of directors, a report on the activity and performance of the Trust in accordance with the InvIT Regulations. The Investment Manager shall designate an employee from the team or a director as the compliance officer for monitoring of compliance with the InvIT Regulations and any circulars or guidelines issued thereunder and intimating SEBI in case of non-compliance.

(x). The Investment Manager shall maintain records pertaining to the activity of the Trust in terms of the InvIT Regulations.

(xi). The Investment Manager shall adopt, as applicable, and shall ensure that, the Trust, the Project Manager, the holding companies and the SPVs adopt policies, including corporate governance policies, policies in relation to acquisition of assets from the Sponsors and third parties, policies in relation to the net distributable cash flows, policies in relation to anti-bribery and anti-corruption, policies in relation to the investments by the Trust, policies in relation to environment, safety and health, policies for anti-money laundering, policy on related party transactions and any other policies, in relation to their activities related to the Trust as may be required and applicable, prior to filing of the relevant initial offer document for the initial offer. The terms, such as, manner or requirement of Unitholders' approval for each of these policies, applicability, amendment and termination, of the respective policies shall be set out in each of the policies.

(xii). The Investment Manager shall manage the Trust in accordance with the InvIT Regulations, the InvIT Documents, the investment objectives of the Trust and applicable laws, and shall ensure that the investments made by the Trust are in accordance with the investment conditions enumerated in the InvIT Regulations, applicable law and in accordance with the investment objectives and the InvIT Documents and are solely in the interest of Unitholders.

(xiii). The Investment Manager shall review the transactions carried out between the Project Manager and its associates and where the Project Manager has advised that there may be a conflict of interest, shall obtain confirmation from a practising chartered accountant or a valuer, as applicable, that such transaction is on an arm's length basis.

(xiv). The Investment Manager shall ensure adequate and timely redressal of all Unitholders' grievances pertaining to the activities of the Trust, in accordance with the InvIT Regulations.

(xv). The Investment Manager shall submit to the Trustee:

(a). quarterly reports on the activities of the Trust including receipts for all funds received by it and for all payments made, status of compliance with the InvIT Regulations, specifically Regulations 18, 19 and 20 of the InvIT Regulations, performance report, status of development of under-construction projects, within the time period specified under the InvIT Regulations;

(b). valuation reports as required under the InvIT Regulations within the time period specified under the InvIT Regulations;

(c). proposal to acquire, sell or develop, or bid for any asset or project or expand existing completed assets or projects along with rationale for the same;

(d). details of any action which requires approval from the Unitholders as may be stipulated under the InvIT Regulations;

(e). details of transactions it enters into with its associates;

(f). details of any other material fact including change in its directors, change in its shareholding, any legal proceedings that may have a significant bearing on the activity of the Trust, within such period as stipulated under applicable law;

(g). details of any breach of the investment conditions specified under the InvIT Regulations or of any borrowings exceeding such percentage of the value of the InvIT Assets as may be prescribed by the InvIT Regulations, in each case, on account of market movements of the price of the InvIT Assets;

(h). such information, document and records as pertaining to the activities of the Trust and as may be reasonably necessary for the Trustee with respect to its responsibilities under the Trust Deed or the InvIT Regulations and applicable law;

(i). such other information, document and records as pertaining to its activities, obligations, duties and responsibilities under the Investment Management Agreement or the InvIT Regulations and applicable law; and

(j). any other reports, presentations, documents, as may be required under the InvIT Documents and applicable law including the InvIT Regulations.

In the event of failure of the Investment Manager to submit information or reports as specified above, or such reports as requested by Trustee to be delivered to the Trustee, as may be necessary for effective monitoring of the functioning of the Trust, in a timely manner and in terms of the InvIT Regulations, the Trustee shall intimate SEBI.

(xvi). The Investment Manager shall submit to the Unitholders such information, document and records as pertaining to the activities of the Trust or having bearing on the operation or performance of the Trust and/or the InvIT Assets as may be required by the Unitholders in accordance with InvIT Regulations and other applicable law and subject to compliance with Insider Trading Regulations and other applicable law.

(xvii). The Investment Manager shall be responsible for all activities pertaining to the issue and listing of the Units of the Trust, in accordance with applicable law, including:

(a). filing of offer document with SEBI;

(b). filing the offer document with SEBI and stock exchange(s), in the event the Trust is listed or proposes to be listed, within the prescribed time period;

(c). dealing with all matters up to allotment of Units to the Unitholders;

(d). obtaining in-principle approval and final listing and trading approvals from the stock exchanges, in the event the Trust is listed or proposes to be listed; and

(e). dealing with all matters relating to the issue and listing of the Units as specified under Chapter IV of the InvIT Regulations and all matters relating to the offer and issue of Units under Chapter VIA of the InvIT Regulations and any guidelines as may be issued by SEBI in this regard, as applicable. The Trust shall also comply with the minimum public holding for the Units and minimum number of Unitholders as prescribed under the InvIT Regulations.

(xviii). The Investment Manager is also responsible for ensuring that all relevant provisions of the InvIT Regulations and applicable law have been complied with and that all statements and disclosures made in any offer document are material, true, correct, not misleading and are adequate disclosures in order to enable the investors to make an informed decision and are in accordance with the InvIT Regulations and applicable law, and such offer document should not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading, and shall include such other disclosures as may be specified by SEBI.

(xix). In the event the Trust is listed and in case of occurrence of any event specified in Regulations 17(1)(a) to 17(1)(g) of the InvIT Regulations, the Investment Manager shall apply for delisting of units of the Trust to SEBI and the designated stock exchange in accordance with the InvIT Regulations and applicable law. The Investment Manager shall, on the instruction of the Trustee, wind up the Trust in accordance with applicable law. Upon winding up of the Trust, the Trustee shall surrender the certificate of registration to SEBI.

(xx). The Investment Manager shall within the time period prescribed under the InvIT Regulations, submit half-yearly reports, annual reports and any other such reports including quarterly reports, if applicable, as may be required under the InvIT Regulations to all the Unitholders electronically or through physical copies and to the designated stock exchange.

(xxi). The Investment Manager shall, in accordance with the requirements of the InvIT Regulations and other applicable law, including any requirements prescribed by SEBI or the stock exchange(s) from time to time, disclose half-yearly reports and any other such reports, as may be required under the InvIT Regulations, within the time period prescribed under the InvIT Regulations to the stock exchange(s) and provide any information having bearing on the operation or performance of the Trust, as well as price sensitive information and other information that is required in terms of the InvIT Regulations and applicable law, including in relation to intimating SEBI in case of any discrepancy in the operation of the InvIT with the InvIT Regulations and the InvIT Documents, as required under applicable law.

(xxii). The Investment Manager (along with the Trustee) shall ensure that all related party transactions in relation to the Trust and InvIT Assets are on an arms' length basis in accordance with relevant accounting standards, in the best interests of the Unitholders, and are consistent with the Investment Objectives of the Trust and shall be disclosed in accordance with the InvIT Regulations

(xxiii). Without prejudice to any other provision of the Investment Management Agreement and the InvIT Regulations, the Investment Manager will also have the following duties and obligations:

(a). ensure that computation and declaration of net asset value of the Trust is based on the valuation done by the valuer in accordance with the InvIT Regulations and applicable law and is disclosed to the stock exchanges in accordance with the InvIT Regulations and applicable law, if applicable, within the time period specified under the InvIT Regulations;

(b). maintain regular interaction with the Trustee regarding performance of the Trust and providing the Trustee with any information in relation to the operations of the Trust as maybe required under applicable law;

(c). conducting its affairs and the affairs of the Trust in such a manner that no Unitholder will have any personal liability with respect to any liability or obligation of the Trust;

(d). keeping the Unitholders of the Trust informed and updated on investment activities of the Trust in accordance with the terms of the InvIT Documents;

(e). collecting all dividends, fees, property and other payments due and receivable by the Trust declaring distribution to the Unitholders in the manner set out in the Trust Deed and in terms of the InvIT Regulations and applicable law;

(f). to ensure that no commission or rebate or any other remuneration, arising out of transactions pertaining to the Trust is collected by it or its associates, other than as specified in the offer document or any other document as may be specified by SEBI for the purpose of the issue of the Units of the Trust;

(g). to ensure that the InvIT Assets and Project SPVs and/ or Holding Company(ies), have proper legal titles, to the extent applicable, and that all the material contracts entered into on behalf of the Trust or the InvIT Assets are legal, valid, binding and enforceable by and on behalf of the Trust;

(h). to ensure that the activities of the intermediaries or agents or service providers appointed by it are in accordance with the InvIT Regulations or any guidelines or circulars issued thereunder;

(i). to ensure that any possible conflict of interest involving its role as Investment Manager is reported to the Trustee;

(j). to ensure that disclosures or reporting to Unitholders, SEBI, the Trustee and the designated stock exchange(s) are in accordance with the InvIT Regulations and applicable law;

(k). to ensure compliance with reporting and disclosure requirements under applicable law, and in case of any delay or discrepancy, to rectify such delay or discrepancy on an urgent basis;

(l). submit a compliance certificate to the Trustee, in the form and at such intervals as may be specified under the InvIT Regulations and Applicable Law;

(m). provide SEBI, the designated stock exchange and Trustee, where applicable, such information as may be sought by SEBI or by the designated stock exchange or Trustee pertaining to the activity of the Trust;

(n). to immediately notify the Trustee, the Unitholders and SEBI (if required) of any act which is detrimental to the interest of the Unitholders;

(o). to fulfil any other duty, obligation and responsibility that may be required of the Investment Manager, in accordance with, and within the timelines prescribed under (if any) the provisions of the InvIT Regulations

(p). to inform the Trustee in writing about any change in the representations and warranties provided under the Investment Management Agreement; and

(q). taking any other actions reasonably incidental to any of the foregoing, or necessary or convenient in order to fully effect or evidence any action or transaction contemplated under the Investment Management Agreement.

(xxiv). The Investment Manager shall provide to the Trustee such assistance as may be required by the Trustee in fulfilling its obligation towards the Trust under applicable law or as may be required by any regulatory authority with respect to the Trust.

(xxv). The assets and liabilities of the Trust shall at all times be segregated from the assets and liabilities of the Investment Manager. The assets held under the Trust shall be held by the Trustee for the exclusive benefit of the Unitholders and such assets shall not be subject to the claims of any creditor or any person claiming against the Investment Manager.

3. *Liabilities of the Investment Manager*

The liabilities of the Investment Manager in terms of the Investment Management Agreement are as follows:

(i). The Investment Manager shall not be liable in respect of any action taken or damage suffered by it on reliance upon any notice, resolution, direction, consent, certificate, affidavit, statement, certificate of stock, plan of reorganization or (without being limited in any way by the foregoing) other paper or document believed to be genuine and to have been passed, sealed or signed by appropriate authorities or entities, after exercising due care in accordance with customary industry standards.

(ii). The Investment Manager shall not be liable to the Unitholders for doing or failing to do any act or thing which by reason of any provision of any present or future law or regulation made pursuant thereto, or of any decree, order or judgment of any court, or by reason of any request, announcement or similar action (whether of binding legal effect or not) which may be taken or made by any person or body acting with or purporting to exercise the authority of any government (which legally or otherwise) it shall be directed or requested to do or perform or to forbear from doing or performing. If for any reason it becomes impossible or impracticable (as determined by the Trustee and the Investment Manager) to carry out any of the provisions of the Investment Management Agreement, the Investment Manager shall not be under any liability. However, it shall duly inform the Trustee and the Unitholders of the same.

(iii). If the Investment Manager is required, by the InvIT Regulations or any other applicable law to provide information regarding the Trust and/or the Unitholders, the Trust investments and income therefrom and provisions of the Investment Management Agreement and complies with such request in good faith, whether or not it was in fact enforceable, the Investment Manager shall not be liable to the Unitholder or any of them or to any other party as a result of such compliance or in connection with such compliance.

(iv). The Investment Manager shall not incur any liability for any act or omission which may result in a loss to a Unitholder (by reason of any depletion in the value of the InvIT Assets or otherwise), except in the event that such loss is a result of fraud or gross negligence or dishonest acts of commission or omission or wilful default on the part of the Investment Manager, or disregard of duty or breach of duties under the Investment Management Agreement or applicable law by the Investment Manager.

(v). If the distributions, after being declared, are not made within the period prescribed in the InvIT Regulations, the Investment Manager shall be liable to pay interest to the Unitholders at the rate as may be prescribed in the InvIT Regulations until the distribution is made, and such interest shall not be recovered in the form of fees or any other form payable to the Investment Manager by the Trust. In the event of delay or non-payment of such interest by the Investment Manager within 30 days of such interest becoming due, the Trustee shall set off the relevant amount against the management fees payable to the Investment Manager.

(vi). The Investment Manager shall not be liable to any Unitholder for the authenticity of any signature or of any seal affixed to any endorsement or other document affecting the title to or the transmission of Units or interests in the InvIT or of any investments of the InvIT or be in any way liable for any forged or unauthorized signature or seal affixed to such endorsement, transfer or other document, or for acting upon or giving effect to any such forged or unauthorized signature or seal, so long as the Investment Manager was not aware that such signature, seal or document was unauthorized or forged and acted in good faith thereto. The Investment Manager shall be bound to require that the signature of any Unitholder to any document required to be signed by such Unitholder, under or in connection with these presents shall be verified to its reasonable satisfaction.

4. *Indemnity*

(i). In addition to the fees, distributions and expense reimbursements described, subject to any exceptions set out in the InvIT Documents, the Trustee (on behalf of the Trust) shall, from the InvIT Assets, indemnify and hold harmless the Investment Manager and its affiliates, respective officers, directors, shareholders, partners, members, employees, advisors and agents ("**Indemnified Parties**") from and against any direct and actual claims, actions, losses, damages, liabilities, suits, proceedings and reasonable costs and expenses including legal fees ("**Losses**") suffered or incurred by them by reason of their activities on behalf of the Trust, unless such Losses have resulted from fraud or gross negligence or dishonest acts of commission or omission or wilful default on the part of the Investment Manager, or disregard of duty or breach of duties under the Investment Management Agreement or applicable law by the Investment Manager.

(ii). The Trust (acting through the Trustee) and the Trustee's directors, employees and officers acting on behalf of the Trust (collectively, the "**Trustee Party**") shall be indemnified by the Investment Manager against any and all Losses, incurred or suffered by the Trustee Party in connection with the breach of any of the terms of this Agreement by the Investment Manager, or failure in furnishing information required by SEBI or any regulatory authority with respect to the Trust, or furnishing incorrect information by the Investment Manager under the InvIT Regulations or related to InvIT including in any offer document, or arising out of gross negligence, wilful default or misconduct or fraud on part of the Investment Manager, in carrying out its obligations under the Investment Management Agreement, the Trust Deed, the other InvIT Documents any information memorandum / offer document and applicable law. The Trustee acknowledges and agrees that the aggregate maximum liability of the Investment Manager in each financial year shall be limited to the aggregate fees paid to the Investment Manager for the immediately preceding one financial year, provided that such aggregate maximum liability shall not be applicable in the event such liability of the Investment Manager to indemnify the Trustee Party for losses or damages suffered arising out of any gross negligence, wilful default or misconduct or fraud of the Investment Manager.

5. *Termination*

(i). Subject to the other provisions of the Investment Management Agreement, the Investment Management Agreement shall continue during the term of the Trust and shall terminate upon dissolution of the Trust.

(ii). The Investment Management Agreement shall be effective from the date of execution of the Investment Management Agreement and shall terminate in accordance with the terms of the Investment Management Agreement.

(iii). The appointment of the Investment Manager may be terminated by the Trustee or the Unitholders in accordance with the procedure specified under the InvIT Regulations.

(iv). The Unitholders, other than any party related to the transactions and its associates holding not less than such percentage by value as specified under the InvIT Regulations, may apply in writing to the Trustee for removal of the Investment Manager.

(v). Subject to the approval of Unitholders (as required) and compliance with other requirements under applicable law, the Investment Management Agreement may be terminated:

(a). by the Investment Manager by delivery of a written notice to the Trustee, subject to appointment of new Investment Manager in accordance with the Investment Management Agreement and the InvIT Regulations; or

(b). by the Trustee in accordance with applicable law; or

(c). by any Party by delivery of a written notice to the other Party upon the bankruptcy of such other Party, or if winding up or liquidation proceedings are commenced against such other Party (and such proceedings persist for a period of more than three months).

(vi). After approval from the Unitholders and SEBI in accordance with the InvIT Regulations, the Trustee shall appoint a new investment manager and execute a new investment management agreement within three months from the termination of the earlier investment management agreement in accordance with applicable law. The Trustee shall also ensure that the new investment manager stands substituted as a party in all documents to which the Investment Manager was a party. The Investment Manager shall remain in office until the appointment of a new investment manager. The Investment Manager shall continue to be liable for all its acts and omissions and commissions during its tenure as Investment Manager notwithstanding its termination.

(vii). Upon removal or replacement of the Investment Manager, the Investment Manager shall, within a period of 30 business days, transfer custody of the Trust to the Trustee and give the Trustee all books of accounts,

correspondence, documents and records relating to the Trust which the Investment Manager has in its possession. In the event of removal or resignation of the Investment Manager, the Investment Manager shall be entitled to receive management fees only up to the end of its term.

Notwithstanding anything contained hereinabove, (i) in the event that the offer of Units does not occur within the time period stipulated in the InvIT Regulations or such other date as may be mutually agreed to between the Investment Manager and the Trustee, or (ii) in the event of cancellation of registration of the Trust by SEBI, or (iii) winding up of the Trust, then the Investment Management Agreement shall automatically terminate without any liability on any party.

D. The Project Manager – Cube Highways and Transportation Assets Advisors Private Limited

History and Certain Corporate Matters

Cube Highways and Transportation Assets Advisors Private Limited is the Project Manager in respect of the Trust. The Project Manager is a private company incorporated on January 1, 2015 under the Companies Act, 2013 having CIN U74140DL2015PTC274877. The Project Manager's registered office is situated at N-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The Project Manager is an Indian entity providing advisory services in the infrastructure sector. Currently, it has entered into project management agreements with several companies in India for providing infrastructure advisory services.

Background of the Project Manager

The Project Manager will be looking over the operation and maintenance of the entire portfolio of the 18 projects transferred to the InvIT.

Neither the Project Manager nor any of the promoters or directors of the Project Manager (i) are or have been debarred from accessing the securities market by SEBI; (ii) are or have been a promoter, director or person in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/or (iii) are or have been declared a wilful defaulter by any bank or financial institution or consortium thereof in accordance with the guidelines on wilful defaulters published by the RBI.

Key terms of the Project Implementation and Management Agreement

The Project Manager has entered into the Project Implementation and Management Agreement for the Initial Portfolio Assets, in terms of the InvIT Regulations, the key terms of which, are provided below:

1. *Scope of Services*

   The Project Manager shall, either directly or through the appointment and supervision of appropriate agents, which may be persons directly employed by the Project SPVs ("**Agents**"), undertake the operation, maintenance and management of the InvIT Assets, in compliance with the Concession Agreements and applicable law.

   The scope of services of the Project Manager are as follows:

   (i). supervision of the engineering, procurement and construction works in relation to the InvIT Assets as required under the Concession Agreements, including completion of all outstanding capital works in respect of the InvIT Assets, such as any punch list items, to the extent applicable, and in procuring the completion certificate in accordance with the Concession Agreements, where applicable;

   (ii). ensuring implementation of the operations and maintenance for the InvIT Assets as stipulated under the Concession Agreements, including tolling;

   (iii). undertaking periodic inspection visits of the InvIT Assets and promptly reporting to the Trustee and the Investment Manager, any deficiency, non-compliance or failure in fulfilling the obligations of the Project Manager. The Project Manager, either by itself or by way of supervision of Agents shall undertake all steps to remedy such deficiency;

   (iv). coordination and undertaking of any and all activities required to be performed by the Project SPVs pursuant to the Concession Agreements or pursuant to any communication from concessioning authorities or any other governmental authorities, including in relation to shifting of utilities, associated roads, felling of trees and related works with respect to the project site or any work to be undertaken pursuant to a change of scope order based on a determination of change of scope by concessioning

authorities under the Concession Agreements;

(v). providing assistance wherever sought by the Project SPVs or considered expedient by the Project Manager, in relation to the following:

a. liasioning with governmental authorities, in connection with the InvIT Assets;

b. sending appropriate responses to notices from the governmental authorities and coordinating with them to obtain appropriate approvals, if any, for the InvIT Assets;

c. liasioning with the independent engineer in connection with the InvIT Assets; and

d. submitting appropriate reports on interactions with governmental authorities in relation to the InvIT Assets;

e. operation of the bank accounts of the Project SPVs; and

(vi). provide business support services for the activities to be undertaken by the Project SPVs.

2. *Functions, Duties and Responsibilities of the Project Manager*

The functions, duties and responsibilities of the Project Manager in terms of the Project Implementation and Management Agreement are as follows:

(i). The Project Manager shall, either directly or through the appointment and supervision of Agents, provide the specified services in relation to the InvIT Assets as may be necessary for the discharge of its duties under the terms of the agreement and under the InvIT Regulations.

(ii). The Project Manager shall, either directly or through Agents, oversee the progress of development, approval status and other aspects of the InvIT Assets that may be under development or is to be established until its completion in accordance with any agreement that may be entered into in this regard, including the relevant concession agreements and discharge all obligations in respect of achieving timely completion of the infrastructure projects, wherever applicable, including the supervision of agents appointed for such purpose.

(iii). The Project Manager shall, either directly or through Agents, discharge all obligations in respect of the maintenance, operation and management of the infrastructure projects which have achieved the commercial operations date in terms of the respective concession agreements in terms of the Project Implementation and Management Agreement and the InvIT Regulations and ensure compliance with the relevant provisions of the concession agreements in this regard.

(iv). The Project Manager shall ensure that, for the purpose of provision of the services, all procurement of goods (including raw materials) and award of contracts, either directly or through Agents, is undertaken in accordance with procedures established and within the budget determined by the Project Manager in consultation with the Investment Manager.

(v). The Project Manager acknowledges that the Trustee and the Investment Manager will oversee the activities undertaken by the Project Manager in accordance with the InvIT Regulations and the InvIT Documents and accordingly, the Project Manager shall extend complete co-ordination to enable the Trustee and the Investment Manager to perform such obligations in accordance with the InvIT Regulations and the InvIT Documents. The Project Manager shall provide compliance certificate(s), as may be specified, to the Investment Manager and the Trustee in accordance with the InvIT Regulations, in the form prescribed by SEBI, if any.

(vi). The Project Manager shall at all times ensure that the transactions or arrangements entered into by the Project Manager with a related party are on an arm's-length basis and shall provide the Investment Manager with details of transactions carried out between itself and its associates and disclose any conflict of interest in such cases to the Investment Manager, in accordance with the InvIT Regulations.

(vii). The Project Manager shall intimate the Trustee prior to any change in control of the Project Manager to enable the Trustee to seek requisite approval from regulatory, statutory, legal or government authorities, lenders and any contractual counter parties in accordance with any documents pertaining to the InvIT Assets, if applicable.

(viii). The Project Manager shall provide to the Trustee and the Investment Manager or to such other person as the Trustee and/or the Investment Manager may direct, all information that may be necessary for each of them to maintain the records of the InvIT and as may be required for making submissions to SEBI or any other Governmental Authority, including with respect to relevant approvals, consents and other documents required in relation to the InvIT Assets and the reporting requirements under the InvIT Regulations, in a proper and timely manner, and in the format prescribed (if any), as required by the Trustee and /or the Investment Manager. Further, the Project Manager shall provide reasonable assistance to the Project SPVs to apply for, obtain and maintain all necessary approvals (and renewals of the same) that each of the Project SPVs is required to obtain from or file relevant applications for approvals with any Governmental Authority in connection with InvIT Assets or as may be required under any third party agreement entered into by the Project SPVs and will oversee the progress of the Project SPVs in this regard.

(ix). The Project Manager shall have full authority, to receive directions and instructions from each of the Project SPVs and to take actions in relation to and ensure compliance with such directions and instructions and report back to each Project SPV, the Trustee and the Investment Manager.

(x). The Project Manager shall promptly inform the Parties in writing of any act, occurrence or event, which the Project Manager believes is reasonably likely to increase the cost of or the time for implementation taken in relation to any InvIT Asset, materially change the financial viability, quality or function of any InvIT Asset or materially change the budget determined by the Project Manager in consultation with the Investment Manager in relation to the operations and maintenance of the Project SPVs.

(xi). If any defects are found in the maintenance, materials and workmanship of the services provided under this Agreement by the Project Manager and/or by the team members, the Project Manager shall promptly, in consultation and agreement with the other parties to the Project Implementation and Management Agreement regarding appropriate remedying of the defects, repair, replace or otherwise make good such defects as well as any damage caused by such defect at the cost of the relevant Project SPV.

(xii). The duties of Project Manager shall also include the following:

a. supervision of revenue streams from the InvIT Assets and providing the necessary information and documents as may be required under the applicable law and the InvIT Regulations;

b. execution and completion of activities in relation to the InvIT Assets under development or to be developed in accordance with and in the manner contemplated in any agreement entered into by the relevant Project SPV in this regard;

c. exercising diligence and vigilance in carrying out its duties and protecting the InvIT Assets;

d. keeping the Investment Manager informed on all matters which have a material bearing on the operations of the InvIT Assets;

e. liaising with governmental authorities in respect of its obligations under the agreement;

f. taking appropriate measures to mitigate the risks which may be encountered by the InvIT in respect of the InvIT Assets;

g. keeping proper records for actions taken in respect of the InvIT Assets;

h. appointing external consultants and advisers, including legal advisers, technical consultants and valuers, as may be required, for the purposes of rendering the services; and

i. complying with the instructions of the Investment Manager and the Trustee and the provisions of the InvIT Regulations.

(xiii). If, in the assessment of the Project Manager, additional services are required for the purposes of carrying out its duties and obligations under the agreement and applicable law, the Project Manager shall notify the parties in writing of such requirement and obtain prior written approval of the relevant parties in this regard.

(xiv). Notwithstanding anything to the contrary contained in the agreement, nothing contained in the Project Implementation and Management Agreement shall be construed to limit or restrict the performance of any duties or obligations of the Project Manager, Investment Manager or the Trustee contained in the

InvIT Regulations and other applicable law.

(xv). During the term of the Project Implementation and Management Agreement, in the event the representations provided by the Project Manager under the agreement, become untrue or incorrect or incomplete in any respect, the Project Manager shall, within a reasonable time, inform the Trustee and Investment Manager of such event.

3. *Indemnity*

If the Project Manager is required to make any payments for such taxes, levies, duties, or charges (excluding direct tax) in relation to services provided during the subsistence of the agreement, then the relevant Project SPV shall promptly make good such payment and shall keep the Project Manager indemnified against any tax liability or duties that relate to the service or the agreement.

4. *Termination*

(i). The Project Implementation and Management Agreement shall remain valid and effective, unless terminated by the parties in accordance with the provisions of the agreement or extended by mutual consent expressed in writing by the Parties until the such time as the last of the Concession Agreements is in force ("**Validity Period**"). It is clarified that the Project Implementation and Management Agreement shall be terminated in respect of a particular Project SPV, upon termination of the relevant concession agreements entered into by such Project SPV.

(ii). Prior to the expiry of its Validity Period, the Project Implementation and Management Agreement, may be terminated:

a. by the Investment Manager after consultation with the Trustee by delivery of a prior written notice of 60 days to the Project Manager, subject to appointment of new project manager in accordance with the Project Implementation and Management Agreement and the InvIT Regulations; or

b. by the Investment Manager after consultation with the Trustee by delivery of a written notice to the Project Manager at any time, upon breach of any of the terms, covenants, conditions or provisions of the agreement by the Project Manager and a failure of the Project Manager to remedy the said breach within a period of 60 days or such other period as may be mutually agreed to cure such breach; or

c. by any party by delivery of a written notice to the other party upon the bankruptcy of such other party or if winding up or liquidation proceedings whether voluntary or involuntary are commenced or admitted against such other party (and such proceedings persist for a period of more than three months).

(iii). In the event that the offer of the Units does not occur within the time period stipulated in the InvIT Regulations or such other date as may be mutually agreed to between the parties, or in the event of cancellation of registration of the InvIT by SEBI, or upon winding up of the InvIT, then the Project Implementation and Management Agreement shall automatically terminate without any liability to any party.

Shared Services

Shared Services Agreement *("SSA")*

The Project Manager and the Investment Manager have entered into the SSA dated September 7, 2022, in relation to services to be provided by the Project Manager to the Investment Manager. Certain key terms of the SSA are as follows:

Provision of services: The Project Manager shall, on and from the effective date, as defined in the SSA, provide the services, as set out in the SSA, to the Investment Manager (such services, the "**Support Services**"), with reasonable skill and care and keeping with the good practices for the industry in which the Trust and Sponsors/ Project Manager operate, and in compliance with applicable law. The Investment Manager shall authorise the Project Manager to take all steps and actions required for it to provide the Support Services.

Further, the Project Manager may subcontract any part of its obligations in relation to the Support Services to its affiliates or any third party contractor ("**Contractor**") with prior notice to the Investment Manager, provided that the Project Manager shall ensure that any of its affiliates or the Contractors (i) are adequately trained, skilled and

experienced at a level appropriate to provide and perform the Support Services, and (ii) provide and perform the Support Services in compliance with applicable law. The Project Manager shall be liable for all acts and omissions of such affiliates and the Contractors in relation to the Support Services, as well as for compliance by such affiliates and Contractors with the applicable provisions of the SSA. Any breach or default by such affiliate or Contractor of any terms of the SSA shall be deemed to be a breach of the Project Manager.

Fee: The fee is based on a 'cost' plus mark-up basis for specified general services. The 'cost' shall be as determined in accordance with the principles described in the SSA, and the 'mark-up' will be determined based on a suitable benchmarking report. For specified infrastructure services, the Project Manager shall be entitled to claim a reimbursement for all costs/expenses/fees, calculated in accordance with the SSA. The Project Manager shall determine the cost or expenses in relation to the Support Services which may include any expenditures that are (a) directly incurred in relation to the Support Services, and (b) indirectly incurred and as may be attributable/allocable to the Support Services.

Representations and warranties: Each party represents and warrants to the other party to the SSA, as follows:

(i) Each party is duly organized and validly existing under applicable law, and has the right, power and authority to execute, deliver and perform the SSA;

(ii) The SSA has been duly executed and delivered by such party and, assuming the due authorization, execution and delivery by all other parties, constitutes valid and binding obligations of such party enforceable against such party in accordance with its terms, subject to any principles of equity or insolvency law;

(iii) The execution and delivery of the SSA by such party and the performance by such party of its obligations under the SSA has been duly and validly authorized by all necessary corporate action, including on the part of the Trust, if required, and does not require any further authorization or consent of any third party;

(iv) The execution, delivery and performance by such party of the SSA, and the compliance by it with the provisions of the SSA will not result in:

  (a) a breach of, or constitute a default under, any agreement or instrument to which such party is a party or by which such party is bound; or

  (b) result in a violation of its constitutional documents; or

  (c) contravene any applicable law to which it is subject, or any order, writ, injunction or decree of any court or Governmental Authority to which it is subject; and

  (d) No liquidation, dissolution, winding up, commencement of bankruptcy, insolvency, liquidation or similar proceedings, whether voluntary or involuntary, with respect to it is pending or has been pending, or to the knowledge of such party, threatened.

Force majeure: The Project Manager shall not be liable or responsible for any failure to perform or delay in performance of their respective obligations under the SSA, when such failure or delay is due or attributable to or arises out of, any force majeure event. Provided that the Project Manager shall, as soon as reasonably practicable, notify the other parties thereafter, provide detailed information concerning such force majeure event and documents evidencing such force majeure event, explaining the reasons for its inability to execute, or for its delay in the execution of, all or part of its obligations under the SSA. The Project Manager shall take all reasonable steps within its power to recommence performance of the SSA on the ceasing of such event. If either party has delayed the performance of, or not performed, any obligation under the SSA due to any force majeure event, the performance of any corresponding obligations of the other party shall stand suspended to the same extent.

Termination: The SSA shall become effective and binding on the parties on and from the effective date, as defined in the SSA, and shall continue to be valid and in full force and effect unless terminated. The SSA may be terminated as follows:

(i) by mutual consent of the parties in writing; or

(ii) by the Investment Manager by delivery of a written notice to the Project Manager at any time, including upon breach of any of the terms, covenants, conditions or provisions of the SSA by the Project Manager and a failure of the Project Manager to remedy the said breach within a period of 30 days or such other period as may be mutually agreed to cure such breach; or

(iii) by any party by delivery of a written notice to the other party upon the bankruptcy of such other party, or if

winding up or liquidation proceedings, whether voluntary or involuntary, are commenced or admitted against such other party (and such proceedings persist for a period of more than three months); or

(iv) in the event of cancellation of registration of the Trust by SEBI, or winding up of the Trust, then the SSA shall automatically terminate without any liability to any party.

Indemnification: The Investment Manager shall be indemnified by the Project Manager against any claims, losses, costs, damages, liabilities, suits, proceedings, taxes and expenses, including legal fee from and incurred or suffered by the Investment Manager in connection with the breach of any of the terms of the SSA by the Project Manager or its agents or arising out of gross negligence, wilful default or fraud on part of the Project Manager, in carrying out its obligations under the SSA or under applicable law, subject to such maximum aggregate liability of the Project Manager as set out under the SSA.

OTHER PARTIES INVOLVED IN THE TRUST

The Auditors

Background and terms of appointment

The Investment Manager, in consultation with the Trustee, shall appoint the auditor of the Trust ("**Auditors**"), from list of auditors previously approved by the board of directors of the Investment Manager, in a timely manner and in accordance with the InvIT Regulations. The Investment Manager shall appoint an Auditor who shall hold office from the date of conclusion of the annual meeting in which the auditor has been appointed till the date of conclusion of the sixth annual meeting of the unitholders in accordance with the procedure for selection of auditors, as may be specified by the Board. The Auditor, not being an individual, may be reappointed for a period of another five consecutive years (provided that the Auditor is not appointed or re-appointed for more than two terms of five consecutive years), subject to approval of Unitholders in the annual meeting in accordance with the InvIT Regulations. The Auditors shall be identified and appointed in accordance with the policy on *'Appointment of Auditor and Valuer of Cube Highway Trust'*.

The Investment Manager, in consultation with the Trustee, has appointed S.B. Billimoria & Co. LLP., Chartered Accountants (Firm Registration No. 101496/W/100774) with effect from May 20, 2022, as the auditors of the Trust for the Financial Years ended March 31, 2022 and March 31, 2023. The Auditors have audited the Audited Special Purpose Combined Financial Statements and have examined the Projections of Revenue from Operations and Cash Flow from Operating Activities, and their reports in relation to such Audited Special Purpose Combined Financial Statements dated January 20, 2023 and Projections of Revenue from Operations and Cash Flow from Operating Activities dated October 17, 2022 have been included in this Final Placement Memorandum.

Functions, Duties and Responsibilities of the Auditors

The functions, duties and responsibilities of the Auditors will be in accordance with the InvIT Regulations. Presently, in terms of the InvIT Regulations, the Auditors are required to comply with the following conditions at all times:

1. the Auditors shall conduct audit of the accounts of the Trust and draft the audit report based on the accounts examined after taking into account the relevant accounting and auditing standards, as may be specified by SEBI;

2. the Auditors shall, to the best of its information and knowledge, ensure that the accounts and financial statements give a true and fair view of the state of the affairs of the Trust, including profit or loss and cash flow for the period and such other matters as may be specified;

3. the Auditors shall have a right of access at all times to the books of accounts and vouchers pertaining to activities of the Trust;

4. the Auditors shall have a right to require such information and explanation pertaining to activities of the Trust as it may consider necessary for the performance of its duties as auditors from the employees of the Trust or parties to the Trust or the Initial Portfolio Assets or any other person in possession of such information; and

5. the Auditors shall undertake a limited review of the audit of all the entities or companies whose accounts are to be consolidated with the accounts of the Trust as per the applicable Indian Accounting Standards and any addendum thereto as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015, in such manner as may be specified by the SEBI.

The Valuer

Background and terms of appointment

The Investment Manager, in consultation with Trustee, shall appoint the valuer of the Trust ("**Valuer**"), in a timely manner and shall determine the remuneration of such Valuer, in accordance with the InvIT Regulations. The Valuer shall be identified and appointed in accordance with the policy on '*Appointment of Auditor and Valuer of Cube Highway Trust*'.

The Investment Manager, in consultation with the Trustee, has appointed Ernst & Young Merchant Banking Services LLP with effect from May 20, 2022, as the valuer of the Trust, for initial valuation. In accordance with the InvIT Regulations, the Valuer has undertaken a full valuation of the Initial Portfolio Assets, and their report dated January 13, 2023 in relation to such valuation as on October 31, 2022, has been included in this Final Placement Memorandum.

Functions of the Valuer

The functions, duties and responsibilities of the Valuer will be in accordance with the InvIT Regulations. Presently, in terms of the InvIT Regulations, the Valuer is required to comply with the following conditions at all times:

1. the Valuer shall ensure that the valuation of the InvIT Assets is impartial, true and fair and is in accordance with Regulation 21 of the InvIT Regulations;

2. the Valuer shall ensure that adequate and robust internal controls to ensure the integrity of its valuation reports;

3. the Valuer shall ensure that it has sufficient key personnel with adequate experience and qualification to perform valuations;

4. the Valuer shall ensure that it has sufficient financial resources to enable it to conduct its business effectively and meet its liabilities;

5. the Valuer and any of its employees involved in valuing of the assets of the Trust, shall not, (i) invest in Units or in the assets being valued; and (ii) sell the assets or Units held prior to being appointed as the valuer, until the time the Valuer is designated as the valuer of the Trust and not less than six months after ceasing to be valuer of the Trust;

6. the Valuer shall conduct valuation of the Trust's assets with transparency and fairness and shall render, at all times, high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment;

7. the Valuer shall act with independence, objectivity and impartiality in performing the valuation;

8. the Valuer shall discharge its duties towards the Trust in an efficient and competent manner, utilizing its knowledge, skills and experience in best possible way to complete given assignment;

9. the Valuer shall not accept remuneration, in any form, for performing a valuation of the Trust's assets from any person other than the Trust or its authorized representative;

10. the Valuer shall before accepting any assignment from any related party of the Trust, disclose to the Trust any direct or indirect consideration which the valuer may have in respect of such assignment;

11. the Valuer shall disclose to the Trust any pending business transactions, contracts under negotiation and other arrangements with the investment manager or any other party whom the Trust is contracting with and any other factors that may interfere with the Valuer's ability to give an independent and professional valuation of the assets;

12. the Valuer shall not make false, misleading or exaggerated claims in order to secure assignments;

13. the Valuer shall not provide misleading valuation, either by providing incorrect information or by withholding relevant information;

14. the Valuer shall not accept an assignment which interferes with its ability to do fair valuation; and

15. the Valuer shall, prior to performing a valuation, acquaint itself with all laws or regulations relevant to such valuation.

Policy on Appointment of Auditor and Valuer ("Appointment Policy")

The Investment Manager has adopted a policy on the appointment of auditor and valuer of the Trust, pursuant to the resolution of the IM Board dated July 11, 2022. Under the terms of the Appointment Policy, it shall stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders. The key terms of the Appointment Policy are set out below:

Appointment and role of the auditor of the Trust

(i). The Investment Manager, in consultation with the Trustee, shall appoint the auditor of the Trust (the "**Auditor**"), from list of auditors previously approved by the board of directors of the Investment Manager, in a timely manner and in accordance with the InvIT Regulations.

(ii). The Auditor shall at all times be any of PricewaterhouseCoopers, Deloitte Touche Tohmatsu Limited, Ernst & Young or KPMG (or their affiliates in India).

(iii). The Investment Manager shall ensure that the appointment of the Auditor and the fees payable to the Auditor is approved by the Unitholders in accordance with the InvIT Regulations.

(iv). The Investment Manager shall ensure that the removal of the Auditor and appointment of another auditor to the Trust is taken up at a meeting of the Unitholders at the request of the Unitholders, such that the removal of the Auditor shall be approved by the Unitholders in accordance with Regulation 22 (5)(f) of the InvIT Regulations.

(v). The Investment Manager shall appoint an Auditor for a period of not more than five consecutive years; provided that the Auditor, not being an individual, may be reappointed for a period of another five consecutive years, subject to approval of Unitholders in the annual meeting in accordance with the InvIT Regulations.

(vi). The Investment Manager shall ensure that the audit of accounts of the Trust by the Auditor is done not less than once in a year and such report is submitted to the stock exchanges within the timelines prescribed under the InvIT Regulations.

(vii). The Auditor shall conduct the audit of the accounts of the Trust and draft the audit report based on the accounts examined by him/her after taking into account the relevant accounting and auditing standards under applicable law, including the InvIT Regulations and any guidelines, circulars, notifications and clarifications framed or issued by SEBI, as may be specified from time to time.

(viii). The Auditor shall comply with the conditions and be entitled to the rights prescribed under the InvIT Regulations at all times, including the following:

(a). the accounts of the Trust shall be subjected to audit by the Auditors and shall be accompanied by a report of the Auditors in such manner and at such intervals as may be prescribed under applicable law, including the InvIT Regulations;

(b). the Auditor shall, to the best of his information and knowledge, ensure that the accounts and financial statements give a true and fair view of the state of the affairs of the Trust, including profit or loss and cash flow for the period and such other matters as may be specified by SEBI;

(c). the Auditor shall have a right of access at all times to the books of accounts and vouchers pertaining to activities of the Trust; and

(d). the Auditor shall have a right to obtain such information and explanation pertaining to activities of the Trust as he may consider necessary for the performance of his duties as auditor from the employees of Trust or any holding company or parties to the Trust or any holding company or the special purpose vehicle(s) or any other person in possession of such information.

(ix). The Investment Manager, in consultation with the Trustee, shall have the right to take all necessary steps to remove the Auditor who ceases to comply with the eligibility criteria required under the InvIT Regulations and/or applicable law or for any other reason as determined by the Investment Manager. In case of removal of the Auditor and appointment of another auditor to the InvIT, approval from the Unitholders shall be required in accordance with the InvIT Regulations.

The Appointment Policy of the Trust shall stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders. Accordingly, pursuant to the amendments to the InvIT Regulations dated February 14, 2023, the following provisions shall override the paragraph on the term of the Auditor of the Trust as set out above:

(i). The Investment Manager shall appoint a firm as the Auditor, who shall hold office from the date of conclusion of the annual meeting in which the Auditor has been appointed till the date of conclusion of the sixth annual meeting of the Unitholders in accordance with the procedure for selection of auditors, in accordance with the InvIT Regulations.

(ii). The Investment Manager shall not appoint or re-appoint an audit firm as the Auditor for more than two terms of five consecutive years, provided that, upon completion of two terms of five consecutive years, such audit firm shall not be eligible for re-appointment as the auditor in the Trust for a period of five years from the date of completion of its term.

Appointment and role of valuer of the Trust

(i). The Investment Manager, in consultation with Trustee, shall appoint the valuer of the Trust ("**Valuer**"), in a timely manner and shall determine the remuneration of such Valuer, in accordance with the InvIT Regulations. A 'Valuer' shall have the meaning provided under the InvIT Regulations.

(ii). The remuneration of the Valuer shall not be linked to or based on the value of the assets being valued.

(iii). The Valuer shall not be an associate of any of the sponsor(s) of the Trust or the Investment Manager or Trustee.

(iv). The Valuer shall be eligible to act as a valuer in accordance with the InvIT Regulations or any clarifications, guidelines, notifications or exemptions issued by SEBI.

(v). A Valuer shall not undertake valuation of the same project for more than four years consecutively, provided that the Valuer may be reappointed after a period of not less than two years from the date it ceases to be the Valuer of the Trust.

(vi). The Valuer shall not undertake valuation of any assets in which it has either been involved with the acquisition or disposal within the last twelve months other than such cases where the Valuer was engaged by the Trust for such acquisition or disposal.

(vii). The Investment Manager shall ensure that the valuation of the assets of the Trust is done by the Valuer in accordance with and in the frequency stipulated in the InvIT Regulations. The Investment Manager shall ensure that the valuation reports received by it shall be submitted, and the computation and declaration of net asset value, as defined in the InvIT Regulations, of the InvIT based on the valuation done by the Valuer shall be disclosed, to the stock exchange(s) within the timelines prescribed under the InvIT Regulations.

(viii). The Valuer shall comply with the following conditions at all times:

(a). the Valuer shall ensure that the valuation of the Trust assets is impartial, true and fair and is in accordance with the InvIT Regulations;

(b). the Valuer shall ensure adequate and robust internal controls to ensure the integrity of its valuation reports, and shall maintain strict confidentiality in relation to all non-public information that comes into its possession by virtue of its engagement;

(c). the Valuer shall ensure that it has sufficient key personnel with adequate experience and qualification to perform valuations;

(d). the Valuer shall ensure that it has sufficient financial resources to enable it to conduct its business effectively and meet its liabilities;

(e). the Valuer and any of its employees involved in valuing of the assets of the Trust, shall not:

a. invest in Units of the Trust or in the assets being valued; and

b. sell the assets or Units of the Trust held prior to being appointed as the Valuer,

during the time such person is designated as Valuer of the Trust and not less than six months after ceasing to be Valuer of the InvIT;

(f). the Valuer shall conduct valuation of the Trust assets with transparency and fairness and shall render, at all times, high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment;

(g). the Valuer shall act with independence, objectivity and impartiality in performing the valuation;

(h). the Valuer shall discharge its duties towards the InvIT in an efficient and competent manner, utilizing its knowledge, skills and experience in best possible way to complete given assignment;

(i). the Valuer shall not accept remuneration, in any form, for performing a valuation of the Trust assets from any person other than the Trust or its authorized representative;

(j). the Valuer shall, before accepting any assignment from any related party of the Trust, disclose to the Trust, by disclosing to the Investment Manager or the Trustee, any direct or indirect consideration which the Valuer may have in respect of such assignment;

(k). the Valuer shall disclose to the Trust, through the Investment Manager or the Trustee, any pending business transactions, contracts under negotiation and other arrangements with the Investment Manager or any other party whom the Trust is contracting with and any other factors that may interfere with the Valuer's ability to give an independent and professional valuation of the assets, and other necessary disclosures required under the InvIT Regulations;

(l). the Valuer shall not make false, misleading or exaggerated claims in order to secure assignments;

(m). the Valuer shall not provide misleading valuation, either by providing incorrect information or by withholding relevant information;

(n). the Valuer shall not accept an assignment which interferes with its ability to do fair valuation; and

(o). the Valuer shall, prior to performing a valuation, acquaint itself with all laws or regulations relevant to such valuation.

(ix). The Investment Manager in consultation with the Trustee shall have the right to take all necessary steps to remove the Valuer who ceases to comply with the eligibility criteria required under the InvIT Regulations and/ or applicable law or for any other reason as determined by the Investment Manager. If the removal of the Valuer and appointment of another valuer to the Trust is taken up at a meeting of the Unitholders at the request of the Unitholders, such removal of the Valuer shall be approved by the Unitholders in accordance with the InvIT Regulations.

CORPORATE GOVERNANCE

The section below is a summary of the corporate governance framework in relation to the Trust, implemented by or to be implemented by the Investment Manager and the Initial Portfolio Assets, as applicable and as specified in this section.

1. Investment Manager

Board of Directors

*Composition of the Board of Directors of the Investment Manager ("**IM Board**")*

In addition to the applicable provisions of the InvIT Regulations and the Companies Act, the IM Board shall adhere to the following:

(a). Subsequent to the listing of the Ordinary Units, the IM Board shall comprise of seven directors;

(b). Not less than 50% (fifty per cent) of the board of directors shall comprise independent directors, determined in accordance with the InvIT Regulations. The IM Board shall also have not less than one woman independent director. Such directors shall not be directors or members of the governing board of the investment manager of another infrastructure investment trust registered under the InvIT Regulations. The remaining directors shall be appointed in accordance with the provisions of the Companies Act;

(c). The independence of directors shall be determined in accordance with the InvIT Regulations and other applicable law; and such other requirements as may be specified in the articles of association of the Investment Manager;

(d). the chairman of the board of directors may be an executive or a non-executive director;

(e). collective experience of the directors should cover a broad range of commercial experience, particularly experience in infrastructure sector (including the applicable sub-sector), including development, investment/fund management or advisory and financial matters; and

(f). the shareholders of the Investment Manager shall have the right to (i) nominate three directors on the IM Board (the "**Nominee Directors**"); and (ii) nominate one observer on the IM Board ("**Observer**").

For details of the current composition of the board of directors, please see the section entitled "*Parties to the Trust – The Investment Manager – Cube Highways Fund Advisors Private Limited – Board of Directors of the Investment Manager*" on page 120. Subsequent to the Offer, the shareholders of the Investment Manager may appoint or replace directors on the IM Board subject to compliance with the requirements of the InvIT Regulations, the Articles of Association of the Investment Manager and other applicable law.

Quorum

The quorum for every meeting of the Board shall be in accordance with the InvIT Regulations, including at least one independent director and one Nominee Director, must be present at a meeting of the IM Board, for purposes of constitution of a valid quorum. Further, the Observer shall have the right to attend all meetings of the IM Board and all the committees of the IM Board.

Frequency of meetings

The board of directors of the Investment Manager shall meet at least four times every year, with a maximum gap of 120 days between any two successive meetings or such gap as prescribed under applicable law.

Sitting fee

The independent directors of the Investment Manager will receive sitting fee for attending board meetings and meetings of the committees, in accordance with the provisions of the Companies Act and other applicable law.

Matters to be decided by the committee and IM Board

The Investment Manager shall not, whether by way of a resolution of its shareholder(s), board of directors or committee of its board of directors or through any of their respective delegates or otherwise (including with respect to the Trust and the Project SPVs), take any decisions or actions with respect to certain specified matters, except with the prior approval by the committees, other than the Investment Committee and the Operations Committee, or the IM Board, in accordance with the following:

- *Committee matters*

Notwithstanding anything contained in the Corporate Governance Policy, subject to the provisions on 'Investment Committee and Operations Committee matters' below, specific matters, as specified in the Corporate Governance Policy, shall be validly approved by the Investment Committee or the Operations Committee or the IM Board in respect of the Investment Manager or its subsidiaries, or any matters pertaining to the Trust and its Project SPVs, unless such matter has been taken up at a meeting of the members of either the Investment Committee or the Operations Committee or the IM Board, as the case may be, or by circulation, and a resolution has been passed in its favour (whether in a meeting or by circulation):

(i) by the majority of the members on such committee or the IM Board, as applicable, who are entitled to vote on such matter and not disqualified from voting due to being interested in such matter or otherwise, and

(ii) unanimously by the members on such committee or the IM Board, as applicable, who are not independent directors, and who are entitled to vote on such matter (in case of matters such as, amongst others, (a). as any removal or replacement of the auditors of the Trust, subject to certain conditions; (b). the undertaking by the Trust of any sale or disposal, or any transaction having the effect of a sale or disposal of assets, subject to certain conditions; (c). any material changes in compliance or environmental, social and governance policies of the Trust; and (d). any appointment or removal of the Project Manager or Valuer with respect to the Trust);

or,

(i) by the majority of the members on such committee or the IM Board, as applicable, who are entitled to vote on such matter and not disqualified from voting due to being interested in such matter or otherwise, and

(ii) at least two-thirds of the members on the committee or the IM Board, as applicable, who are not independent directors, and who are entitled to vote on such matter (in case of matters such as, amongst others, (a). any material change to the employee share plan and/or stock appreciation rights plan of the employees of the Investment Manager; (b). any material change to the employee share plan and/or stock appreciation rights plan of the employees of the Investment Manager; and (c). any change in the annual budget of the Trust, subject to certain conditions);

subject to the matter proposed to be approved.

Provided, that if such matter has already been taken up first at a meeting of the Operations Committee or Investment Committee and has been approved in the manner set out above, as applicable, read with the provisions on 'Investment Committee and Operations Committee matters' below, and such matter is then taken up at the level of the IM Board, the requirement for the unanimous approval or approval of two-thirds of the non-independent directors, as the case may be, shall not be required at the level of the IM Board.

- *Investment Committee and Operations Committee matters*

If any of the specified matters are being taken up by either the Operations Committee or Investment Committee, or the IM Board, as the case may be, in respect of the Investment Manager or its subsidiaries, or any matters pertaining to the Trust and its SPVs, a notice and agenda of such matters shall first be sent to all members of the Operations Committee or Investment Committee, as the case may be, or the directors on IM Board, as applicable, at least 10 days prior to the date on which such matter is being taken up at a meeting or by way of circulation. In the event that the members of the Operations Committee or Investment Committee, or the directors on IM Board, as applicable (each a "**Relevant Member/Director**") are unable to attend the relevant meeting of the members of the Operations Committee or Investment Committee, as the case may be, or the IM Board, as applicable, the Relevant Member/Director shall be entitled to send in communication as to their approval or rejection of the proposed resolution on the said matter, and such decision shall be binding on the Operations Committee or Investment Committee, as the case may be, or the IM Board, as applicable. If such Relevant Member/Director is unable to attend such meeting as scheduled, and has not sent any communication as to his/her approval or rejection of the proposed resolution on the said matter by the time of commencement of the meeting of the members of the Operations Committee or Investment Committee, or the IM Board, as applicable, such Relevant Member/Director's vote shall not be considered for the requirement for unanimous approval and/or approval of two-thirds of the non-independent directors (as set out above), as the case may be, for such specified matter.

Committees of the board of directors

Name of the committee	Composition	Present Members	Quorum	Frequency of meetings
Nomination and Remuneration Committee	The nomination and remuneration committee shall consist of at least three independent directors. The chairperson of the committee should be an independent director and shall not be the chairperson on board of directors of the Investment Manager. The company secretary	Upendra Kumar Sinha, Jayesh Ramniklal Desai, Surinder Chawla	The quorum shall be either two members or one third of the members of the committee,	The nomination and remuneration committee shall meet at least once in a year or as necessary.

Name of the committee	Composition	Present Members	Quorum	Frequency of meetings
	shall act as the secretary to the nomination and remuneration committee.		whichever is greater.	
Audit Committee	The audit committee shall consist of at least three directors and shall have a maximum of four directors. At least two-thirds of the members of audit committee shall be independent directors. The non-independent director members of the audit committee shall retire annually by rotation. The chairperson of the audit committee should be an independent director. All members of the audit committee should be financially literate and at least one member should have accounting or related financial management expertise, in accordance with the LODR Regulations. The company secretary shall act as the secretary to the audit committee. The audit committee at its discretion shall invite the finance director or head of the finance function, head of internal audit and a representative of the statutory auditor and any other such executives to be present at the meetings of the committee.	Upendra Kumar Sinha, Jayesh Ramniklal Desai, Surinder Chawla, Sandeep Lakhanpal	The quorum shall either be two members or one third of the members of the audit committee, whichever is greater, including at least two independent directors in attendance.	The audit committee should meet at least four times every year, with a maximum gap of 120 days between any two successive meetings.
Stakeholders' Relationship Committee	The stakeholders' relationship committee shall consist of at least three directors and shall have a maximum of four directors. At least two-thirds of the members of the committee shall be independent directors. The chairperson of the stakeholders' relationship committee shall be an independent director.	Upendra Kumar Sinha, Jayesh Ramniklal Desai, Surinder Chawla	The quorum shall either be two members or one third of the members of the committee, whichever is greater, including at least one independent director in attendance.	The stakeholders' relationship committee shall meet at least once in a year.
Risk Management Committee	The risk management committee shall consist of at least three members. A majority of the members of the committee shall be directors on the IM Board and senior executives of the Investment Manager may be members of the risk management committee. The chairperson of this committee shall be a director on the board. At least one member of the committee shall be an independent director.	Jayesh Ramniklal Desai, Sandeep Lakhanpal, Surinder Chawla, Vinay Sekar, Pankaj Vasani	The quorum shall either be two members or one third of the members of the committee, whichever is greater, including at least one director in attendance.	The risk management committee should meet at least twice every year, with a maximum gap of 180 days between any two successive meetings.
Investment Committee*	The Investment Committee shall consist of three Nominee Directors and one independent director.	N.A.	The quorum shall either be two members or one third of the members of the committee, whichever is greater.^	The Investment Committee shall meet at least once in a year or as necessary.
Operations Committee*	The Operations Committee shall consist of three Nominee Directors and one independent director.	N.A.	The quorum shall either be two members or one third of the members of the committee, whichever is greater.^	The Operations Committee shall meet at least once in a year or as necessary.

** In terms of the Corporate Governance Policy adopted by the Investment Manager, the Investment Committee and Operations Committee shall be constituted immediately upon Allotment.*
^The Observer shall have the right to attend the meetings.

For details of the scope of each committee, please see below.

Nomination and Remuneration Committee

Terms of reference of the Nomination and Remuneration Committee

The key terms of reference of the Nomination and Remuneration Committee include the following:

(i). formulation of the criteria for determining qualifications, positive attributes and independence of a director and recommend to the IM Board a policy relating to, the remuneration of the directors, key managerial personnel and other employees;

(ii). for every appointment of an independent director, evaluation of the balance of skills, knowledge and experience on the IM Board and on the basis of such evaluation, prepare a description of the role and capabilities required of an independent director. The person recommended to the IM Board for appointment as an independent director shall have the capabilities identified in such description. For the purpose of identifying suitable candidates, the Nomination and Remuneration Committee may:

a. use the services of external agencies, if required;
b. consider candidates from a wide range of backgrounds, having due regard to diversity; and
c. consider the time commitments of the candidates.

(iii). formulation of criteria for evaluation of performance of independent directors and the board of directors;

(iv). devising a policy on diversity of board of directors;

(v). identifying persons who are qualified to become directors and who may be appointed in senior management in accordance with the criteria laid down, and recommend to the IM Board their appointment and removal;

(vi). whether to extend or continue the term of appointment of the independent director, on the basis of the report of performance evaluation of independent directors; and

(vii). recommend to the board, all remuneration, in whatever form, payable to senior management (if any).

Audit Committee

Terms of reference of the Audit Committee

The key terms of reference of the Audit Committee include the following:

(i). oversight of the financial reporting process of the Trust and/or the Investment Manager and the disclosure of its financial information to ensure that the financial statement is correct, sufficient and credible;

(ii). recommendation for appointment, remuneration and terms of appointment of auditors of the Trust;

(iii). approval of payment to statutory auditors for any other services rendered by the statutory auditors of the Trust;

(iv). determining the occurrence of Entitlement Events (*as defined in the Trust Deed*) and undertaking all such actions in relation to the Subordinate Units (*as defined in the Trust Deed*) issued by the Trust as set out in the Trust Deed;

(v). reviewing, with the management, the annual financial statements and auditor's report thereon before submission to the IM Board for approval, with particular reference to:

a. matters required to be included in the director's responsibility statement to be included in the IM board's report of Investment manager in terms of clause (c) of sub-section (3) of Section 134 of Companies Act 2013;
b. changes, if any, in accounting policies act practices and reason for the same
c. major accounting entries involving estimates based on exercise of judgment by management;
d. significant adjustments made in the financial statements arising out of audit findings;
e. compliance with listing and other legal requirements relating to financial statements;
f. disclosure of any related party transactions; and
g. modified opinion(s) in the draft audit report;

(vi). reviewing, with the management, the quarterly financial statements before submission to the IM Board for approval;

(vii). reviewing, with the management, the statement of uses / application of funds raised through an issue (public issue, rights issue, preferential issue, etc.), the statement of funds utilized for purposes other than those stated in the placement document / offer documents / notice and the report submitted by the monitoring agency monitoring the utilisation of proceeds of a public or rights issue, and making appropriate recommendations to the board to take up steps in this matter;

(viii). reviewing and monitoring the auditor's independence and performance, and effectiveness of audit process;

(ix). approval or any subsequent modification of all transactions of the Trust and/or the Investment Manager with related parties;

(x). scrutiny of inter-corporate loans and investments;

(xi). valuation of undertakings or assets of the Trust, wherever it is necessary;

(xii). evaluation of internal financial controls and risk management systems;

(xiii). reviewing, with the management, performance of statutory and internal auditors, adequacy of the internal control systems;

(xiv). reviewing the adequacy of internal audit function, if any, including the structure of the internal audit department, staffing and seniority of the official heading the department, reporting structure coverage and frequency of internal audit;

(xv). discussion with internal auditors of any significant findings and follow up thereon;

(xvi). reviewing the findings of any internal investigations by the internal auditors into matters where there is suspected fraud or irregularity or a failure of internal control systems of a material nature and reporting the matter to the IM Board;

(xvii). discussion with statutory auditors of the Trust before the audit commences, about the nature and scope of audit as well as post-audit discussion to ascertain any area of concern;

(xviii). to look into the reasons for substantial defaults in the payment to the depositors, debenture holders, shareholders (in case of non-payment of declared dividends) and creditors;

(xix). to review the functioning of the whistle blower mechanism;

(xx). approval of appointment of chief financial officer after assessing the qualifications, experience and background, etc. of the candidate;

(xxi). reviewing the utilization of loans and/ or advances from/investment by the holding company in the subsidiary exceeding rupees 100 crore or 10% of the asset size of the Trust, Holding Companies and SPVs, whichever is lower including existing loans / advances / investments existing as on the date of the adoption of the policy;

(xxii). considering and commenting on rationale, cost-benefits and impact of schemes involving merger, demerger, amalgamation etc., on the Trust and/or the Investment Manager; and

(xxiii). noting the report of compliance officer as per SEBI (Prohibition of Insider Trading) Regulations, 2015; and

(xxiv). oversee the vigil mechanism.

The audit committee shall mandatorily review the following information:

(i). management discussion and analysis of financial condition and results of operations;

(ii). management letters / letters of internal control weaknesses issued by the statutory auditors;

(iii). internal audit reports relating to internal control weaknesses;

(iv). the appointment, removal and terms of remuneration of the internal auditor, if any, shall be subject to review by the audit committee; and

(v). the statement of deviations, if any.

Further, the audit committee is also responsible for the implementation of the Anti-corruption Policy of the Trust in accordance with the Anti-corruption Policy. For details, please see the section entitled "*Corporate Governance- Policies of the Board of Directors of the Investment Manager in relation to the Trust – Anti-corruption Policy*" on page 153.

Stakeholders' Relationship Committee

Terms of reference of the Stakeholders' Relationship Committee

The terms of reference of the Stakeholders' Relationship Committee include the following:

(i). resolving the grievances of the security holders of the Trust and/or the Investment Manager (as applicable) including complaints related to transfer/transmission of Units, non-receipt of annual report, non-receipt of declared dividends, issue of new/duplicate certificates, general meetings etc.;

(ii). review of measures taken for effective exercise of voting rights by unitholders of the Trust and/or shareholders of the Investment Manager (as applicable);

(iii). review of adherence to the service standards adopted by the Trust and/or the Investment Manager in respect of various services being rendered by the Registrar; and

(iv). review of the various measures and initiatives taken by the Trust and/or the Investment Manager for reducing the quantum of unclaimed distributions, as applicable, and ensuring timely receipt of annual reports/statutory notices by the Unitholders of the Trust.

Risk Management Committee

Terms of reference of the Risk Management Committee

The terms of reference of the Risk Management Committee include, amongst others, the following:

(i). formulation of a detailed risk management policy, which will include:

a. a framework for identification of internal and external risk specifically faced by the trust in particular, including financial, operational, sectoral, substantial (particularly, ESG related risks), information, cyber security risks or any other risk as may be determined by the risk management committee;
b. measures for risk mitigation including systems and processes for internal control of identified risks; and
c. business continuity plan;

(ii). ensuring that ensure that appropriate methodology, processes and systems are in place to monitor and evaluate risks associated with the business of the Trust;

(iii). monitoring and overseeing implementation of the risk management policy, including evaluating the adequacy of risk management systems;

(iv). periodically reviewing the risk management policy, at least once in two years, including by considering the changing industry dynamics and evolving complexity;

(v). keeping the board of directors informed about the nature and content of its discussions, recommendations and actions to be taken;

(vi). reviewing the appointment, removal and terms of remuneration of the chief risk officer, if any; and

(vii). coordinating its activities with other committees, in instances where there is any overlap with activities of such committees, as per the framework laid down by the Board.

Investment Committee

Terms of reference of the Investment Committee

Subject to the provisions under "*Matters to be decided by the committee and IM Board*" on page 144 above, and the specified matters and related provisions in the Corporate Governance Policy, the Investment Committee shall decide upon and recommend to the IM Board, matters in relation to the following:

(i) issuance of capital;

(ii) third party liabilities;
(iii) third party transactions;
(iv) constitutional documents/ parties to the Trust; and
(v) de-listing.

Operations Committee

Terms of reference of the Operations Committee

Subject to the provisions under "*Matters to be decided by the committee and IM Board*" on page 144 above, and the specified matters and related provisions in the Corporate Governance Policy, the Operations Committee shall decide upon and recommend to the IM Board, matters in relation to the following:

(i) third party transactions;
(ii) litigation;
(iii) constitutional documents/ parties to the Trust;
(iv) related party transactions;
(v) operational matters; and
(vi) bankruptcy.

Policies of the Board of Directors of the Investment Manager in relation to the Trust

The Investment Manager has adopted the following policies, in relation to management of the Trust and all assets of the Trust.

1. **Policy on UPSI and Dealing in Units by the Parties ("UPSI Policy")**

The Investment Manager has adopted the UPSI Policy pursuant to a resolution of the IM Board on July 11, 2022 which was amended on April 2, 2023. The purpose of the policy is, *inter alia*, to ensure that the Trust complies with applicable law, including the InvIT Regulations or such other laws, regulations, rules or guidelines prohibiting insider trading and governing disclosure of material, unpublished price sensitive information ("**UPSI**").

The key principles of the UPSI Policy are set out below:

(i). The Investment Manager shall promptly disclose to the relevant stock exchanges all UPSI that would impact price discovery no sooner than credible and concrete information comes into being in order to make such information generally available;

(ii). The Investment Manager shall follow uniform and universal dissemination of UPSI to avoid selective disclosure. The Investment Manager shall also make prompt dissemination of UPSI that gets disclosed selectively, inadvertently or otherwise to make such information generally available;

(iii). The Compliance Officer shall be responsible for deciding whether a public announcement is necessary for verifying or denying rumours and then making the disclosure, in accordance with the procedure specified in the Policy for Determining Materiality of Information for Periodic Disclosures;

(iv). The Compliance Officer shall also make an appropriate and fair response to the queries on news reports and requests for verification of market rumours by regulatory authorities, in accordance with the procedure specified in the Policy for Determining Materiality of Information for Periodic Disclosures. Further, no employee or representative of the Investment Manager who is in receipt of any inquiries relating to the Trust, including from any investors, shall respond to such inquiries. Such employee or representative of the Investment Manager shall refer the inquirer to the Compliance Officer or an any person authorised by the IM Board to deal with inquiries;

(v). While dealing with analysts or research persons, the Investment Manager shall provide only public information. Alternatively, the information given to analysts or research persons shall be simultaneously made public at the earliest; and

(vi). The Investment Manager shall handle all UPSI on a "need to know" basis, provided that UPSI may be disclosed to persons who need such information for furtherance of legitimate purposes, performance of duties or discharge of legal obligations in relation to the Trust.

2. **Corporate Governance Policy ("Corporate Governance Policy")**

The Investment Manager has adopted the Corporate Governance Policy pursuant to a resolution of the IM Board dated July 11, 2022 which was amended on December 22, 2022, in relation to Trust. The objective of the Corporate Governance Policy is to

provide for the standards of governance in relation to the Trust and the Investment Manager including the constitution of the IM Board and committees of the IM Board. For details, please see the section entitled "*Corporate Governance – Investment Manager*" on page 144.

3. **Code of Conduct for the Trust (the "Code")**

The Investment Manager has adopted the Code pursuant to a resolution of the IM Board dated July 11, 2022, in relation to the Trust. The Trust and the parties to the Trust shall comply with the Code at all time, in accordance with the InvIT Regulations.

The key principles of the Code are set out below:

(i). the Trust and the Parties to the Trust shall conduct all affairs of the Trust in the interest of all the Unitholders of the Trust;

(ii). the Trust and the Parties to the Trust shall make adequate, accurate, explicit and timely disclosure of relevant material information to all Unitholders, the stock exchanges and the SEBI in accordance with the InvIT Regulations and as may be specified by the stock exchanges from time to time;

(iii). the Trust and the Parties to the Trust shall try to avoid conflicts of interest, as far as possible, in managing the affairs of the Trust and keep the interest of all Unitholders paramount in all matters. In case such events cannot be avoided, it shall be ensured that appropriate disclosures are made to the Unitholders and they are fairly treated;

(iv). the Trust and the Parties to the Trust shall ensure that fees charged by them with respect to activities of the Trust shall be fair and reasonable;

(v). the Investment Manager shall carry out the business of the Trust and invest in accordance with the Investment Objectives (as disclosed in the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum) and take investment decisions solely in the interest of Unitholders;

(vi). the Trust, the Parties to the Trust and any third party appointed by the Investment Manager shall not use any unethical means to sell, market or induce any person to buy Units of the Trust and where a third party appointed by the Investment Manager fails to comply with this condition, the Investment Manager shall be held liable for the same;

(vii). the Trust and the Parties to the Trust shall maintain high standards of integrity and fairness in all their dealings and in the conduct of their business;

(viii). the Trust and the Parties to the Trust shall render at all times high standards of service, exercise due diligence, ensure proper care and exercise independent professional judgment; and

(ix). the Trust and the Parties to the Trust shall not make any exaggerated statement, whether oral or written, either about their qualifications or capabilities or experience.

4. **Determination of Materiality of Information for Periodic Disclosures Policy ("Materiality of Information Policy")**

The Investment Manager has adopted the Materiality of Information Policy pursuant to a resolution of the IM Board dated July 11, 2022, in relation to Trust. The Materiality of Information Policy aims to outline process and procedures for determining materiality of information in relation to periodic disclosures on the Trust's website, to the Stock Exchanges and to all stakeholders at large, in relation to the Trust. The key principles of the Materiality of Information Policy are set out below:

(i). Any information concerning the InvIT is considered material to the business and affairs of the Trust if (i) it results in, or would reasonably be expected to result in a significant change in the market price or value of units of the Trust; or (ii) if there is a substantial likelihood that a reasonable unitholder would consider it important in determining whether to buy, sell or hold, or engage in other transactions concerning the Trust's units; or (iii) an investor would consider important in making an investment decision.

(ii). The Investment Manager or the Trustee shall provide to SEBI and to the Stock Exchanges, wherever applicable, such information as may be sought by SEBI or by the Stock Exchanges pertaining to the activity of the Trust.

(iii). The Trust shall also submit such information to the Designated Stock Exchange and Unitholders on a periodical basis as may be required under the listing agreements. Further, the Trust shall disclose all such information as may be specified by SEBI to the Designated Stock Exchange, Unitholders and SEBI, in the manner as may be specified by SEBI.

(iv). The Materiality of Information Policy also provides for the approval process for disclosure or dissemination of any material or unpublished price sensitive information on behalf of the Trust and authorises the compliance officer and other authorised persons to make the disclosures, as may be required.

5. **Borrowing Policy of the Trust ("Borrowing Policy")**

The Investment Manager has adopted the Borrowing Policy pursuant to a resolution of the IM Board dated July 11, 2022, in relation to Trust. The Investment Manager shall ensure that all funds borrowed by the Trust or in relation to the Trust are (i) in compliance with the InvIT Regulations, applicable prudential norms and other applicable law; (ii) availed subject to the ability of the Trust to repay such borrowings. Accordingly, the board of directors of the Investment Manager has formulated the Borrowing Policy to outline the process for borrowing monies in relation to the Trust. The key terms of the Borrowing Policy include, among other things, the following:

(i). The Investment Manager shall ensure that all funds borrowed in relation to the Trust are in compliance with the InvIT Regulations, applicable prudential norms and other applicable law. Further, the Investment Manager may decide the end use of all funds borrowed by the Trust, in compliance with the InvIT Regulations and other applicable law.

(ii). The Investment Manager shall ensure that in the event the aggregate consolidated borrowings and deferred payments (net of cash and cash equivalents) of the Trust, holding companies and the SPVs, exceed any thresholds prescribed under the InvIT Regulations in this regard, any further borrowings by the Trust shall be availed in accordance with the requirements prescribed under the InvIT Regulations. If the thresholds prescribed under the InvIT Regulations are breached on account of market movements of the price of the underlying assets or securities, the Investment Manager shall inform the same to the Trustee and ensure that the conditions prescribed under the InvIT Regulations are satisfied within the timelines prescribed under the InvIT Regulations for curing such breach.

(iii). The Trust may raise debt and avail borrowings and deferred payments from time to time, including through (i) issuance of debt securities, in accordance with applicable law, and (ii) availing loans from banks and financial institutions in accordance with applicable law (including the InvIT Regulations). The Trust shall be permitted to borrow monies through any permitted means, by any instrument, in Indian or foreign currency, as permitted by applicable law, including as prescribed by the Reserve Bank of India. The Investment Manager and the Trustee (on behalf of the Trust) shall be permitted to borrow monies in relation to the Trust, subject to the approval of the board of the IM Board or such other committee, including the Investment Committee of the IM Board as may be constituted in this regard.

(iv). The Trust also has the power to create mortgage or secure any of its Assets or provide guarantees in order to borrow funds. However, the Investment Manager shall not be allowed to create any obligation which would allow the liabilities to extend beyond the assets held by the Trust.

(v). The Investment Manager will not cause the Trust to undertake any obligation which will make the liabilities of the Trust unlimited except with prior approval by the 60% of the Unitholders and the obtaining of any other approvals required under applicable law. Notwithstanding anything contained in the Borrowing Policy, the Investment Manager will not cause the Trust to undertake any obligation which will result in the Trust assuming unlimited liability in respect of any related party transaction.

6. **Policy on Preservation of Documents ("Document Archival Policy")**

The Investment Manager has adopted the Document Archival Policy pursuant to a resolution of the IM Board dated July 11, 2022, in relation to Trust. The document archival policy aims to provide a comprehensive policy on the preservation and conservation of the records and documents of the Trust. It provides guidance on the preservation and management of documents to help ensure the authenticity, reliability and accessibility of such documents. The policy aims at identifying, classifying, storing, securing, retrieving, tracking and destroying or permanently preserving records. It stipulates the duration and manner in and place at which records and documents of the Trust shall be preserved.

7. **Policy on appointment of the auditor and valuer of the Trust**

The IM Board has adopted the policy on appointment of the auditor and valuer of the Trust pursuant to a resolution dated July 11, 2022. For details of the policy on appointment of the auditor and the valuer of the Trust, please see the section entitled "*Other Parties Involved in the Trust – Policy on appointment of Auditor and Valuer*" on page 140.

8. **Distribution Policy**

The IM Board has adopted the distribution policy pursuant to a resolution dated July 11, 2022, which was amended on December 22, 2022. For details of the distribution policy, please see the section entitled "*Distribution*" on page 243.

9. **Policy on Related Party Transactions ("RPT Policy")**

The IM Board has adopted the RPT Policy pursuant to a resolution dated July 11, 2022. For details of the RPT Policy, please see the section entitled "*Related Party Transactions – Procedure for dealing with Related Party Transactions*" on page 275.

10. **Insurance Policy**

The IM Board has adopted the insurance policy pursuant to its resolution dated July 11, 2022. In accordance with the insurance policy, the Investment Manager shall necessitate and validate that the respective holding companies and special purpose vehicles, either by themselves or through their agents or brokers shall obtain insurance policies with a financially sound and reputable insurer(s) adequately covering for:

(i). liability of the directors and officers;
(ii). property all risks or fire and other named perils (including natural perils and strike, riot and malicious damage) based on new replacement cost of assets;
(iii). terrorism (standalone or as an add-on to property/material damage policy);
(iv). employee/workmen compensation in case of death or bodily injury caused to employees due to an injury/accident arising at the workplace;
(v). public liability; and
(vi). all kinds of risks required to be covered in accordance with applicable law and the relevant project agreements

11. **Environmental and Social Due Diligence Policy ("ESDD Policy")**

The IM Board has adopted the ESDD policy pursuant to its resolution dated July 11, 2022. The ESDD policy aims to provide a criteria for selection of future projects. The key terms of the ESDD Policy are:

(i). Prior to the acquisition of an eligible infrastructure project, the Investment Manager shall undertake the following steps:

a. review the Environmental Impact Assessment ("**EIA**") and environment and social management system, of such eligible infrastructure asset, if available. The Investment Manager shall also evaluate the compliances of environmental issues as highlighted in the EIA and highlight significant areas of concern to the IM Board and Unitholders;

b. ensure that all requisite environmental approvals are obtained and renewed, as and when required. In the event that the environmental clearance is not obtained by an eligible infrastructure project, such project shall not be acquired except for where all the applications have been timely filed and the approval or clearance is expected soon;

c. conduct due diligence to assess the outstanding litigation involving the land utilized or to be utilized for purposes of the eligible infrastructure project; and

d. undertake diligence of the concerns of stakeholders expressed in public domain and instances of protests or civil action in relation to adverse environmental impacts; and

(ii). The Investment Manager may propose an environmental and social action plan to the Board, for purposes of resolving the key issues and gaps identified in the environmental and social due diligence.

12. **Policy on Investment**

The IM Board has adopted the investment policy pursuant to its resolution dated July 11, 2022. The investment policy aims to specify the assets in which the Trust will be entitled to invest. The Trust will only be entitled to invest in, and acquire (directly or indirectly), the Initial Portfolio Assets, N.A.M. Expressway Limited, Chenani Nashri Tunnelway Limited, Borgaon Watambare Highways Private Limited, Mangalwedha Solapur Highways Private Limited, Mangloor Highways Private Limited, KNR Srirangam Infra Private Limited, KNR Shankarampet Projects Private Limited and KNR Tirumala Infra Private Limited. In addition to the above, the Trust may invest in, and acquire directly or indirectly, any securities or assets from Cube Highways and Infrastructure V Pte. Ltd. or other affiliates of the Sponsors or any other securities or asset subject to the approval of the IM Board or any other approvals as may be required in accordance with applicable law.

13. **Anti-Corruption Policy**

The IM Board has adopted the anti-corruption policy pursuant to its resolution dated July 11, 2022 which was amended on April 2, 2023. The anti-corruption policy aims to ensure that the InvIT sets up adequate procedures in order to prevent its involvement in any activity relating to bribery, facilitation of payments that are not permitted under applicable law, or corruption, even where the involvement may be unintentional. The key terms of the policy are:

(i). The Investment Manager shall not and shall ensure that the Holdco's/SPVs shall not engage in (nor authorize or permit any of its affiliates or any other person acting on its behalf, to engage in) any Corrupt Practices, Fraudulent Practices, Coercive Practices or Collusive Practices (*as defined in the policy*), or enter into any transaction: (i) with, or for the benefit of, any of the individuals or entities named on lists promulgated by; or (ii) related to any activity prohibited by, the United Nations Security Council or its committees pursuant to any resolution under Chapter VII of the United Nations Charter (collectively, "**Sanctionable Practices**") with respect to the Trust or any transaction contemplated with respect to the Trust.

(ii). The Project Manager shall not and shall endeavour to ensure that all contractual counterparties and sub-contractors shall not engage in (nor authorize or permit any of its affiliates or any other person acting on its behalf, to engage in) any Corrupt Practices, Fraudulent Practices, Coercive Practices or Collusive Practices (*as defined in the policy*), or enter into any Sanctionable Practices with respect to the Trust or any transaction contemplated with respect to the Trust.

(iii). The Investment Manager shall not authorize or permit any of its directors, officers, employees or agents, acting on behalf of the Investment Manager or the Holdco's/SPVs (the "**Representatives**") to engage in any Sanctionable Practice with respect to the Trust or any transaction contemplated with respect to the Trust. As a preventive measure, the Investment Manager shall ensure that this Policy is applicable to the third-party service providers by way of incorporation in the agreement or contracts to be entered into with them.

(iv). The Audit Committee shall be responsible for the implementation of this policy. The Audit Committee shall set up procedures or recommend to the IM Board procedures to implement this policy, if required. The Investment Manager shall also develop and disseminate tools and conduct training for Representatives to facilitate the implementation of this policy.

(v). The Investment Manager and the Project Manager shall ensure that the Representatives and all contractual counterparties and sub-contractors agree to comply with the policy under their respective terms of employment or contract/engagement with the Investment Manager and/or the Project Manager or as per the instructions or authorizations of the Investment Manager and/or the Project Manager, as the case may be.

(vi). To minimize the risk of doing business with a corrupt third party, complete assessment of the third party shall be undertaken to confirm that it is a legitimate business with a reputation for integrity. The management of the Investment Manager will have internal control mechanisms in place, to try to avoid dealing with corrupt third parties.

(vii). The Investment Manager shall establish a vigil mechanism for its directors and employees to report their genuine concerns and grievances. The Audit Committee shall oversee the vigil mechanism and if any of the members of the committee have a conflict of interest in a given case, they should recuse themselves and the others on the committee would deal with the matter on hand. The vigil mechanism shall provide for adequate safeguards against victimisation of employees and directors who avail of the vigil mechanism and also provide for direct access to the chairperson of the Audit Committee, in exceptional cases. Provided that In case of repeated frivolous complaints being filed by a director or an employee, the Audit Committee may take suitable action against the concerned director or employee including reprimand.

The Investment Manager undertakes on behalf of the Trust that it shall comply with such disclosure and accounting norms as specified by SEBI from time to time.

14. Valuation Policy

The IM Board has adopted the valuation policy pursuant to its resolution dated July 11, 2022 which was amended on December 22, 2022. The valuation policy aims to outline the principles in relation to the valuation of the following road assets to be acquired by the Trust from CH-I and CH-III: Borgaon Watambare Highways Private Limited, Mangalwedha Solapur Highways Private Limited, Mangloor Highways Private Limited, N.A.M. Expressway Limited, KNR Srirangam Infra Private Limited, KNR Shankarampet Projects Private Limited and KNR Tirumala Infra Private Limited.

Any amendment to the policies adopted by the IM Board as set out above shall be undertaken by the IM Board in compliance with applicable law. Notwithstanding this, the policies will stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the unitholders of the Trust.

15. Nomination and Remuneration Policy ("NR Policy")

The Investment Manager has adopted the NR Policy pursuant to a resolution of its board of directors on April 2, 2023. The NR Policy aims to provide a framework for nomination and remuneration of members of the board of directors of the Investment

Manager, its key managerial personnel, and other employees of the Investment Manager. The key terms of the NR Policy are set out below:

(i). The NR Policy reflect the remuneration philosophy and principles of the Investment Manager and the Trust, and consider the pay and employment conditions with peers / competitive market to ensure that pay structures are appropriately aligned.

(ii). The remuneration of the independent directors of the Investment Manager will be paid by way of sitting fees and commission. This remuneration will be determined by the Nomination and Remuneration Committee and recommended to the IM Board for its approval.

(iii). No remuneration shall be payable by the Investment Manager to non-independent directors.

(iv). The Investment Manager's total compensation for its managerial personnel will consist of:

a. fixed compensation;
b. variable compensation in the form of annual incentive;
c. work related facilities and perquisites; and
d. any other component as recommended by the NRC and approved by the Board

(v). KMP of the Investment Manager will also be eligible for work related facilities and perquisites as may be determined through human resources policies issued from time to time based on the grade of the KMP.

16. **Policy on Code of Conduct for Board of Directors and Senior Management Personnel (the "CoC")**

The Investment Manager has adopted the CoC pursuant to a resolution of the IM Board dated April 2, 2023, for all members of board of directors and senior management personnel of the Investment Manager. The senior management personnel of the Investment Manager shall include officers and personnel of the Investment Manager who are members of its core management team, excluding the IM Board, and shall also comprise all members of management, one level below the chief executive officer or managing director or whole time director or manager (including chief executive officer or manager, in case they are not part of the IM Board) and shall specifically include the compliance officer and chief financial officer, as applicable ("**Senior Management Personnel**").

The key terms of the CoC are set out below:

(vi). The CoC enables the Investment Manager to publicly state to the external stakeholders of the Trust (suppliers, customers, consumers, Unitholders, etc.), the way in which they intend to carry out their business and their business in relation to the Trust.

(vii). In accordance with the CoC, the IM Board and Senior Management Personnel should:

a. demonstrate the highest standards of integrity, business ethics, and corporate governance;
b. perform their roles with competence, diligence, in good faith and in the best interests of the Trust and the Unitholders of the Trust;
c. provide expertise and experience in their areas of specialization and share learnings at the meetings of the IM Board with best interests of the Trust and its stakeholders along with the Unitholders in mind. They should point the Investment Manager's management in the 'right' direction based on their experience and judgement;
d. give careful and independent consideration to the affairs of the Investment Manager and the Trust and all documents placed before them to satisfy themselves with the soundness of key decisions taken by the management. They should call for additional information, where necessary, for making such judgements;
e. not engage in any business, relationship or any activity which detrimentally conflicts with the interest of the Trust or bring discredit to the Investment Manager or the Trust. Any situation that creates a conflict of interest between personal interests and the Trust or its Unitholders' interest must be avoided at all costs;
f. follow all the guidelines put forth in the policy for prevention of insider trading;
g. not disclose any confidential / privileged information of the Investment Manager or the Trust and should direct any media queries or approaches to the appropriate spokesperson within the Investment Manager; and
h. not achieve or attempt to achieve any undue gain or advantage either to himself or to his relatives, partners, or associates.

(viii). The CoC also sets out the duties of the independent directors on the IM Board, including, amongst others, (a) undertaking appropriate induction and regularly update and refresh their skills, knowledge and familiarity with the Investment Manager and the Trust; (b) seeking appropriate clarification or amplification of information and, where necessary, take and follow appropriate professional advice and opinion of outside experts at the expense of the Trust;

and (c) striving to attend all meetings of the IM Board and of the committees of the IM Board, which the independent director(s) is a member of.

(ix). All members of the IM Board and Senior Management Personnel shall affirm compliance with the CoC on an annual basis.

17. **Policy to Promote Diversity of Board of Directors (the "Diversity Policy")**

The Investment Manager has adopted the Diversity Policy pursuant to a resolution of the IM Board dated April 2, 2023. The key terms of the Diversity Policy are set out below:

(i). The Nomination and Remuneration Committee shall ensure that the IM Board shall have an optimum combination of non-independent, independent and woman directors in accordance with requirements of the InvIT Regulations, SEBI Listing Regulations and other statutory, regulatory and contractual obligations of the Investment Manager and the Trust.

(ii). The Nomination and Remuneration Committee shall review the profile of the prospective candidates for appointment as a director on the IM Board taking in consideration knowledge, experience, financial literacy / expertise, global market awareness and other relevant factors as may be considered appropriate and the IM Board shall be so formulated with mix of members to maintain high level of ethical standards. The Nomination and Remuneration Committee shall also take into consideration the provisions of the InvIT Regulations, SEBI Listing Regulations and other statutory, regulatory and contractual obligations of the Investment Manager.

18. **Risk Management Policy in relation to the Trust ("RM Policy")**

The Investment Manager has adopted the RM Policy pursuant to a resolution of its board of directors on April 2, 2023. The RM Policy aims to provide a framework for management of risks associated with the business of the Trust. The key terms of the RM Policy are set out below:

(i). *Principles of risk management:* The risk management committee shall provide reasonable assurance in protection of business value of the Trust from uncertainties and consequent losses.

(ii). *General:* Risk management process includes four activities:

a. Risk identification;
b. Risk assessment;
c. Risk mitigation and monitoring; and
d. Reporting.

(iii). *Risk identification:* The purpose of risk identification is to identify internal and external risks specifically faced by the Trust, in particular including financial, operational, sectoral, sustainability (particularly, environment, social and governance related risks), information, cyber security risks or any other risk as may be determined by the Risk Management Committee and identify all other events that can have an adverse impact on the achievement of the business objectives.

(iv). *Risk assessment:* Assessment involves quantification of the impact of Risks to determine potential severity and probability of occurrence.

(v). *Risk mitigation:* All identified risks should be mitigated using any of the following risk mitigation plans:

a. Risk avoidance: by not performing an activity that could carry any risk. Avoidance may seem the answer to all Risks but avoiding Risks also means losing out on the potential gain that accepting (retaining) the risk may have allowed;
b. Risk transfer: mitigation by having another party to accept the risk, either partial or total, typically by contract or by hedging / insurance;
c. Risk reduction: Employing methods/solutions that reduce the severity of the loss; and
d. Risk retention: Accepting the loss when it occurs. Risk retention is a viable strategy for small risks where the cost of insuring against the risk would be greater than the total losses sustained. All Risks that are not avoided or transferred are retained by default.

(vi). *Monitoring and reviewing risks:* The risk management committee shall formulate the policies for effective identification, monitoring, mitigation of the risks. The Risk Management Committee shall take cognizance of risks

which may impact business continuity while framing risk responses. Existing process of Risk Assessment of identified Risks and its mitigation plan will be appraised by the Risk Management Committee to the Board on an annual basis

19. **Vigil Mechanism and Whistle Blower Policy ("Whistleblower Policy")**

The Investment Manager has adopted the Whistleblower Policy pursuant to a resolution of its board of directors on April 2, 2023. The key terms of the Whistleblower Policy are set out below:

(i). Any communication made in good faith that discloses or demonstrates information that may evidence unethical or improper activity, including of a Leak (as defined in the UPSI Policy) ("**Protected Disclosure**") should be made by the relevant whistle-blower ("**Whistleblower**") to the Compliance Officer.

(ii). Protected Disclosure should be in writing so as to ensure a clear understanding of the issues raised and should be either typed or written in legible writing in English, Hindi or a regional language. The protective disclosure or reporting can also be made by electronic mail.

(iii). Protected Disclosure should be forwarded with a cover letter which shall bear the identity of the Whistleblower.

(iv). Protected Disclosure should be factual and not speculative and should contain as much specific information as possible in order to allow proper investigation.

(v). The Whistleblower is not required or expected to conduct any investigation and shall not have the right to participate in any investigation conducted by the Compliance Officer in relation to Protected Disclosure made by such Whistleblower.

(vi). The Compliance Officer, on finding the Protected Disclosure to be proper, shall forward the details of the Protected Disclosure to the Empowered Committee (as defined in the Whistleblower Policy). The Empowered Committee will apply due diligence on Protected Disclosure received from the Compliance Officer and conclude if it is of administrative or of disciplinary nature and whether it requires further investigation or decide appropriate course of action including closure of the complaint. The decision taken by the Empowered Committee on the Protected Disclosure along with its justification shall be put up to Board or to any person authorised by the Board in this regard for approval.

(vii). The Investment Manager shall ensure that no Whistleblower who has made any Protected Disclosure is subjected to victimization by initiation of any proceedings or otherwise merely on the grounds that such Whistleblower had made any Protected Disclosure or rendered assistance in any inquiry.

(viii). If any Whistleblower is being victimized or likely to be victimized on the ground of making any Protected Disclosure, filing a complaint or rendering assistance in any inquiry pursuant to the Protected Disclosure made by such Whistleblower, such Whistleblower may approach or file an application to the chairman, managing director or the members (including the chairman) of the Audit Committee of the Investment Manager seeking redress in the matter and such authority shall take such action as it deems fit and may give suitable directions to protect the Whistleblower being victimized and avoid any further victimization.

(ix). Every effort will be made to protect Whistleblowers' identity and under no circumstances shall such identity be discussed with any unauthorized person. Utmost care should be taken by the Compliance Officer that the Protected Disclosure made by any Whistleblower is kept confidential and identity of the Whistleblower is not revealed. In case any such information is disclosed, necessary action shall be taken against the concerned employee making such disclosure.

2. Initial Portfolio Assets

Representatives on the Board of Directors of the Initial Portfolio Assets

The Investment Manager, in consultation with the Trustee, has appointed the majority of the members of the board of directors of each of the Initial Portfolio Assets, in accordance with the requirements prescribed under the InvIT Regulations, upon acquisition of the Initial Portfolio Assets by the Trust.

Unless otherwise stated, the information contained in this section is derived from the CRISIL Report. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry publications are also prepared based on information available as of specific dates and may no longer be current or reflect current trends. Accordingly, investment decisions should take these limitations into account. All references to years refer to calendar years except as otherwise stated. References to Indian fiscal years are to the one-year period ending March 31 of the named year.

Overview of the Indian Economy

India's Gross Domestic Product ("**GDP**") grew at a CAGR of 5.4%, growing to ₹ 147 trillion in Fiscal Year 2022 from ₹ 87 trillion in Fiscal Year 2012. Fiscal Year 2021 was a significant aberration from this trajectory, primarily on account of the COVID-19 pandemic. At approximately ₹ 136 trillion in Fiscal Year 2021, India's GDP (in absolute terms) was below the Fiscal Year 2019 level of approximately ₹ 140 trillion.

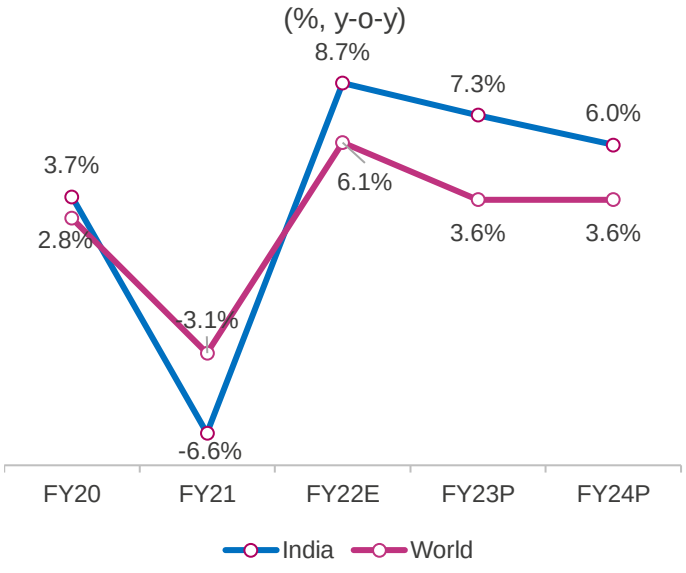
After contracting in the first half of Fiscal Year 2021 due to the COVID-19 pandemic, the economy rebounded in the second half of the year. The economy got into recovery mode, with GDP expanding 20.1% on-year in the first quarter of Fiscal Year 2022, 8.4% in the second quarter and 5.4% in the third quarter before slowing to 4.1% in the fourth quarter primarily due to a sharp decline in private final consumption expenditure.

Outlook for GDP growth in India

Fiscal Year 2022 GDP growth at 8.7%

Fiscal Year 2022 had been a story of two halves — the first half characterised by a base effect-driven recovery amid the challenges associated with resurgence in COVID-19 infections, and the second half seeing a more broad-based growth, as vaccine rollout and less stringent nationwide restrictions supporting lagging sectors. The gains made by the economy in the fourth quarter of Fiscal Year 2021 had evaporated in the first quarter of Fiscal Year 2022 on account of the fierce second wave, which led to localised lockdowns in most states. As per the provisional estimates released by the National Statistical Office, India's real GDP grew at 8.7% in Fiscal Year 2022, compared with 8.9% estimated in February.

India is expected to surpass global GDP growth in the next two fiscal years as represented below:



CRISIL EXPECTS INDIA'S GDP TO GROW AT 7.3% IN FISCAL YEAR 2023, GROWING FASTER THAN THE WORLD BACKED BY BROAD BASING OF ECONOMIC ACTIVITY, ESPECIALLY THE UPTICK IN THE CONTACT INTENSIVE SERVICES AND FORECAST OF A NORMAL MONSOON LENDING THE MUCH NEEDED SUPPORT TO GROWTH THIS FISCAL.

Note: Forecasts for World are for calendar year; Fiscal Year 2020 corresponds to 2019 and so on; P: Projected; India numbers for Fiscal Year 2020, 2021 and 2022 are based on Ministry of Statistics and Programme Implementation's latest GDP estimates and Fiscal Year 2023 onwards are CRISIL Research's forecast. World GDP growth rates are from IMF world economic outlook update as of April 2022.

Overview of the Infrastructure Sector in India

Developing and modernising the infrastructure sector has been a priority area for the GoI and has witnessed increasing public investments and budgetary support. Further, the government has also undertaken several reforms and initiatives in the infrastructure sector which has resulted in robust secular growth in most of the segments within the sector. Road

construction by NHAI registered a strong pace, growing to 4,673 kms (12.8 km per day in Fiscal Year 2022 from 3,071 kms (8.4 kms per day) in Fiscal Year 2018. The investment in roads and highways sector has risen from ₹ 1.7 trillion in Fiscal Year 2018 to ₹ 2.9 trillion in Fiscal Year 2022, registering a rise of more than 1.7 times during such period. Civil aviation has witnessed strong growth as well. India's air passenger traffic grew at a CAGR of approximately 8% from around 265 million in Fiscal Year 2017 to around 341 million in Fiscal Year 2020 before declining to 115 million in Fiscal Year 2021 majorly led by restrictions on account of the pandemic. In Fiscal Year 2022 passenger traffic increased to 180 million. In ports and shipping sector, the installed capacity of major ports in India rose to 2,346 million tonnes in Fiscal Year 2021 as compared to 1,869 million tonnes in Fiscal Year 2017.

National Infrastructure Pipeline ("**NIP**") has been launched by the GoI for Fiscal Year 2020 to 2025, to boost infrastructure. As per the Final Report of NIP Task Force, the NIP is expected to have an investment of ₹ 111 trillion during the Fiscal Years 2020 to 2025. Investments in energy (24%), roads (18%), urban (17%), and railways (12%) will account for over 70% of the projected capital expenditure during the said period. As per the economic survey, NIP will be funded by the Central Government (39%), State Government (40%), and the private sector (21%). As per the official India investment grid website accessed on June 20, 2022, 2,420 projects are currently under development covering over 34 sub sectors.

The Government of India set up the Public Private Partnership Appraisal Committee ("**PPPAC**") responsible for the appraisal of public-private partnership ("**PPP**") projects. During Fiscal Year 2020, PPPAC recommended four projects with a total project cost of ₹ 50.41 billion. Of these four projects, two were tourism related projects, one was a railways project pertaining to upgradation of railway stations and one was a port expansion project. In Fiscal Year 2021, PPPAC recommended six projects with total project cost of ₹ 444 billion. Of these six projects, three were railway sector projects, one was a Ministry of Home Affairs project (eco-tourism projects), one was a Ministry of Shipping project and one was a telecom project pertaining to deployment of Bharat Net optical fibre. Further, in Fiscal Year 2022, PPPAC approved 3 projects worth ₹ 316 billion, of which two are railways projects and one is a Ministry of Home Affairs project.

In Fiscal Year 2021, the GoI approved the continuation of the revamped Infrastructure Viability Gap Funding ("**VGF**") scheme till Fiscal Year 2025. The objective of the revamped VGF scheme is to attract PPP projects and facilitate the private investment in social sectors such as, health, education, waste water and solid waste management and water supply.

Review of Roads Infrastructure in India

The share of road transport in India's GDP has been stable at approximately 3.3% from Fiscal Years 2012 to 2020 and stood at 2.6% in Fiscal Year 2021.

Road Network in India

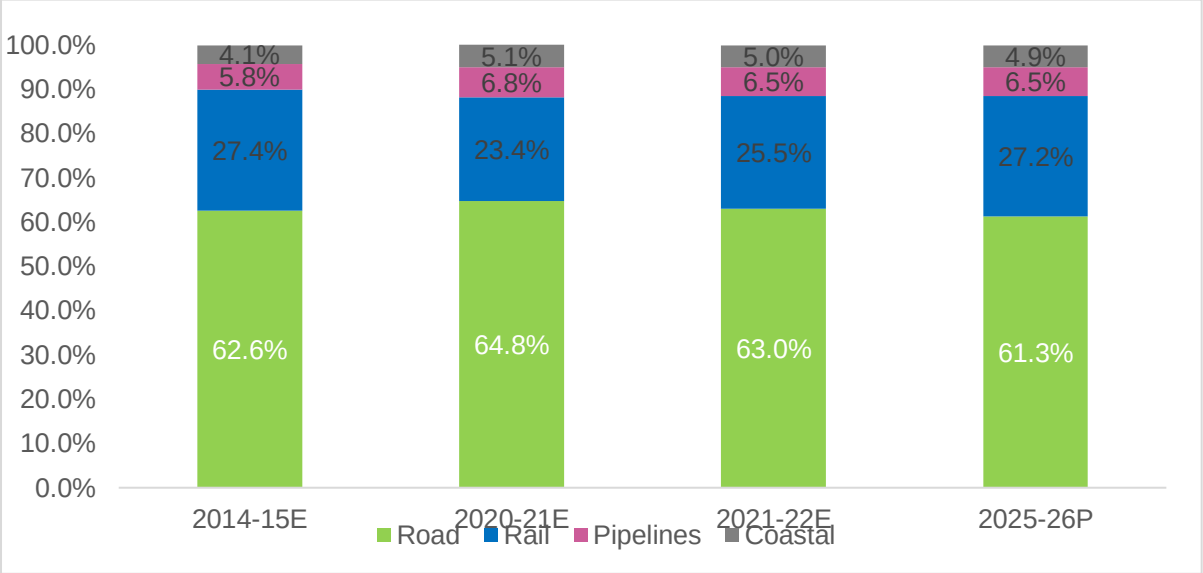
India has the second-largest road network in the world, spanning 6.372 million km as of Fiscal Year 2022. Road transportation, the most frequently used mode of transportation in India, accounts for approximately 86% of passenger traffic and approximately 64% of freight traffic as of Fiscal Year 2022. Although Indian national highways span nearly 140,995 km, constituting just 2% of road length, they accounted for about 40% of total road traffic in Fiscal Year 2022. The secondary system of roads comprises of state roads and major district roads, which accounted for the remaining 60% of traffic and 98% of road length. A detailed break-down of national highways, state and rural roads is as follows:

(in km)

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY 22
National highways	97,991	101,011	114,158	126,350	132,500	132,995	136,440	140,995
State highways	167,109	176,166	175,036	186,908	186,528	194,900	176,818	171,039
Other roads	5,207,044	5,326,116	5,608,477	5,902,539	6,067,269	6,165,660	5,902,539	6,059,813
Total	**54,72,144**	**56,03,293**	**58,97,671**	**62,15,797**	**63,86,297**	**64,93,555**	**6,215,797**	6,371,847

Indian freight traffic analysis

Roads are expected to continue having a dominant share in the overall freight movement. In Fiscal Year 2022, roads are estimated to have a share of approximately 63% in overall freight movement as compared to approximately 26% of rail mode of transport. According to CRISIL, road freight traffic is expected to grow at a CAGR of 4-6% (in billion tonne kilometers ("**BTKM**")) between Fiscal Years 2022 and 2026. A bar chart representing the share of roads in total freight movement (in BTKM) is as follows:



Note: E: Estimated; P: Projected

Overview of PPP framework and models in operations

PPP is an arrangement between a government/statutory entity and a private sector entity for enabling the provision of public assets or public services, wherein the private sector entity undertakes investments and/or management of the public good for a specified period of time. There is a defined allocation of risk between the private sector and the public entity. The private entity receives performance-linked payments that conform with (or are benchmarked to) specified and pre-determined performance standards, measurable by the public entity or its representative.

A summary of the various types of PPP Models relevant to the roads sector are discussed below:

Type of project	**Description**	**Development risk**	**Financing risk**	**Traffic risk and accrual of toll fee collection**	**Revenue for private party**	**Concession period**	**Award criteria**
BOT-toll	Private party builds road, undertakes O&M and collects toll	Concessionaire	Concessionaire	Concessionaire	Toll	Around 20-30 years for NHAI and other authorities	Highest revenue sharing bid/ highest premium/ lowest equity support
BOT-annuity	Private party builds road, undertakes O&M and collects annuity from the granting authority	Concessionaire	Concessionaire	Authority	Annuity payment	Around 15-20 years for NHAI and other authorities	Lowest annuity

Type of project	Description	Development risk	Financing risk	Traffic risk and accrual of toll fee collection	Revenue for private party	Concession period	Award criteria
BOT-HAM	Private party builds road, undertakes O&M. Gets 40% of lifetime annuity receivable during construction and 60% in semi-annual installments after completion of construction	Concessionaire	Concessionaire – 60% and Authority – 40%	Authority	Construction grant plus annuity payments, interest on annuities, inflation indexed O&M payments	15 years of operations plus additional construction period	Lowest project cost plus O&M cost
EPC	Private party builds road, based on cost incurred by the government	Concessionaire	Authority	Authority	Contracted amount	Not Applicable	Lowest EPC quote
Operate Maintain Transfer	Private party collects toll and undertakes O&M and major maintenance	No development risk except minimal risk in case of paved shoulders	Concessionaire	Concessionaire	Toll	Up to nine years for NHAI projects	Highest % of toll revenue share or highest premium per year to be shared with NHAI
Tolling	Private party pays the estimated toll upfront to the authority and collects the toll during concession period	No development	Concessionaire	Concessionaire	Toll	Around one year for NHAI projects	Highest revenue-sharing bid
TOT	Private party pays an upfront Bid Concession Fee (summation of NPV of free cash flows basis concessionaire estimates) to the authority, undertakes O&M plus certain capital expenditures and collects the toll during concession period	Initial rectification works carried out by Concessionaire. Authority responsible for any lane upgradation works during the concession period.	Concessionaire	Concessionaire	Toll	15, 20, 30 years (as per the TOT bundles of NHAI in 2021-2022)	Highest upfront payment

Note: Development risk refers to construction risk in developing a road project

A few of these models are described in some detail below:

Build-operate-transfer (BOT)

These contracts are typically PPP agreements wherein a government agency provides a private player the rights to build, operate and maintain a facility on public land for a fixed period, after which assets are transferred back to the public authority at the end of the contract period.

Funding is arranged by the concessionaire, through a mix of equity and external debt. Under the basic BOT mode, the concessionaire charges a fee to the users of the project/ facility, and may either transfer the entire user fee collected to the authority or may retain the entire amount as revenue. BOT contracts are, therefore, classified into the following types:

Annuity-based contract: Under this contract, the concessionaire is responsible for the construction and maintenance of the project during the concession period. Variability in traffic and user fee gives rise to revenue risk, which is borne by the authority. However, the concessionaire generates revenue through fixed annuity payments received from the authority, over the concession period. Since this annuity payment is a cost to the authority, the contract is awarded to the lowest bidder. Tolls charged under these contracts are generally regulated by a policy or a public agency.

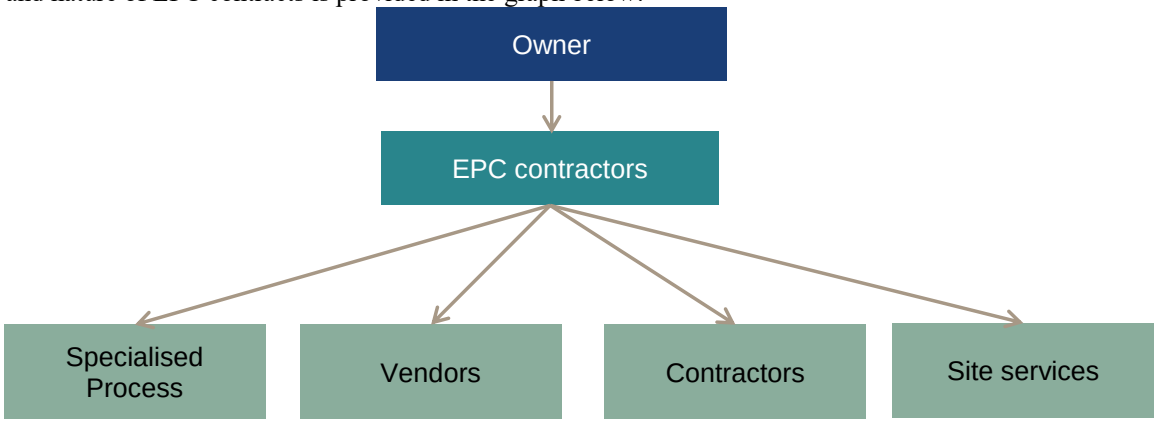
Toll-based: Under this model too, the concessionaire is responsible for the construction and maintenance of the project, post which the project's ownership is transferred to the public authority. However, the toll collected is retained by the concessionaire and not transferred to the authority. Therefore, the concessionaire bears the revenue risk during the concession period. As in BOT annuity-based projects, toll charged under these contracts is generally regulated by a policy or a public agency.

Hybrid Annity Model (HAM)

This is a mix of EPC and BOT (annuity) model. In this model, the project cost is shared between the authority and the concessionaire in a 40:60 ratio. This model aims to lower the financial burden on the concessionaire during project-implementation phase. Compared to EPC projects, the shift to HAM will ease cash flow pressure on NHAI and also lower project risk for concessionaires since NHAI will bear the risk of traffic volumes and the concessionaire earns fixed annuity payments. The model will help concessionaires to participate in more projects since their equity contribution per project will now be lower. This model will also encourage banks to lend to road projects because of the stable revenue stream from NHAI.

EPC

EPC contracts are fixed-price contracts, wherein the contractor undertakes the responsibility of designing the project, either through an in-house design team or by appointing consultants. Unlike item rate and lump sum turnkey contracts, the contractor is allowed to innovate on the project design. Based on these designs, the contractor draws up cost estimates and accordingly bids for the project. Technical parameters, based on the desired output, are specified in the contract. The scope and nature of EPC contracts is provided in the graph below:



Toll Collection

Toll collection, as a separate business model, evolved in 2009. Under this model, the authority invites bids from private players to collect toll on roads constructed under EPC and BOT-annuity. It is used for short-duration projects, typically

those lasting 12 months. The private player with the highest bid is awarded the project. The methodology for calculating user fee is pre-determined by the contracting authority. The right to collect user fees during the concession period lies with the private player. A contract of this category involves negligible to minimal road construction and maintenance.

Electronic toll collection ("**ETC**") is a strategic focus area for regulatory and administrative bodies involved in the process of toll collection. It presents several advantages such as limiting toll leakages, reducing waiting time for vehicles, and improving overall traffic flow at toll plazas. In the future, this may result in significant changes in toll collection operating procedures, followed in each of the PPP models.

Toll, operate and transfer

The "toll, operate and transfer" ("**TOT**") model is a relatively new PPP model to spur private participation in the roads sector. In this model, globally, the concessionaire pays a one-time upfront concession fee to the Authority. The TOT concessionaire will then be allowed to operate and toll the project stretch during the concession period. Any initial improvement of the road asset required may be taken up by the concessionaire as a part of the agreement in the TOT model. Further, with the implementation of FASTags, TOT has become more attractive as its able to eliminate cash handling and plug leakages in the system.

The key differences between the tolling and TOT models are:

In the tolling model, the concession period is typically of a shorter duration (approximately one year for NHAI projects) whereas in the TOT model, the concession period is longer (approximately 15-30 years). The NHAI has reduced the concession period to 15 and 20 years in recent tenders pertaining to TOT bundle 5 onwards.

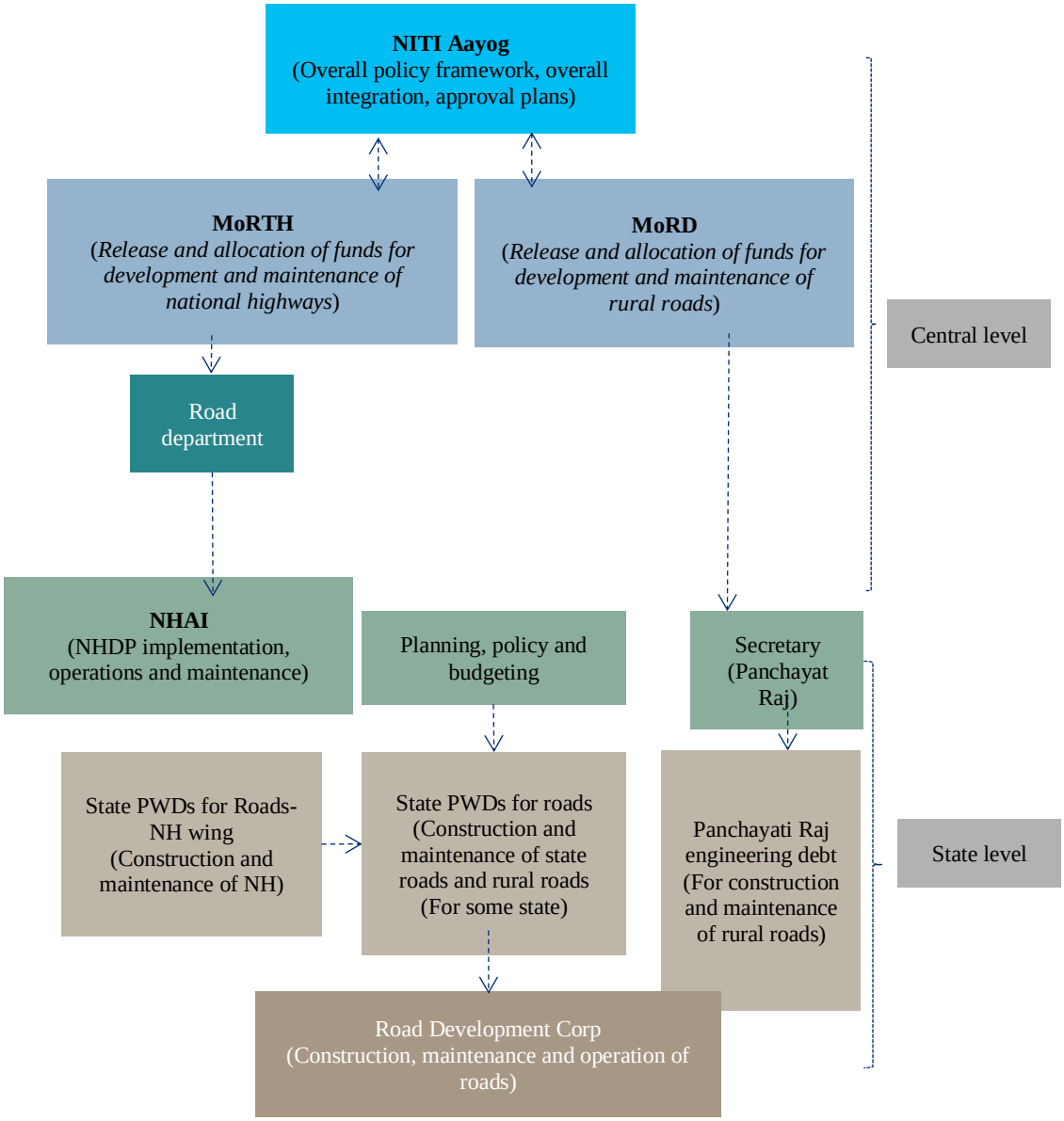
In the TOT model, the concessionaire has the responsibility to maintain the project stretch, which is not the case in the tolling model.

Over the past four years, NHAI has been able to successfully monetise 4 TOT bundles and raise approximately ₹ 230 billion and another ₹ 80 billion through InvITs.

As of June 2022, NHAI has offered 10 bundles under the TOT framework. Request for proposals for TOT Bundles 6, 7 and 8 were released in August 2021 and bids were submitted in January 2022. However, TOT Bundles 6 and 8 were cancelled in April 2022. NHAI had also launched its Infrastructure Investment Trust in November 2021 and they have also secured debt funding of ₹ 97.31 billion for the Delhi-Mumbai Expressway. Further, request for proposals for TOT Bundles 9 and 10 were released in March 2022 and the bid submissions have been completed and the bids are under evaluation. For Fiscal Year 2023, NHAI plans to raise ₹ 200 billion by monetisation of road assets of about 1,500 to 2,000 kms.

Institutional framework for roads

In January 2015, the government replaced the Planning Commission with the National Institution for Transforming India ("**NITI**") Aayog, a multi-tiered structure providing strategic and technical advice to the central and state governments. At the central government level, several line ministries handle transport planning, coordination and policy-setting, with NITI Aayog coordinating the entire effort. A graph representing the organisation framework is presented below:



Policy Framework for the roads sector

Recent policy reforms provide a significant push to the sector

In order to encourage and facilitate private sector investment and participation in the roads sector, the central government has undertaken certain policy measures and provided certain fiscal incentives. The most significant policy reforms in recent times and their impact are discussed below.

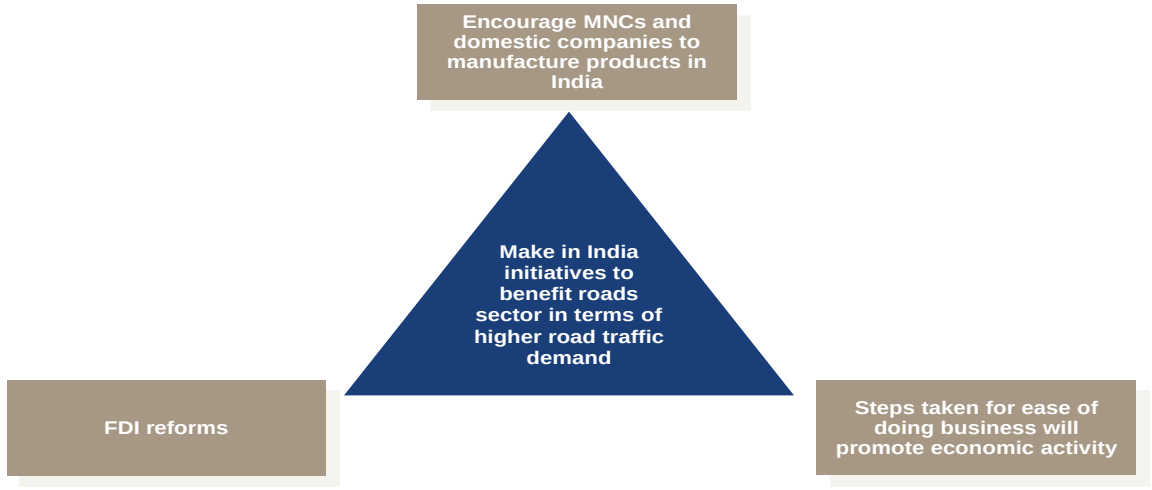
Policy Reforms	Impact
Amendments to EPC Model Concession Agreement • Reduction of various timelines, including for approval/ clearance for area under forest or sanctuary; • Timely completion of milestones and project, and any failure to achieve these may result in penalty and blacklisting of developer; • Lower compensation and longer tenure for maintenance obligations of contractor. Defect	• The authority's obligations increased to enable quicker land acquisition; and • Developer's working capital needs increased, and they are also responsible for timely completion of project

Policy Reforms	Impact
liability period increased from four years to 10 years; and • Higher interest on mobilisation advance paid to authority. Earlier recovery of mobilisation advance by the authority. Release of retention money against bank guarantees discontinued.	
*Introduction of Hybrid Annuity Model ("**HAM**") in 2016* • Of the total project cost, 40% is to be funded by the government and the remaining by the concessionaire; • Construction support is to be disbursed in five equal instalments of 8% each and the timing of each such payment shall be linked to percentage of project cost spent by the concessionaire; • Traffic risk will be borne by the government with developers receiving fixed annuities; and • 80% of land to be provided prior to appointed date.	• With land being acquired and other clearances already in place before appointed date, construction risk is lower; • Lenders will be assured a steady stream of inflows as traffic risk will entirely be borne by the government; and • Low risk and lower capital requirements are expected to entice private players as well as lenders towards these projects and gradually help increase private participation in the sector.
*Amendments to HAM - Model Concession Agreement ("**MCA**"), 2020* • Back-ending of premium payment and lenders receive first charge on all receivables; • Redefinition of project milestones along with a deemed termination of projects; and • Maintenance obligations and toll fee notifications.	• Since premium payment only begins in the fourth year of completion, developers and lenders receive some comfort as interest payments are high in the first three years of operations; • Deemed termination of projects ensures troubled projects are terminated without delay, thereby avoiding problems that previously existed with prolonged delay of projects; and • Amendments with regard to toll fees and maintenance of national highways will provide better protection to the users of highways.
Exit Policy On August 26 2015, the Cabinet Committee on Economic Affairs ("**CCEA**") amended its earlier approval dated May 13, 2015, to allow 100% equity divestment after two years of completion for all BOT projects, irrespective of year of award. The previous policy allowed such divestments only for projects awarded prior to September 30, 2009. While the previous policy allowed the funds obtained through such divestments to be used only for completion of the concessionaire/promoter's other pending BOT road projects, the new policy allows the proceeds to be used to complete any highway projects, any power sector projects or also to retire their debt in any other infrastructure projects. The exit policy has been changed to 6 month for HAM projects and it remains 2 years for BOT as per the latest MCA changes in 2020.	This move helped closing of stake sale transactions announced in the last one year and help free up capital of developers, which can be used to repay debt or invest in new projects.
NHAI fund infusion	

Policy Reforms	Impact
On May 13, 2015, the CCEA permitted NHAI to infuse funds in projects stuck in advanced stages of completion. Below are the broad contours of the policy: • Government to look at one-time fund infusion installed projects, where 50% work has already been done; and • NHAI to have the first charge on toll revenue.	This policy improved developers' cash flows through toll collections and also improved their debt servicing ability. However, as NHAI will have the first charge on receivables, lenders are hesitant to allow such a fund infusion. Hence, this policy may not have a significant impact in the near future.
Payment of 75% of arbitration claims In August 2016, the ministry introduced a policy with regard to payment of 75% of arbitration claims to the concessionaires. According to it, if an arbitration claim has been awarded in favour of a private concessionaire in a lower court/tribunal and the government agency has appealed against it in a higher court/tribunal, then the private player can receive 75% of the claimed amount. It will have to provide to the authorities a bank guarantee of an equivalent amount to the government agency.	This policy helped private players facing financial problems and having substantial amount of claims pending with NHAI. This was also expected to help kick-start stalled projects on account of fund infusion by developer and provide some relief to lenders because of loan repayment.

Impact of 'Make in India' initiative on roads sector

Launched in September 2014, the 'Make in India' campaign covers 25 major sectors in the economy, including roads and highways. The initiatives under the campaign, such as encouraging multinational companies ("**MNCs**") to manufacture products in India, taking steps to improve the ease of doing business, as well as FDI reforms (as represented in the graph below), are expected to benefit the roads sector in terms of increase in traffic movement.



Overview of government initiatives

New Tolling Policy (2011)

Toll Act: The central government is authorised to levy a fee (toll) under Section 7 of the National Highways Act, 1956, for public-funded projects and under Section 8-A of the said Act, for private investment projects. The government can levy fees on all sections of national highways (irrespective of four or two lanes), tunnels, bypasses and bridges with specific cost criteria.

Fee Structure: Toll charges are based on rates notified by the government. The fee for use of a section of the national highways of four or more lanes for the base year Fiscal Year 2008 shall be the product of the length of such a section multiplied by the specified rates.

Overview of National Highways Development Project

National Highways Development Project ("**NHDP**") encompasses building, upgradation, rehabilitation and broadening of existing national highways. The project is executed by NHAI, in coordination with the public works departments of various states. NHAI also collaborates with the Border Roads Organization for the development of certain stretches. NHDP is being implemented in seven phases.

The projects are awarded to private players either on EPC (cash) or on build-operate-transfer (BOT) basis and now on the newly introduced hybrid annuity model. NHDP cash contracts are mainly financed through budgetary allocations from the Central Road Fund (CRF), negative grants/premium received, and toll revenue. Loans and grants are also received from the World Bank and Asian Development Bank.

Bharatmala Pariyojana

Bharatmala Pariyojana is an umbrella project of the central government since 2015 that aims to improve efficiency in the roads sector. It is expected to supersede the NHDP and envisages the construction of 65,000 km of highways under the following categories: national corridor (north-south, east-west, and golden quadrilateral), economic corridor, inter-corridor roads, and feeder roads. As per the Ministry of Road Transport and Highways announcements in 2017, Bharatmala Pariyojana, along with the other schemes currently undertaken, were estimated to require a total outlay of ₹ 6.9 trillion till Fiscal Year 2022.

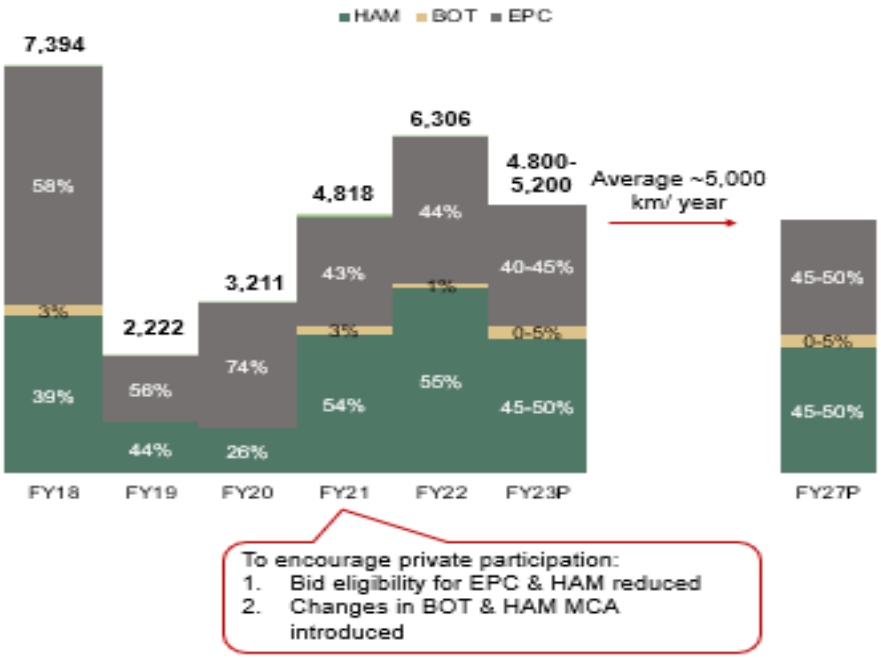
Phase-I of the scheme envisages development of about 24,800 km length of national highways/roads, plus residual 10,000 km of NHDP between Fiscal Years 2018 and 2022. Awarding under Bharatmala has begun from Fiscal Year 2018 and we believe it will stretch till Fiscal Year 2025 for Phase 1. Components of Phase I of Bharatmala Pariyojana are as follows:

Category	Description	Total length (Km)	Upgrade proposed in Phase I (Km)
National Corridor efficiency improvement	Lane expansion, de-congestion of existing National corridor	13,100	5,000
Economic Corridors development	Connecting economically important production & consumption centres	26,200	9,000
Inter-corridor and feeder routes development	Inter-connection between economic corridors, first mile and last mile connectivity	15,500	6,000
Border and international roads	Connectivity to border areas and boosting trades with neighbouring countries	5,300	2,000
Coastal and port connectivity roads	Connectivity to coastal areas to enable port-led economic development	4,100	2,000
Expressways	Greenfield expressways	1,900	800
Total		66,100	24,800

Review and outlook of investments in national highways

According to CRISIL, the awarding momentum is likely to moderate. In order to revive the roads sector, amidst the pandemic-led disruption – NHAI awarded 4,818 kms in Fiscal Year 2021, a three-year high. Of these, 54% were awarded under the HAM, 3% under the BOT mode and rest under the EPC mode. Favourable changes in the BOT and HAM agreements, and relaxation of bidder eligibility criteria indicated a clear policy shift last fiscal year to improve private-sector participation.

Fiscal Year 2022 witnessed even higher awarding, with NHAI awarding 6,306 kms with 55% projects under HAM. The awarding momentum is expected to moderate over the medium term at approximately 5,000 km per year with similar share of HAM, EPC and BOT, as shown in the graph below:



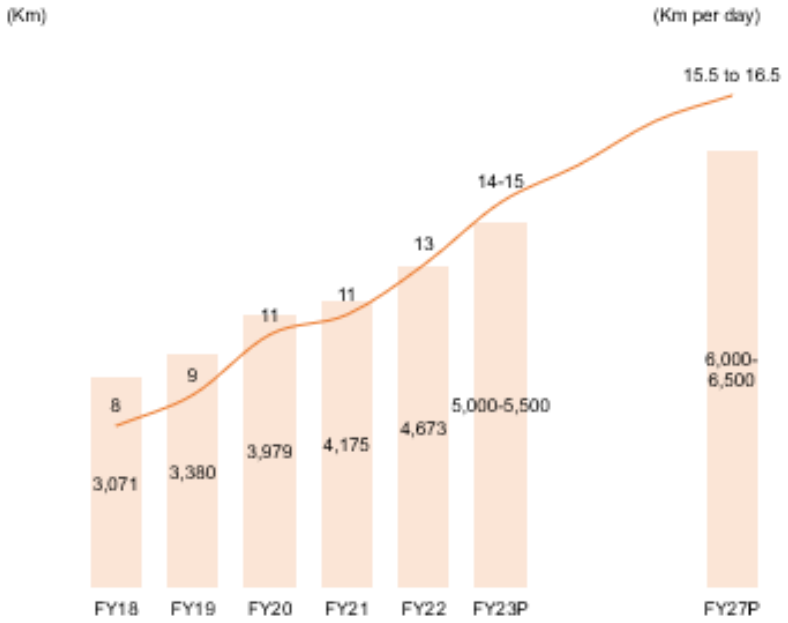
P: Projected

Further, developers will be able to free up capital through stake sales supported by the strong pipeline of projects under Bharatmala Pariyojana and the NIP. Furthermore, despite the lockdowns and labour-related issues, developers made up for lost time and construction at NHAI projects rose 5% on-year to 4,175 kms in Fiscal Year 2021. Given the acceleration in project awards, sharper focus on resolving land acquisition issues, and the 'Atmanirbhar Bharat' initiatives to ease liquidity (monthly milestone payments, release of retention money, reduction in performance security and extension of 3-6 months in milestones and Scheduled Commercial Operation Date) for EPC road players, the pace of construction should continue to increase steadily.

As COVID-19 hit India, and the first lockdown was imposed on March 25, 2020, road construction activities came to a standstill. While some resumption was allowed from April 20, 2021 itself, normalcy returned post monsoons. Shortage of labour and mobilization of raw materials were some of the biggest challenges developers were facing during the lockdown amidst the fear of the virus spread.

By the time the nationwide lockdown was announced, highway construction under NHAI in Fiscal Year 2020 was already at 3,979 km, 18% higher than the 3,380 km constructed in Fiscal Year 2019. A shift in focus to swifter execution has paid off for NHAI. In Fiscal Year 2022, NHAI constructed 4,673 kms, 12% higher due to swifter focus on execution.

CRISIL Research expects Fiscal Year 2023 NHAI construction to be in the range of 5,000-5,500 kms and to rise steadily to approximately 16 km per day by Fiscal Year 2027 as shown in the chart below:



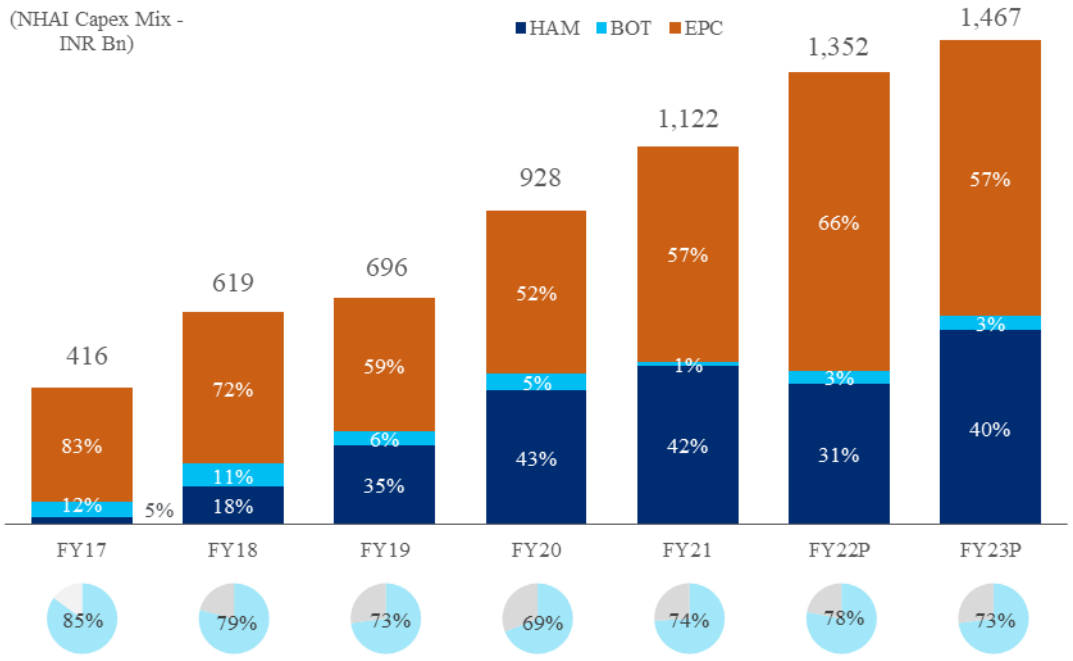
Policy push for HAM enabled higher share in awarding concessions

The Ministry of Road Transport and Highways and NHAI, post multiple suggestions from various stakeholders have amended the HAM Model Concession Agreement across the below mentioned parameters in October 2020. These are largely aimed to protect developers' returns and ease their liquidity. A summary of the changes to HAM Model Concession Agreement and their impact is presented below:

	Old Clause	**Revised Clause**	**Impact**
Annuity Payments	Interest on annuity payment linked to RBI determined Bank Rate +3%	Interest on annuity payment linked to average of one year MCLR of top 5 Scheduled Commercial banks + 1.25%	Differential between cost of borrowing and interest on annuity reduced, thus preventing erosion of developers' returns due to RBI repo rate changes
Milestone Payments	5 instalments, each equal to 8% of the Bid Project Cost	10 instalments, each equal to 4% of the Bid Project Cost	Quicker payments helping developers' liquidity
Change in ownership	Original sponsor / concessionaire shall hold at least 26% of equity during construction period and 2 years thereafter	Original sponsor / concessionaire shall hold at least 26% of equity during construction period and 6 months thereafter	Quicker stake sell-off would ease up developers' balance sheets to bid for new projects
Financial Closure	No clarity on amount on FC	FC to be undertaken for an amount no lower than either: 1. Total Project Cost (60% of BPC); or 2. 10% less than (Estimated Project Cost minus 40% of Bid Project Cost)	Would likely prevent termination of projects due to inadequate financing
Dispute Resolution	In case of a dispute, either party may call upon the Independent Engineer to mediate.	Failing mediation by the Independent Engineer, either party may require such dispute to be referred to the Dispute Resolution Board.	Quicker dispute resolution mechanism to prevent stuck projects.

According to CRISIL of the approximately 7,000 kms of NHAI tenders floated between December 2020 and August 2021, 60-70% projects are under HAM and rest are under the EPC mode. This is the highest share of HAM in the past two years. Despite the higher HAM awarding, according to CRISIL, EPC projects continue to represent a significant majority of

NHAI's capital expenditure. Thus, NHAI funding would remain critical to sustain the sector forward. A bar chart of NHAI capital expenditure mix for the periods indicated is reproduced below:

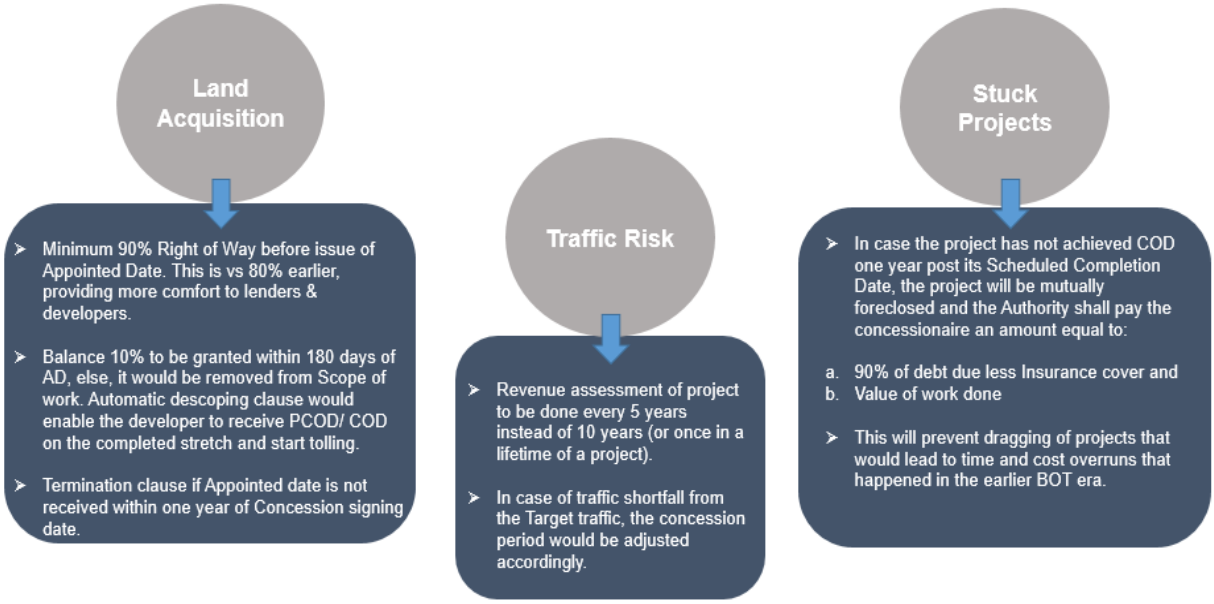


Number of lanes in highways upgraded over the past five fiscal years

NHAI has also focused on the number of lanes in national highways. Single lane roads decreased from 32% in 2014-2015 to 21% in 2015-2016. Two lane roads increased from 47% to 56%, while four lane roads increased from 12% to 25% during the same period.

Changes in BOT MCA were also introduced

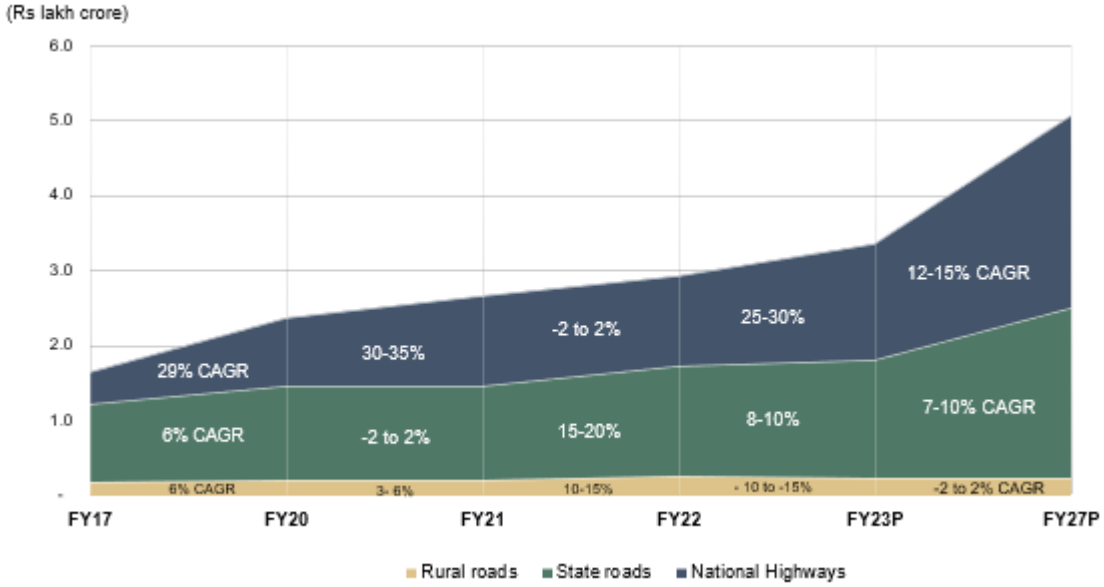
In order to improve private participation *via* the BOT-toll mode, NHAI and the Ministry of Road Transport and Highways also introduced changes to the BOT MCA aimed at key issues such as land acquisition, revenue assessment in case of traffic shortfall and stuck projects. According to CRISL, despite these changes, they don't expect any BOT awarding this fiscal year due to the uncertainty in traffic growth on account of COVID-19 restrictions and muted economic activity this fiscal year. The revamped BOT MCA is as follows:



Despite COVID-19 induced lockdowns, national highways capital expenditure grew by 30-35% in Fiscal Year 2021, boosted by COVID relief measures taken under Atmanirbhar Bharat

According to CRISIL, despite the setbacks witnessed in the first in Fiscal Year 2021, where state expenditure was constrained due to the COVID-19 pandemic and then in Fiscal Year 2022 where elongated monsoon hampered national highway construction, the sector's medium term growth story remains intact. This is based on comfort derived from the Bharatmala Pariyojana, NIP pipeline, higher awards in Fiscal Year 2022 and revival in state government expenditure.

The chart below represents investments towards national highways for the periods indicated:



E: Estimated, P: Projected
Note: Investments excludes land acquisition costs

Outlook of toll collection and remittance on national highways

According to CRISIL, the total toll collection is estimated to have reached ₹ 430 billion in the Fiscal Year 2022. Further, toll collections are expected to grow at a CAGR of 9.5-10.0% between Fiscal Years 2022 and 2027 on a like-to-like basis and to grow at 18-19% considering new road additions and subsequent tolling on them over the same period. The growth will be driven by factors such as improvement in overall economic activity, efficiency gains due to removal of check posts post implementation of GST, increase in both passenger and commercial vehicles, strong execution pipeline of road and highway projects, better compliance and blocking of leakages due to electronic toll collection.

BUSINESS

Some of the information in this section, including information with respect to our plans, strengths, and strategies, contain forward-looking statements that involve risks and uncertainties. You should read "Forward Looking Statements" on page 18 for a discussion on the risks and uncertainties related to those statements and also "Risk Factors", "Summary of Combined Financial Statements", "Projections of Revenue From Operations and Cash Flow from Operating Activities" and "Discussion and Analysis by the Directors of the Investment Manager of Financial Condition and Results of Operations and Cash Flows of the Initial Portfolio Assets of the Trust" on pages 63, 33, 461 and 246, respectively, for a discussion of certain factors that may affect our business, financial condition or results of operations. Our actual results may differ materially from those expressed in or implied by these forward-looking statements. Our fiscal year ends on March 31 of each year, and references to a particular Fiscal are to the twelve months ended March 31 of that year. Unless otherwise stated or the context requires otherwise, the financial information included herein is based on our Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum. For further details, please see the section entitled "Summary of Combined Financial Statements" on page 33.

Unless otherwise stated or the context requires otherwise, references in this section to "we", "our" or "us" are to Cube Highways Trust along with the Initial Portfolio Assets. However, for the purpose of the Audited Special Purpose Combined Financial Statements, references to "we", "us", and "our" refers to the Initial Portfolio Assets. We have included various operational and financial performance indicators in this section, some of which may not have been derived from our Audited Special Purpose Combined Financial Statements and which may not have been subject to an audit or review of the auditors. The manner in which such operational and financial indicators are calculated and presented, and the assumptions and estimates used in such calculations, may vary from that used by other entities in the business similar to ours. Investors are accordingly cautioned against placing undue reliance on such information in making an investment decision and must evaluate such information in the context of the Audited Special Purpose Combined Financial Statements.

Unless stated otherwise or the context otherwise requires, industry and market data used in this section has been obtained or derived from the CRISIL Report dated June 2022 with respect to the assessment of the roads sector in India, publicly available information as well as industry publications and sources, including from various government publications and websites. The data may have been re-classified by us for the purposes of presentation. Industry sources and publications generally state that the information contained therein has been obtained from sources generally believed to be reliable, but that their accuracy, completeness and underlying assumptions are not guaranteed, and their reliability cannot be assured. Industry sources and publications are also prepared based on information as of specific dates and may no longer be current or reflect current trends. Industry sources and publications may also base their information on estimates, projections, forecasts and assumptions that may prove to be incorrect. Investors must rely on their independent examination of, and should not place undue reliance on, or base their investment decision solely on this information.

Overview

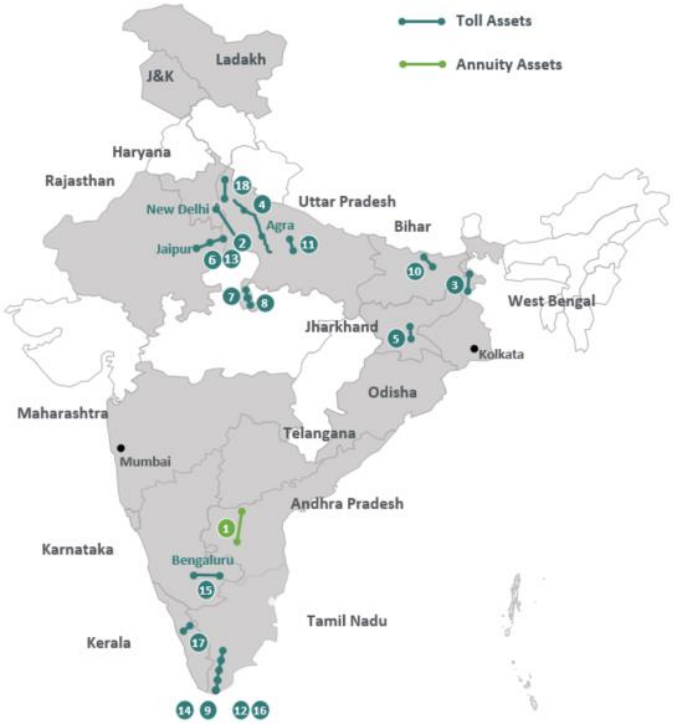
Cube Highways Trust is an Indian infrastructure investment trust sponsored by Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd. (collectively referred to as the "**Sponsors**"), established with the objective of acquiring and operating road assets in India and registered under the InvIT Regulations. We believe that, based on our robust financial position and support from our Sponsors, we are well positioned to take advantage of the growth potential of India's highways sector and make consistent distributions to our Ordinary Unitholders.

The Cube Group is engaged in implementing the public-private partnership ("**PPP**") model in the country's highways sector to operate and manage highway projects in association with the central and state governments. The Cube Group is a 100% institutionally-owned platform backed by a diversified investor base, including ISQ Asia Aggregator Pte. Ltd., Platinum Rock B 2014 RSC Limited (as trustee of the Platinum Stone A 2014 Trust) and Japan Highways International B.V.

The Settlor has set up Cube Highways Trust, which has acquired 100.00% of the issued and paid-up equity share capital in each of the Project SPVs of the Initial Portfolio Assets (other than Mahua Bharatpur Expressways Limited, in which the Trust has acquired 99.97% of the issued and paid-up equity share capital). These Project SPVs together operate 18 road assets, aggregating to 1,423.6 kilometers, located across 11 states in India.

The Initial Portfolio Assets had a weighted average residual concession life (weighted on the basis of residual life-time pre-MM EBITDA) of 22.10 years as on October 31, 2022 and a weighted average operating history (weighted on the basis of Fiscal 2023 estimated pre-MM EBITDA, assuming COD and appointed date as the beginning date for BOT/DBFOT and TOT assets, respectively) of 8.03 years as on October 31, 2022.

The map below sets forth the location of our projects in the Initial Portfolio Assets:



Legends

1. Andhra Pradesh Expressway Limited (APEL)
2. DA Toll Road Private Limited (DATRL)
3. Farakka – Raiganj Highways Limited (FRHL)
4. Ghaziabad Aligarh Expressway Private Limited (GAEPL)
5. Hazaribagh Tollway Limited (HTL)
6. Jaipur Mahua Tollway Limited (JMTL)
7. Jhansi – Lalitpur Tollway Limited (JLTL)
8. Jhansi – Vigakhet Tollway Limited (JVTL)
9. Kanyakumari – Etturavattam Tollway Limited (KETL)
10. Kotwa – Muzaffarpur Tollway Limited (KMTL)
11. Lucknow – Raebareli Tollway Limited (LRTL)
12. Madurai – Kanyakumari Tollway Limited (MKTL)
13. Mahua Bharatpur Expressways Limited (MBEL)
14. Nanguneri – Kanyakumari Tollway Limited (NKTL)
15. Nelamangala Devihalli Expressway Private Limited (NDEPL)
16. Salaipudhur – Madurai Tollway Limited (SMTL)
17. Walayar Vadakkencherry Expressways Private Limited (WVEPL)
18. Western UP Tollway Limited (WUPTL)

The tables below set forth an overview of the Initial Portfolio Assets:

S. No.	Relevant Project SPV	Project Length and number of lanes	State(s)	Residual Life (in years, as of October 31, 2022)	Actual Revenue in FY 2022
1.	Andhra Pradesh Expressway Limited ("**APEL**")	74.6 kms 4 lanes	Telangana and Andhra Pradesh	3.92 years	₹443.00 million
2.	DA Toll Road Private Limited ("**DATRPL**")	179.5 kms 6 lanes	Uttar Pradesh and Haryana	15.97 years	₹3,937.53 million
3.	Farakka – Raiganj Highways Limited ("**FRHL**")	100.1 kms 4 lanes	West Bengal	18.51 years	₹2,019.57 million
4.	Ghaziabad Aligarh Expressway Private Limited **("GAEPL")**	125.2 kms 4 lanes	Uttar Pradesh	16.65 years	₹2,254.55 million
5.	Hazaribagh Tollway Limited ("**HTL**")	73.8 kms 4 lanes	Jharkhand	27.98 years	₹763.94 million
6.	Jaipur Mahua Tollway Limited ("**JMTL**")	109.0 kms 4 lanes	Rajasthan	8.67 years	₹1,692.61 million
7.	Jhansi – Lalitpur Tollway Limited ("**JLTL**")	49.7 kms 4 lanes	Uttar Pradesh	27.98 years	₹669.77 million
8.	Jhansi – Vigakhet Tollway Limited ("**JVTL**")	49.3 kms 4 lanes	Uttar Pradesh	27.98 years	₹472.12 million
9.	Kanyakumari – Etturavattam Tollway Limited ("**KETL**")	64.2 kms 4 lanes	Tamil Nadu	27.98 years	₹427.95 million
10.	Kotwa – Muzaffarpur Tollway Limited ("**KMTL**")	80.0 kms 4 lanes	Bihar	27.98 years	₹905.00 million
11.	Lucknow – Raebareli Tollway Limited ("**LRTL**")	70.0 kms 4 lanes	Uttar Pradesh	27.98 years	₹668.02 million
12.	Madurai – Kanyakumari Tollway Limited ("**MKTL**")	52.3 kms 4 lanes	Tamil Nadu	27.98 years	₹733.59 million
13.	Mahua Bharatpur Expressways Limited ("**MBEL**")	57.3 kms 4 lanes	Rajasthan	8.64 years	₹811.25 million
14.	Nanguneri – Kanyakumari Tollway Limited ("**NKTL**")	63.5 kms 4 lanes	Tamil Nadu	27.98 years	₹440.27 million
15.	Nelamangala Devihalli Expressway Private Limited ("**NDEPL**")	80.3 kms 4 lanes	Karnataka	10.30 years	₹724.91 million
16.	Salaipudhur – Madurai Tollway Limited ("**SMTL**")	63.5 kms 4 lanes	Tamil Nadu	27.98 years	₹448.19 million
17.	Walayar Vadakkencherry Expressways Private Limited ("**WVEPL**")	53.5 kms 4 lanes	Kerala	10.30 years	₹657.26 million
18.	Western UP Tollway Limited ("**WUPTL**")	77.8 kms 4 lanes	Uttar Pradesh	3.65 years	₹1,059.08 million

(1) FRHL toll fee revenue includes 100% share of overloading revenue. However, only 25% of the overloading revenue is to the account of FRHL/ CH-II and the balance 75% of the overloading revenue is to the account of the erstwhile owner of FRHL.
(2) APEL is an annuity asset and hence revenue corresponds to annuity income.

In addition to the Initial Portfolio Assets, the Trust through the Investment Manager will also have the ability to acquire new projects through (i) a right of first offer with CH-I and CH-III in accordance with the Right of First Offer Agreement ("**ROFO Agreement**") and the Valuation Policy; and (ii) through other acquisitions in terms of the Investment Policy, on an arm's length basis. For further details, please see, "*Corporate Governance*" and "*Related Party Transactions*" on pages 144 and 275, respectively. The Investment Manager, Cube Highways Fund Advisors Private Limited, is responsible for managing the Trust and the Initial Portfolio Assets, as well as undertaking investment decisions relating to us and our assets. The Investment Manager meets the experience criteria as required under the SEBI InvIT Regulations. The cumulative experience of the key personnel (i.e. directors/ partners or employees, as applicable) of the Investment Manager in fund management or advisory services or development in the infrastructure sector is above 30 years. Further, the Investment Manager is responsible for defining our strategic direction, including in relation to our future acquisitions, divestments or enhancement of assets. For further details, please see "*Parties to the Trust – The Investment Manager – Cube Highways Fund Advisors Private Limited*" on page 120.

The Trustee, Axis Trustee Services Limited, is a trusteeship company registered with SEBI as a debenture trustee under the Securities and Exchange Board of India (Debenture Trustees) Regulations, 1993, as amended. On behalf of our Unitholders, the Trustee is responsible for (a) ensuring that our business objectives and investment policies comply with the provisions of the InvIT Regulations and other applicable law, and (b) monitoring the activities of the Investment Manager (in terms of the Investment Management Agreement) and the Project Manager (in terms of the Project

Implementation and Management Agreement). For further details, please see "*Parties to the Trust – The Trustee – Axis Trustee Services Limited*" on page 108.

The Project Manager, Cube Highways and Transportation Assets Advisors Private Limited, shall undertake operations and management of the Trust, including advising the Trustee on undertaking operations and management of the SPVs, and ensuring compliance with the respective concession agreements and project documents, making arrangements for appropriate maintenance, oversee the progress of development, status of approvals and other aspects of the projects of the SPVs. The Project Manager has been appointed as per the terms of the Project Implementation and Management Agreement. Neither the Project Manager nor any of the promoters or directors of the Project Manager (i) is debarred from accessing the securities market by SEBI; (ii) are or have been a promoter, director or person in control of any other company or a sponsor, investment manager or trustee of any other infrastructure investment trust or an infrastructure investment trust which is debarred from accessing the capital market under any order or direction made by SEBI; and/ or (iii) are or have been declared a wilful defaulter by any bank or financial institution or consortium thereof in accordance with the guidelines on wilful defaulters published by the RBI. For further details, please see "*Parties to the Trust – The Project Manager – Cube Highways and Transportation Assets Advisors Private Limited*" – on page 133.

Each financial year, we intend to distribute, at least quarterly, a minimum of 90% of the net distributable cash flows of the Trust available for distribution to our Ordinary Unitholders. For further details, please see, "*Distribution*" on page 243.

Our revenue from operations for the seven months period ended October 31, 2022, Fiscals 2022, 2021 and 2020, were ₹14,180.96 million, ₹20,550.40 million, ₹16,285.19 million and ₹13,270.92 million, respectively. Our profit/(loss) after tax for the seven months period ended October 31, 2022, Fiscals 2022, 2021 and 2020, were ₹(567.77) million, ₹(8,251.67) million, ₹(2,409.36) million and ₹(1,336.87) million, respectively.

For details of credit ratings obtained by the Trust, please see "*General Information – Credit ratings"* on page 106.

Our Strengths

The Investment Manager believes the following to be the key strengths of the Trust:

Large and Diversified Portfolio of Highway Assets

Upon completion of the Formation Transactions, Trust has a sizeable initial portfolio consisting of the 18 Initial Portfolio Assets. These assets represent a scaled and diversified portfolio, as the Initial Portfolio Assets consist of 18 highway assets having an aggregate of 1,423.6 kilometers, located across 11 states in India. In addition, pursuant to the right of first offer available to the Trust under the ROFO Agreement with CHI-I and CH-III, the Trust will also have an opportunity to access a pipeline of assets consisting of seven highway assets having an aggregate of 512.86 kilometers, located in four states in India.

Each Project SPV has entered into a long-term concession agreement with NHAI with tenors of between 20 and 30 years. As of October 31, 2022, the Initial Portfolio Assets had a weighted average residual concession life (weighted on the basis of residual life-time pre-MM EBITDA) of approximately 22.10 years.

Our assets are operated under different types of concessions, and for the fiscal years ending March 31, 2020, March 31, 2021, March 31, 2022 and the seven months period ended October 31, 2022, revenue from toll assets represented 78.93%, 79.12%, 90.93% and 92.40% of our combined revenue and 120.04%, 136.13%, 183.64% and 125.26% of the combined EBITDA, while revenue from annuity assets represented 3.41%, 2.97%, 2.15% and 1.69% of our combined revenue and 5.18%, 5.11%, 4.35% and 2.29% of the combined EBITDA, respectively.

Strong Portfolio Construction Capabilities

The Cube Group's portfolio construction philosophy is underpinned by assets with long vintage, proven operating life and long residual life. Further, a number of our assets are contiguously located which minimizes the risk of changes in the network surrounding the asset. Further, the contiguous nature of some of our assets allows us to benefit from economies of scale, especially in relation to maintenance costs for such assets.

The Cube Group employs a robust asset appraisal, evaluation and selection framework, supported by a due diligence approach that has resulted in them acquiring assets with resilience to external shocks and low traffic elasticity.

The vast experience in the Indian roads sector of the key personnel forming a part of the Investment Manager and their technical skills provide us with a competitive advantage over other platforms in India. Further, some of our assets, such as Farakka – Raiganj Highways Limited, Walayar Vadakkencherry Expressways Private Limited and Madurai – Kanyakumari Tollway Limited are located in areas where geographic barriers may preclude competing roads from being constructed, which provides us with a competitive advantage in these regions. Furthermore, with increasing infrastructure

development projects on the roads in the central parts of India, the north-south traffic is moving eastwards which can directly result in higher volumes of traffic for the Initial Portfolio Assets.

Differentiated M&A Capabilities

The Investment Manager believes that the Sponsors (along with its affiliates and subsidiaries) have developed differentiated M&A capabilities, enabling them to construct a large and high–quality portfolio of assets. Over the last seven years, our Sponsors (along with its affiliates and subsidiaries) have evaluated approximately 350 road assets and submitted 80 non–binding expressions of interest, which resulted in an acquisition of 24 assets, representing a conversion ratio of 30%.

Our Project Manager has a dedicated M&A and Project Finance team of approximately 16 professionals with specialized deal making capabilities and a wide relationship network, which enables them to execute transactions bilaterally and execute repeat transactions, reducing deal execution costs and timelines. Further, our Sponsors (along with its affiliates and subsidiaries) also have in-house experience in key areas of asset appraisal, evaluation and selection and due diligence such as traffic and technical assessment, legal diligence, financial diligence and ESG assessment, which enables them to make quick and informed early assessments of opportunities.

Furthermore, we believe that our Ordinary Unitholders will benefit from our ability to leverage each of our Sponsor's extensive network of relationships, its extensive market experience, operating expertise, demonstrated track record of managing capital and its commitment of adequate resources to the Investment Manager.

Asset Management and Maintenance Strategy

We have developed an asset management and maintenance strategy based on procurement, technology and engineering capabilities which is aimed at reducing lifecycle maintenance costs.

Our procurement is managed centrally, which enables us to benefit from economies of scale by negotiating advantageous commercial terms from our vendors. We also have a dedicated team for bitumen procurement given its importance to our overall maintenance strategy. We take various measures to ensure quality control of bitumen, including testing along various stages of the value chain, GPS monitoring and sealing of bitumen tankers at the source. Further, on account of annual maintenance shutdowns observed by domestic refineries and to ensure continuous supply of bitumen, we import the same directly from suppliers.

We have developed in-house capabilities for modelling and analytics which enable us to undertake predictive and preventive maintenance. One of our competitive advantages is the use of advanced testing methodologies such as, (i) falling weight deflectometer (which measures deflection values and structural strength of the pavement); and (ii) network survey vehicle (with an integrated laser profilometer to measure pavement roughness and texture). These tests provide extremely accurate micro level data which we analyse to understand the structural and functional condition of each segment of the pavement. Based on such data we are able to devise a major maintenance ("**MM**") strategy that addresses the immediate stress points and life cycle load patterns. We have experience and capability to use advanced construction materials that result in higher resilience and durability of our assets. For example, we use materials such as polymer modified bitumen and highly modified asphalt ("**HiMA**") thereby providing high riding quality to the users, which can reinforce toll-paying behaviour.

We believe that the Project Manager will also benefit from the Sponsors' approach of employing a tactical mix of in-house and outsourcing maintenance operations based on the strategic importance of the function. Thus, while the Project Manager will maintain control over key functions of strategy, design and procurement, it expects to outsource routine maintenance to third party vendors.

Strong Corporate Finance Capabilities

We have strong corporate finance capabilities which have been developed and built on the following principles:

- a deep understanding of regulations concerning highway construction and operations in India;
- long-standing lender relationships with infrastructure lenders, including public and private sector banks and NBFCs;
- proactive engagement with credit rating agencies and as of October 31, 2022, 14 of the 18 Initial Portfolio Assets were rated AAA (or equivalent) by certain rating agencies in India; and
- an established track record of negotiation and structuring capabilities.

These corporate finance capabilities enable us to generate additional value by designing optimal capital structures and debt repayment profiles that are calibrated with the cash flow profile of the Project SPVs for reducing cost of borrowings and increasing the tenor of the loans.

Investment in a Team of Specialists and Human Resources

Prior to the Offer, both our Sponsors' platform in India were led by a management team with vast experience and a track record in the Indian infrastructure sector. The senior management of our Sponsors' platform, including the Chief Executive Officer, Chief Financing Officer and Chief Operating Officer, each have significant experience in the infrastructure sector.

As a result, the Investment Manager's team has deep knowledge and experience in managing road projects in the infrastructure sector. The Investment Manager (along with its affiliates) also has invested in a team of qualified professionals with diverse academic backgrounds and work experience.

Attractive sector fundamentals with favourable policy environment

The roads sector is an area of national strategic importance to the Indian government, and development of the road infrastructure continues to be a priority for successive governments. In order to spur the development of India's road infrastructure, the GoI has undertaken a series of policy measures to drive investment from the public sector through traditional means of public investment and new channels, such as PPPs.

The GoI has undertaken various initiatives such as National Infrastructure Pipeline ("**NIP**") to boost infrastructure development in India, including an expected investment of ₹ 111 trillion between Fiscals 2020 to 2025, of which 18% is allocated to the roads sector. *(Source: CRISIL Report)* Further, according to CRISIL, toll collections are expected to grow at a CAGR of 9.5-10.0% between Fiscal Years 2022 and 2027 on a like-to-like basis and to grow at 18-19% considering new road additions and subsequent tolling on them over the same period. Through the PPP model, among others, the Investment Manager believes that the Sponsors have acquired, and will continue to capture through further acquisitions, a significant share in the PPP format of the road infrastructure sector.

For further details on the market opportunity for the road infrastructure industry in India, please see, "*Industry Overview*" on page 158.

Business Strategies:

The Investment Manager believes the following to be the key strategies of the Trust:

Active asset management to drive organic growth

The Investment Manager will employ an active asset management strategy in the existing assets to drive growth of the portfolio. In particular, the Investment Manager will seek to maintain or improve the Project SPVs' net incomes and free cash flows by, among other initiatives, minimizing revenue leakages, formulating and adopting policies and procedures and structuring investments to address regulatory considerations. The Project Manager will assist the Investment Manager by carrying out the operations, management and maintenance of the projects in accordance with the relevant concession agreement and the Project Implementation and Management Agreement and by procuring, operating and maintaining the relevant project's toll management systems, improving the effectiveness of routine and major maintenance activities and instituting controls on administrative expenditures and overheads.

Calibrated expansion of the portfolio

The Investment Manager also intends to expand the portfolio of the Trust by acquiring assets from the Sponsors (and their affiliates) that adhere to certain asset selection criteria, which includes access to important locations in the vicinity, connecting roads, industrial and manufacturing hubs, connectivity with raw materials, ports, and also evaluating competing modes of transportation.

The Investment Manager believes that it will be able to leverage each of our Sponsors' network of relationships, extensive knowledge, experience and expertise in the roads sector in India to implement its acquisition strategy, to acquire operational road projects and road projects that may require last mile construction. The Investment Manager intends to expand the portfolio without compromising on the operation and management of the existing Project SPVs while providing attractive cash flows and yields, and opportunities for future income and capital appreciation for our Unitholders.

Pursuant to the ROFO Agreement between CH-I, CH-III, the Investment Manager and the Trustee (on behalf of the Trust), the Trust has a "right of first offer", for a specified period from the date of listing of the Ordinary Units pursuant to the Offer, to acquire the future assets which CH-I or CH-III elect to dispose of. Under the ROFO Agreement, the Trust can make an offer for the acquisition and/ or re-financing of the securities of the ROFO SPVs (*as defined in the ROFO Agreement*), subject to the terms of the ROFO Agreement. For further details, see "*Related Party Transactions – Acquisition of future assets by the Trust*" on page 278.

Implementing prudent capital management policies

The Investment Manager intends to institute and implement a capital management strategy that is consistent with its objective of maximizing distributions to our Ordinary Unitholders while also generating consistent total returns. To achieve these objectives, the Investment Manager will aim to ensure an optimal capital structure of the Trust and the Project SPVs to maximize cash distribution to Ordinary Unitholders while also retaining adequate flexibility to acquire assets in the future.

After utilising the Issue Proceeds, the Trust's total consolidated borrowings are expected to be less than 49% of the total value of the Trust's consolidated assets, in compliance with the InvIT Regulations. As a result, the Trust's consolidated balance sheet will provide flexibility to incur additional debt if needed to support the Investment Manager's strategy of acquiring additional assets.

Structure of Cube Highways Trust

The Cube Highways Trust was settled on December 7, 2021 in accordance with the provisions of the Indian Trusts Act, 1882, and the Trust is registered with SEBI as an InvIT pursuant to the InvIT Regulations. The original trust deed was amended and restated pursuant to the Amended and Restated Trust Deed dated July 8, 2022. The Trust's principal investment objectives are to carry on the activities of, and to make investments as an infrastructure investment trust, as permissible in terms of the InvIT Regulations and in accordance with the InvIT documents, to the extent applicable. For more details on the investment objectives, see "*Overview of the Trust – Investment Objectives"* on page 22.

The Trust has acquired the Initial Portfolio Assets through the acquisition of 100.0% of the issued and paid-up equity share capital of the Project SPVs from the Sponsors and other existing shareholders (other than Mahua Bharatpur Expressways Limited, in which the Trust has acquired 99.97% of the issued and paid-up equity share capital). See "*Formation Transactions in relation to the Trust – Proposed post-listing structure"* on page 31, for a graphical representation of the structure of the Trust upon listing of the Ordinary Units on the Stock Exchanges.

Environment, health and safety

The Project SPVs are required to meet certain health, safety and environmental specifications and standards in the operation and maintenance of the projects, and are subject to a number of laws and regulations relating to health, safety and environmental protection. The Project SPVs are also required to adhere to various labour and workplace related laws and regulations in India. The Project SPVs have policies and procedures in place to ensure that the operation and maintenance of the Projects conform to existing health, safety and environmental regulatory standards and that adequate employees' compensation and group medical insurance policies are maintained. Further, the Investment Manager has adopted the ESDD Policy which aims to provide a criteria for selection of future projects including a review of the Environmental Impact Assessment ("**EIA**") and environment and social management system, of such infrastructure asset, if available. For details, please see "*Corporate Governance*" on page 144.

Operations and maintenance

Under the concession agreements, the Project SPVs are required to operate and maintain the project highway in accordance with the concession agreement either by itself, or through an O&M Contractor. Typically, the operation and maintenance obligations include:

- permitting safe, smooth and uninterrupted flow of traffic during normal operating conditions;
- collecting and appropriating toll;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the project highway by providing rapid and effective response and maintaining liaison procedures with emergency services;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, line markings, lighting and signage;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, repairs and refurbishment of tolling system and hardware and other equipment;
- the protection of the environment and the provision of equipment and materials; and
- maintaining a public relations unit to interface with and attend to suggestions from concerned authorities and law enforcement agencies to preserve the legal right of way on the highway.

Toll collection system and operations

Tolls are collected for each journey by a vehicle through toll plazas. Signs setting out the toll rates for the Toll Road assets are displayed at the toll booths, and tolls can be paid electronically or by cash.

Electronic toll collection

In 2014, an electronic toll collection ("**ETC**") system based on radio-frequency identification ("**RFID**") technology was introduced. FASTags (an RFID-based cashless payment mechanism) were affixed on windscreens to enable toll plazas to auto-debit toll fees from a linked account, without requiring vehicles to stop for transactions. This ETC based on RFID gained more widespread adoption following an Indian transport ministry directive in January 2019, which mandated that all user fee plazas be made ETC compliant. The GoI has also made FASTag at toll plazas mandatory with effect from February 16, 2021.

For October 2022, all 24 toll plazas on Initial Portfolio Assets had close to or more than 90% ETC collection rate.

Cash

Tolls paid in the form of cash are collected by toll collectors at manual toll booths. Vehicles paying toll in cash are also subject to a penalty of 100% of the toll amount as per NHAI guidelines.

Monitoring

Toll collection

Payments at the toll plazas, both electronic as well as cash payments, are processed through an electronic toll collection system, which caters to RFIDs, wallet, UPI, card and cash based transactions. The electronic toll collection system collects and stores traffic and payment data through system generated reports, thereby, reducing the need for manual operation. The electronic toll collection system consists of revenue collection software, a barrier gate, smart card readers, license plate image-capturing cameras and lane monitoring cameras, along with fully automatic vehicle counting-cum-classifier, RFID readers/antennas, a validation system, communication channels and traffic control equipment. All our toll plazas are equipped to process near-real time transactions through API communications with acquirer banks.

For identifying categories of vehicles and to charge an appropriate toll rate, automatic vehicle identification based on video cum artificial intelligence ("**AI**") based cameras/infrared sensors are deployed. Automatic Vehicle Classification and Counting enables collection of variable amounts of tolls depending on the class of motor vehicles and serves as a traffic information system. The Project SPVs use weigh-in-motion technology (Medium Speed WIMs) for projects where weight-based toll collection is mandated. The weight based tolling systems are integrated with the fully automatic toll collection system for enhanced revenue controls.

In addition, cameras are installed to capture and record toll evasion by vehicles. There is also a back-up power supply system in each lane, toll plaza and server room to ensure that there is no interruption to power supply at the toll plazas in order to maintain a stable power supply for critical operations of toll management system ("**TMS**"). Servers used in the toll collection systems at the toll plazas are capable of real-time uploading of transaction data from TMS and performing an automatic daily backup to prevent any toll data loss and to enable system recovery, which would allow the Project SPVs to collect variable amounts of tolls depending on the class of motor vehicles and serves as a traffic information system. To monitor the TMS, a dedicated team is deployed at the toll plazas along with an annual maintenance contract with respective system integrators.

Only authorized persons have access to the toll collection systems and its servers, and their activities are recorded for security purposes. The Project SPVs are responsible for operating the toll collection system at their toll plazas and taking regular preventive and corrective measures to maintain such systems.

Real time review of maintenance and construction works

The Project SPVs can utilise a number of analytics tools and software applications such as Build-Aid and Road-Aid for asset and pavement analytics to maintain centralized control and real–time integrated dashboards of maintenance works across the assets. These tools help ensure timely completion of maintenance and construction activities and minimal disruption for commuters.

Traffic and motorway assistance services

Traffic assistance

Each Project SPV is required to carry out regular patrolling and regulate and maintain traffic order within their projects. Patrol vehicles continuously move along the project stretch to help regulate traffic and carry out surveillance activities.

Helpline numbers are also displayed along the projects for communication between road users and the control room in case of emergencies, and the Project SPVs are required to maintain the emergency telephone system.

In the case of a vehicle breakdown or traffic accident, the control room will announce the occurrence via mobile phones or handsets to instruct a mobile supervisor and a recovery supervisor to proceed to the scene immediately, and file relevant reports with the police if personal injury is involved. At the scene of a traffic accident or vehicle breakdown, the mobile supervisor will report the incident to the control room, take safety precautions at the scene and apply first aid to injured persons, if any. The recovery supervisor will determine whether the vehicle can be recovered on site or deploy recovery vehicles for towing. The traffic officer will stop the traffic, close the affected lane where necessary and direct trapped vehicles away to other unaffected lanes.

Safety Measures

Under each of the concession agreements, the concessionaire is obligated to abide by certain safety requirements, which include measures such as road signs, pavement marking, traffic control devices, enforcement and emergency response. The concessionaire must also abide by, among others, applicable laws and applicable permits, relevant standards and guidelines of the Indian Roads Congress and good industry practice. The concessionaire must also carry out safety audits of the projects from time to time, through a safety consultant, which is comprised typically of, among others, one road safety expert and one traffic planner. These safety requirements apply to all phases of construction, operation and maintenance with emphasis on identification of factors associated with accidents and implementation of appropriate remedial measures.

Competition

Competition for the Trust

As all toll revenues depend on toll receipts and are affected by changes in traffic volumes, the amount of revenue generated by the Project SPVs and future toll projects will depend on a number of factors which can influence the level of traffic volume on those particular toll roads, including competition from other roads that operate in the same area, as well as from other modes of transportation (e.g. railways and airplanes).

We believe we face competition from other road operators, financial investors, private equity funds and from other InvITs, in acquiring lucrative concessions for existing and future projects. In respect of opportunities, the Trust will depend on the Sponsors, which face competition from both domestic and international entities in the roads and highways infrastructure sector, as most of the contracts awarded by the Government and state governments are awarded on a competitive bidding basis and subject to satisfaction of other prescribed pre-qualification criteria. While service quality, technological capacity and performance, health and safety records and personnel, as well as reputation and experience, are important considerations in award decisions, price is a major factor in most tender awards. The ability of the Sponsors to bid for and win major infrastructure development projects is also dependent on experience in executing large projects, strong engineering capabilities in executing technically complex projects, and sufficient financial resources and/or ability to access funds.

Management

The Trust will be managed, upon the listing of the Ordinary Units on the Stock Exchanges, by qualified personnel of the Investment Manager. These personnel will have management and operational experience in the roads and highways sector. For further details about the Investment Manager, please see, "*Parties to the Trust – The Investment Manager – Cube Highways Fund Advisors Private Limited*" on page 120.

Subsequent to the completion of the Formation Transactions, the Investment Manager, in consultation with the Trustee, has appointed a majority of the directors on the boards of the Project SPVs, as applicable, in accordance with the InvIT Regulations. The Project SPVs' boards of directors will also thereafter form committees, if required under the Companies Act, 2013 and rules made thereunder. For details, see "*Corporate Governance*" on page 144.

Seasonality

Traffic volume tends to decrease during the monsoon season and conversely tends to increase during holiday seasons. While the northern parts of India experience monsoon rains during the period from June or July until September or October every year, the southern parts of India, especially coastal parts of Andhra Pradesh, experience monsoon rains even during the months of October to December. The monsoon season may also restrict the Trust's ability to carry on activities related to its operation and maintenance of toll roads. For further details on risk associated with seasonality, please see, "*Risk Factors – Risks Relating to Our Business and Industry – Toll rates and collections and Toll Road traffic volumes are subject to regulatory constraints, number of road users subject to such rates and dependent on factors beyond our control"* on page 64.

Insurance

The Trust's operations will be subject to hazards inherent in providing operation and maintenance services, such as risk of equipment failure, work accidents, fire, earthquake, flood and other force majeure events. This includes hazards that may cause injury and loss of life, damage and destruction of property, equipment and environmental damage. The Project SPVs' principal types of insurance coverage include, amongst others comprehensive or commercial general liability, employees' compensation insurance policies, group medical insurance policies and industrial all risk insurance, to the extent applicable to their operations. The Investment Manager and the Trustee confirm that the amount of insurance that each Project SPV presently maintains represents an adequate and appropriate level of coverage required to insure its business and operations and assets, and is in accordance with the relevant concession agreement and industry standards in India and as available on commercial and reasonable terms and will perform regular assessment on the adequacy of insurance coverage on a yearly basis.

Employees

As of October 31, 2022, the Project SPVs had 495 employees. The table below shows the number of employees in each Project SPV:

S. No.	Name of Project SPV	Number of Employees
1.	APEL	8
2.	DATRPL	71
3.	FRHL	37
4.	GAEPL	40
5.	HTL	12
6.	JLTL	19
7.	JMTL	42
8.	JVTL	16
9.	KETL	23
10.	KMTL	26
11.	LRTL	19
12.	MBEL	34
13.	MKTL	27
14.	NDEPL	25
15.	NKTL	21
16.	SMTL	25
17.	WUPTL	31
18.	WVEPL	19
Total		**495**

Properties

The Investment Manager's registered office is located at B-376, Upper Ground Floor, Nirman Vihar, New Delhi 110 092. The Investment Manager shall be conducting all its administrative and reporting activities from its corporate office located at 19th Floor, Unit No. 1901, Tower-B, World Trade Tower, Plot No. C-1, Sector -16, Noida, Uttar Pradesh 201 301..

Under the terms of the concession agreements, title to the roads and related infrastructure such as toll plazas and monitoring posts remains with NHAI for the duration of the concession period. During the concession period, the Project SPVs are licensed to use the roads and the related infrastructure which constitute the concession assets and the Project SPVs are entitled to an income from the collection of tolls. Upon the expiration of a concession period, each Project SPV is required to transfer possession of its concession assets to the NHAI.

Summary of Our Toll Roads

The details of the BOT and DBFOT Roads are as follows:

Particulars	JMTL	MBEL	WUPTL	NDEPL
Project stretch	Jaipur-Mahua	Mahua-Bharatpur	Meerut to Muzaffarnagar	Nelamangla-Devihalli
Geographic location (state)	Rajasthan	Rajasthan	Uttar Pradesh	Karnataka
Number of lanes	4	4	4	4

Particulars	JMTL	MBEL	WUPTL	NDEPL
National Highway # (New | Old)	NH21 | NH11	NH21 | NH11	NH334 | NH58	NH75 | NH48
Project length (km)	109.0	57.3	77.8	80.3
Number of toll plazas	2	2	1	2
Toll plazas	Rajadhok and Sikandra	Amoli and Ludhawai	Siwaya	Doddakarenhalli and Karbylu
Appointed date	March 21, 2006	April 10, 2006	March 9, 2006	January 5, 2008
Calendar year of acquisition	2015	2016	2016	2021
Type of acquisition	Bilateral	Bilateral	Bilateral	Lender Substitution
Commercial operations date (COD) [(1)]	March 30, 2008	May, 8 2009	April 18, 2011	June 23, 2012
Tolling history (as of October 31, 2022) (in years)	14.60	13.49	11.55	10.36
End of concession[(2)]	April 23, 2031	May 3, 2031	June 25, 2026	January 4, 2033
Residual life (as of October 31, 2022) (in years)	8.67	8.64	3.65	10.30
Projected revenue in Fiscal 2024 (in ₹ million)	2,647.02	1,219.94	1,750.82	1,125.73
Projected revenue in Fiscal 2025 (in ₹ million)	3,059.02	1,394.72	1,938.07	1,273.48

Note:

(1) As per the provisions of the concession agreement, the commercial operations date (COD) of the project highway shall be the date on which the independent consultant has issued the final completion certificate or the provisional certificate certifying completion of the project highway as per the relevant terms of the concession agreement. The project highway shall enter into commercial service on COD whereupon the concessionaire shall be entitled to demand and collect fee as per the relevant provisions of the concession agreement.

(2) Concession agreements provide for an extension or reduction of the concession period based on certain factors, including actual traffic volumes on specified target dates.

The details of the BOT and DBFOT Roads are as follows (continued):

Particulars	**GAEPL**	**WVEPL**	**DATRPL**	**FRHL**
Project stretch	Ghaziabad-Aligarh	Walayar-Vadakkenchery	Delhi-Agra	Farakka- Rajganj
Geographic location (state)	Uttar Pradesh	Kerala	Uttar Pradesh and Haryana	West Bengal
Number of lanes	4	4	6[(2)]	4
National Highway # (New | Old)	NH91 | NH34	NH544 | NH47	NH19 | NH2	NH12 | NH34
Project length (km)	125.2	53.5	179.5	100.1
Number of toll plazas	2	1	3	2
Toll plazas	Luharli and Somna	Chullimada Hamlet (Pampampallam)	Gadpuri, Karman and Mahuvan	Lakshmipur and Gazole
Appointed date	February 25, 2011	May 18, 2013	October 16, 2012	February 3, 2011
Calendar year of acquisition	2022	2020	2020	2020
Type of acquisition	Bilateral	Bilateral	Harmonious Substitution[(3)]	Bilateral
Commercial operations date (COD) [(1)]	June 23, 2015	May 18, 2015	October 16, 2012	October 19, 2016
Tolling history (as of October 31, 2022) (in years)	7.36	7.46	10.05	6.04
End of concession[(4)]	June 20, 2039	May 17, 2033	October 15, 2038	February 2, 2041
Residual life (as of October 31, 2022) (in years)	16.65	10.80	15.97	18.51
Projected revenue in Fiscal 2024 (in ₹ million)	4,874.48	961.19	6,377.41	2,646.99
Projected revenue in Fiscal 2025 (in ₹ million)	3,230.81	1,059.53	6,886.99	2,934.21

Note:

(3) As per the provisions of the concession agreement, the commercial operations date (COD) of the project highway shall be the date on which the independent consultant has issued the final completion certificate or the provisional certificate certifying completion of the project highway as per the relevant terms of the concession agreement. The project highway shall enter into commercial service on COD whereupon the concessionaire shall be entitled to demand and collect fee as per the relevant provisions of the concession agreement.

(4) Since the scope for the DATRPL Project is six-laning of the existing four-lane road of Delhi-Agra section of NH-2, the concessionaire is entitled to collect toll from the appointed date itself for the four-lane road. Upon obtainment of COD, toll rates shall be revised accordingly.

(5) In December 2020, CHIII acquired the shareholding of DA Toll Road Private Limited and substituted the previous concessionaire in accordance with the conditions stipulated in the final approval obtained from NHAI dated November 17, 2020.

(6) Concession agreements provide for an extension or reduction of the concession period based on certain factors, including actual traffic volumes on specified target dates.

The details of the TOT Roads are as follows:

Particulars	MKTL (Kappalur)	KETL (Etturvattam)	SMTL (Salaipudhur)	NKTL (Nanguneri)	JLTL (Babina)	JVTL (Vigakhet)	KMTL	LRTL	HTL
Project stretch	Madurai-Kanyakumari	Madurai-Kanyakumari	Madurai-Kanyakumari	Madurai-Kanyakumari	Jhansi-Lalitpur	Jhansi-Lalitpur	Kotwa-Muzaffarpur	Lucknow-Raebareli	Hazirabagh-Ranchi
Geographic location (state)	Tamil Nadu	Tamil Nadu	Tamil Nadu	Tamil Nadu	Uttar Pradesh	Uttar Pradesh	Bihar	Uttar Pradesh	Jharkhand
Number of lanes	4	4	4	4	4	4	4	4	4
National Highway # (New | Old)	NH44 | NH7	NH44 | NH7	NH44 | NH7	NH44 | NH7	NH44 | NH26	NH44 | NH26	NH27 | NH28	NH30 | NH24-B	NH33 | NH20
Project length (km)	52.3	64.2	63.5	63.5	49.7	49.3	80	70	73.8
Tollable length[1]	68.8	69.3	84.6	75.6	81.7	60	85.7	77.8	86
Number of toll plazas	1	1	1	1	1	1	1	1	1
Toll plazas	Kappalur	Etturvattam	Salaipudhur	Nanguneri	Babina	Vighakhet	Parsoni Khem	Dakhina Sekhpur	Pundag
Appointed Date/ Commercial operations date (COD)	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020	October 20, 2020
Calendar year of acquisition	2019	2019	2019	2019	2019	2019	2019	2019	2019
Tolling history[2] (in years, as of October 31, 2022)	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03	2.03
End of concession	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050	October 19, 2050
Residual Life[3] (as of October 31, 2022) (in years)	27.98	27.98	27.98	27.98	27.98	27.98	27.98	27.98	27.98
O&M Handover Date	Not applicable	Not applicable	Not applicable	Not applicable	March 2027	March 2027	Not applicable	March 2029	March 2028
Projected revenue in Fiscal 2024 (in ₹ million)	1,088.62	627.67	655.75	654.63	872.10	615.31	1,199.02	851.99	1,063.09
Projected revenue in Fiscal 2025 (in ₹ million)	1,213.14	688.33	722.56	726.71	961.74	675.11	1,329.19	948.34	1,181.95

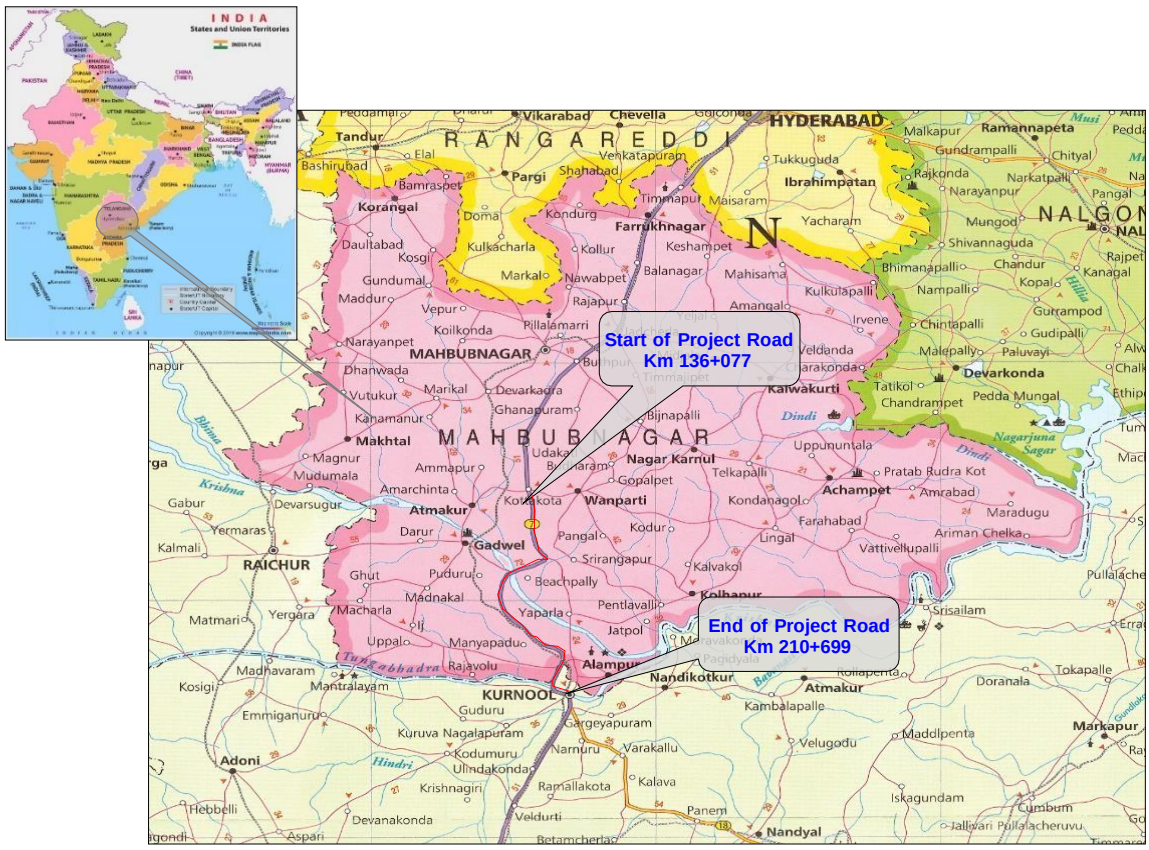
Note:

(7) *Tollable length is determined as per the NHAI notifications published in the National Gazette and is used as the basis for the toll rate of each of the roads. The formula is 10 x length of roads + 1.5 x length of bypasses.*

(8) *Prior to the acquisition, the TOT roads have been collecting tolls for between four to eight years.*

(9) *The residual life is indicative in nature and in accordance with the relevant concession agreement, the actual term of the concession is dependent on the revenue generated by each road.*

In addition to the assets mentioned above, Andhra Pradesh Expressway Limited ("**APEL**"), an annuity asset also forms a part of the Initial Portfolio Assets. APEL is a part of NH 44 (erstwhile NH 7), between Kothakota in Telangana and Kurnool in Andhra Pradesh. Salient features of APEL are as follows:



Item	Particulars
Project Length (in lane kms)	74.6 kms
Number of Lanes	4
Appointed Date	September 15, 2006
Concession Period	20 years from September 15, 2006
Commercial Operations Date (COD)	September 30, 2009
End of Concession	September 14, 2026
Residual Concession Period (as of October 31, 2022)	3.92 years
Annual payment receivable (in ₹ million)	1,130.40
Projected revenue in FY 2024 (in ₹ million)	1,094.70
Projected revenue in FY 2025 (in ₹ million)	1,124.30

In an annuity project model, a fixed amount is paid semi-annually as annuity by the respective concessioning authority pursuant to the applicable concession agreement. Income from the project is thus assured to the extent of the annuity to be collected in accordance with the concession agreement, thus reducing our risk of income fluctuations resulted from changes in traffic volumes. Accordingly, monthly toll revenue collections are not applicable for APEL as an annuity project.

Capital Structure

As of October 31, 2022, total equity was (₹228.83) million and total liabilities including debt from lenders was ₹3,368.67 million.

Land

The land that underlies the APEL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

Description of BOT and DBFOT Toll Roads

1. **Jaipur-Mahua Tollway Limited ("JMTL")**

Overview of the Project and the Concession

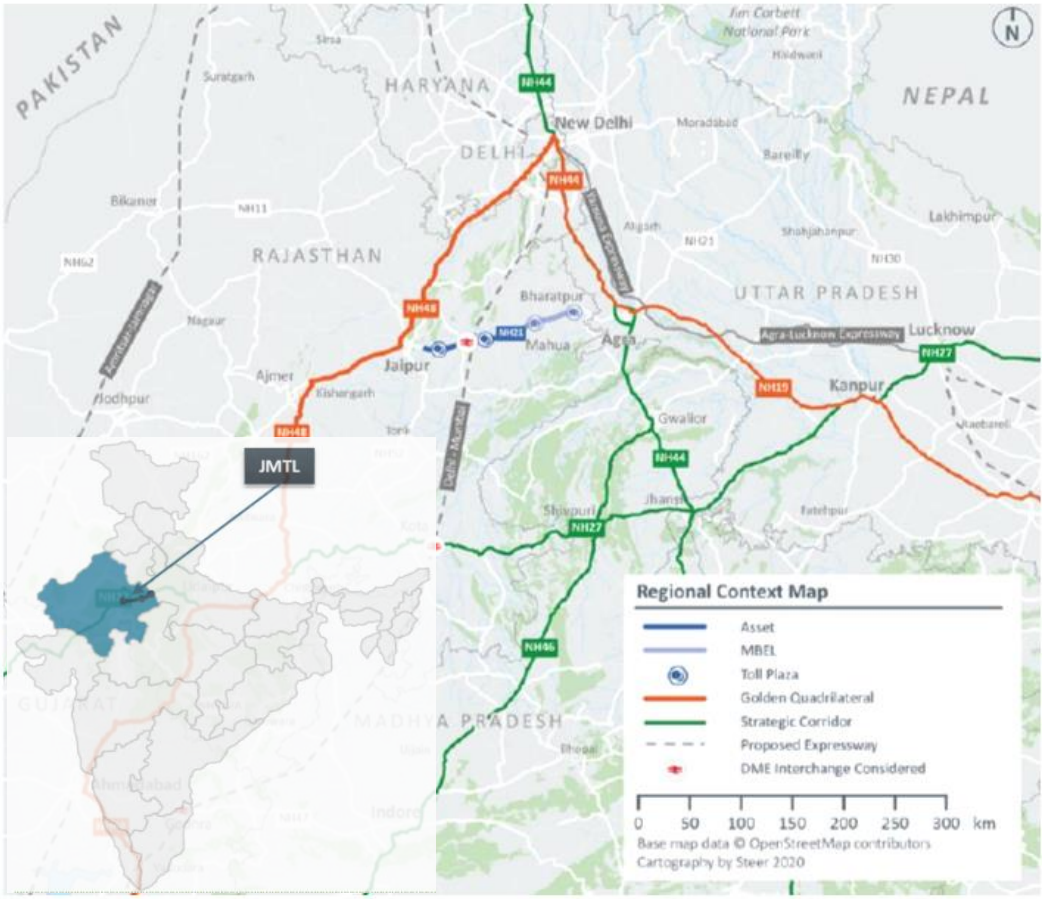
On September 23, 2005, NHAI and JMTL entered in the JMTL Concession Agreement whereby JMTL was engaged, on a build, operate and transfer ("**BOT**") basis, to widen a portion of NH 21 (erstwhile NH11) in Rajasthan from two lanes to four lanes with an overall length of 109.1 kilometers (the "**JMTL Project**"). JMTL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the JMTL Project in accordance with the JMTL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the JMTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

JMTL Project is a strategic national highway, situated along the southern arm of the golden triangle, connecting New Delhi to Jaipur and Agra - two of the most popular tourist destinations in the country. The project highway is also part of the long east-west highway network connecting south Rajasthan, Gujarat and Maharashtra to the union territory of New Delhi, Uttar Pradesh and other eastern states.

A few alternate routes impact traffic along JMTL Project. Travellers on long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states may use an alternative route along NH 27 that connects Udaipur to Kanpur via Chittorgarh-Kota-Jhansi. For medium-distance trips between southern Rajasthan and east of Dausa, there is an alternate road that bypasses the toll plaza located at Rajadhok through the Tonk-Lalsot-Dausa connection.
Certain planned/ underway road network developments in the vicinity of JMTL Project that are likely to positively impact the traffic flow, include (i) completion of the Jaipur Ring Road; (ii) completion of pending sections on the Agra Ring Road; (iii) construction of Jewar Airport and Metro; and (iv) positive diversions due to the upcoming Delhi-Mumbai Expressway.

The map below illustrates the location of the JMTL project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the JMTL Project include tourism in the State of Rajasthan, which is a key driver of passenger traffic, movement of cement-grade limestone and marble from Rajasthan to other parts of India, and movement of agricultural commodities such as grains, oilseeds and edible oil which is key driver of commercial traffic. Furthermore, in January 2021, the state government of Rajasthan released a policy on Manufactured Sand which provides industry status to the units producing it for construction work and reduces dependency on riverbed sand. The new policy is expected to revive the sand mining activities, give rise to new sand production units that is expected to increase the traffic carrying construction-related commodities on JMTL Project.

Traffic Volume

The table below sets forth the historical traffic data of JMTL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Sikandra

Vehicle Type	**FY2020**		**FY2021**[(1)]		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	6,772	51.08	7,402	54.62	8,356	57.19
LCV	1,135	8.56	709	5.23	428	2.93
Bus	1,200	9.05	1,294	9.55	1,754	12.00
2A	458	3.45	218	1.61	126	0.86
3A/ MAV	3,692	27.85	3,930	29.00	3,947	27.01
Total Annual Average Daily Traffic ("AADT")	**13,257**	**100**	**13,553**	**100**	**14,611**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the JMTL Project was operational.

Toll Plaza at Rajadhok

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Passenger Vehicles:						
Car / Jeep / Van	8,691	63.15	8,982	66.07	9,686	67.51
LCV	1,086	7.89	663	4.88	416	2.90
Bus	1,173	8.52	1,106	8.14	1,433	9.99
2A	268	1.95	136	1.00	88	0.61
3A/ MAV	2,545	18.49	2,707	19.91	2,725	18.99
Total AADT	**13,764**	**100**	**13,593**	**100**	**14,348**	**100**

Source: *Traffic Reports.*

Note:

(10) *The data for April 2020 only includes the days during which the JMTL Project was operational*

Substantially all of JMTL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹177.64 million, ₹182.81 million, ₹179.12 million, ₹185.93 million and ₹196.96 million, respectively.

Capital Structure

As of October 31, 2022, total equity was ₹1,716.17 million and total liabilities including debt from lenders was ₹3,260.17 million.

Land

The land that underlies the JMTL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

2. DA Toll Road Private Limited ("DATRPL")

Overview of the Project and the Concession

On July 16, 2010, NHAI and DA Toll Road Private Limited (the erstwhile concessionaire) entered in a concession agreement whereby DA Toll Road Private Limited was engaged, on a design, build, finance, operate and transfer ("**DBFOT**") basis, for six-laning of the Delhi-Agra portion of NH 19 (erstwhile NH2) in Delhi, Uttar Pradesh and Haryana with a total length of 179.5 kilometers (the "**DATRPL Project**"). CH-III had acquired the shareholding of DA Toll Road Private Limited and substituted the previous concessionaire in accordance with the conditions stipulated in the final approval obtained from NHAI dated November 17, 2020.

Following the acquisition, DATRPL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the DATRPL Project in accordance with the DATRPL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the DATRPL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

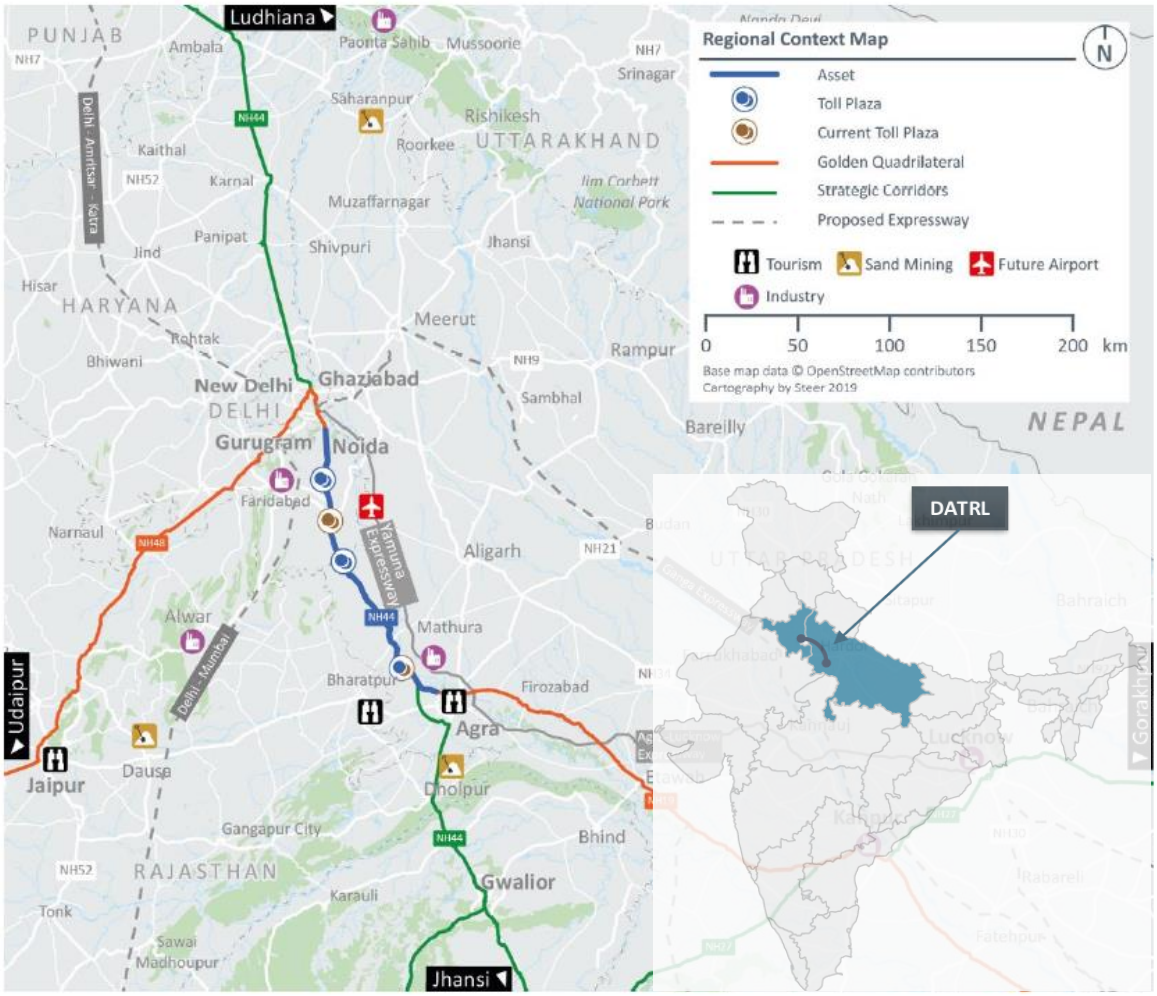
Corridor and Network Description

The DATRPL Project is on the strategically important east-west movement between New Delhi and north-western India at one end, and Uttar Pradesh and eastern India at the other end. It is also located along the eastern arm of the golden triangle, connecting two of the most popular tourist destinations in India, New Delhi and Agra through Mathura, which is also a popular religious attraction.

A few alternate routes affect the flow of traffic along DATRPL Project. For example, the Yamuna Expressway is a six-lane expressway connecting Greater Noida and Agra. However, it primarily serves leisure and tourist trips by cars and tourist buses and the higher toll on the Yamuna Expressway prevents it from creating significant diversion for traffic on the DATRPL Project. There are also a few alternate routes for traffic between Delhi and Lucknow and those travelling from northern India to southern parts of the country. In addition to the above, several state highways have been upgraded, thereby improving the quality of local network and as a result, providing cheaper alternatives to road users.

Certain planned/ underway road network developments in the vicinity of DATRPL Project that are likely to impact the traffic flow include (i) completion of the Delhi-Mumbai Expressway by Financial Year 2026; (ii) completion of four-laning of Aligarh-Kannauj and Palwal-Tappal-Aligarh road sections and the six-laning of the Ghaziabad-Aligarh road; and (iii) commissioning of the proposed Ganga Expressway, which will directly compete with long-distance traffic on the DATRPL Project.

The map below illustrates the location of the DATRPL Project and the corridor it covers:



According to the Traffic Study Consultant, there are several factors that contribute to traffic growth on the DATRPL Project. Since the DATRPL Project connects New Delhi at the north with the tourist city of Agra in the south, it sees a high number of daily commuters and tourists. Furthermore, the DATRPL Project is a traditionally industrial corridor with industries such as leather and textile (Agra and Kanpur), glassmaking (Faizabad) and oil (Indian Oil Corporation's refinery at Mathura), which support the movement of commercial traffic. This is further supplemented by major industrial and commercial centres located at the northern end of the DATRPL Project, including India's largest inland port and container transhipment terminal at Badarpur. The construction of Jewar airport and metro is also likely to result in an increase in traffic carrying construction-related commodities.

Traffic Volume

The table below sets forth the historical traffic data of DATRPL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Srinagar

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	10,150	59.57	10,423	63.15	16,253	66.70
LCV	1,179	6.92	985	5.97	1,259	5.17
2A	2,118	12.43	1,605	9.72	2,193	9.00
MAV	3,591	21.08	3,493	21.16	4,664	19.14
Total AADT	**17,038**	**100**	**16,506**	**100**	**24,369**	**100**

Source: *Traffic Reports.*

Note:

(11) *The data for April 2020 only includes the days during which the DATRPL Project was operational.*

Toll Plaza at Mahuvan

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	7,742	45.72	9,841	55.19	11,156	52.42
LCV	1,350	7.97	1,084	6.08	1,294	6.08
Bus and 2 axle truck	2,915	17.21	2,249	12.61	2,911	13.68
3 axle truck and MAV	4,927	29.10	4,658	26.12	5,920	27.82
Total AADT	**16,934**	**100**	**17,832**	**100**	**21,281**	**100**

Source: *Traffic Reports.*

Note:

(12) *The data for April 2020 only includes the days during which the DATRPL Project was operational.*

Substantially all of DATRPL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹466.80 million, ₹474.56 million, ₹452.97 million, ₹444.31 million and ₹471.65 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹2,132.27)million and total liabilities including debt from lenders was ₹33,249.39 million.

Land

The land that underlies the DATRPL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

3. **Mahua Bharatpur Expressways Limited ("MBEL")**

Overview of the Project and the Concession

On October 13, 2005, NHAI and M/s. Madhucon Agra-Jaipur Express Limited (the erstwhile concessionaire) entered in a concession agreement whereby M/s. Madhucon Agra-Jaipur Express Limited was engaged, on a BOT basis, to widen a portion of NH 21 (erstwhile NH11) in Rajasthan from two lanes to four lanes with an overall length of 57.3 kilometers (the "**MBEL Project**"). On October 21, 2015, CH-I entered into a share purchase agreement to acquire M/s. Madhucon Agra-Jaipur Express Limited. The name of erstwhile company i.e. M/s. Madhucon Agra-Jaipur Express Limited was changed to Mahua Bharatpur Expressways Limited as a post-closing condition to the acquisition. As of the date of this Final Placement Memorandum, the Trust holds 99.97% of the equity shareholding of MBEL.

Following the acquisition, MBEL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the MBEL Project in accordance with the MBEL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the MBEL Concession Agreement, please see "*Summary of the Concession Agreements*" on page 216.

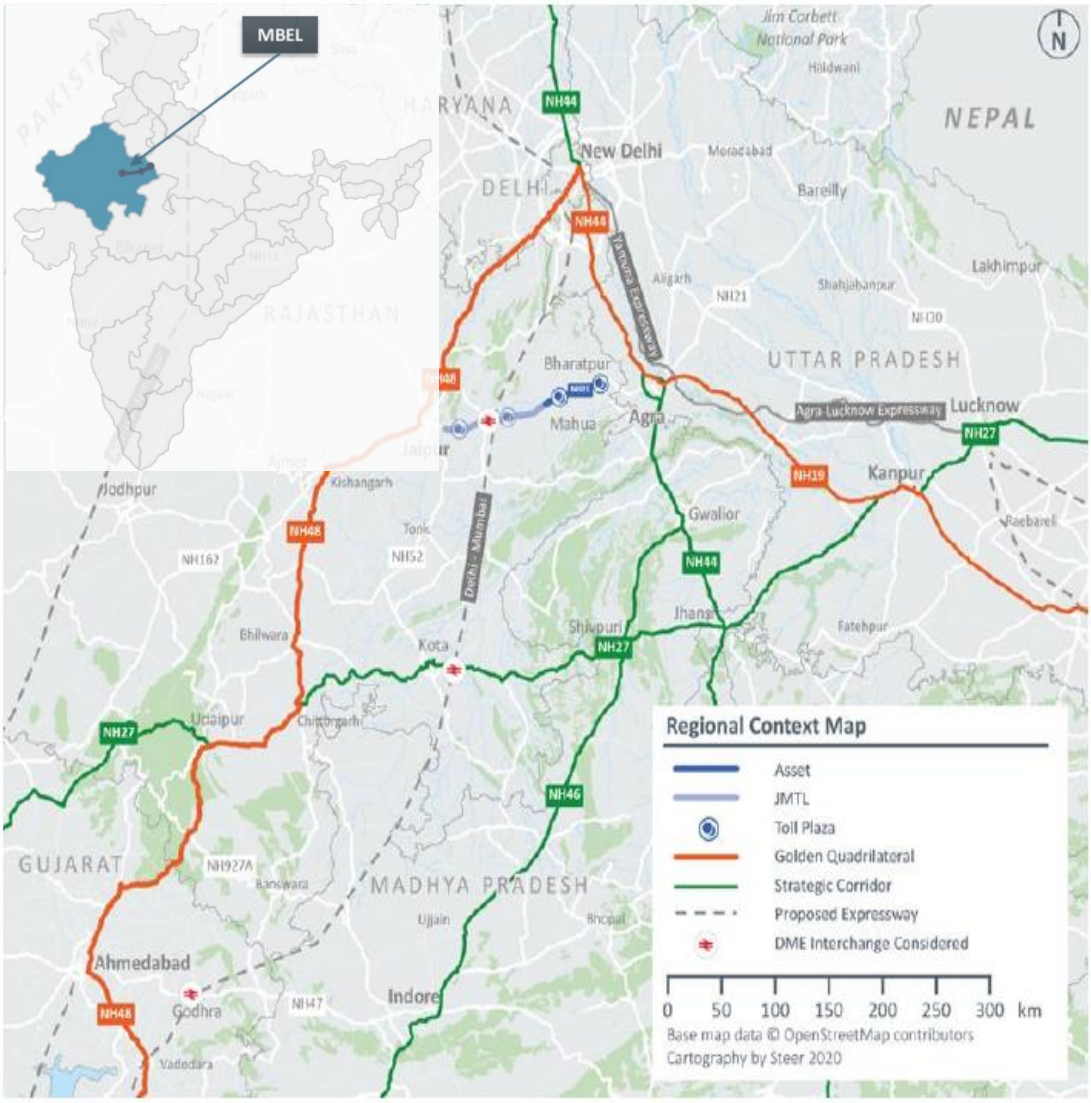
Corridor and Network Description

MBEL Project is a strategic national highway, situated along the southern arm of the golden triangle, connecting New Delhi to Jaipur and Agra - two of the most popular tourist destinations in the country. The MBEL Project connects Mahua to Bharatpur, which is on the outer edge of the south-western Uttar Pradesh. The project highway is also part of the long east-west highway network connecting south Rajasthan, Gujarat and Maharashtra to the union territory of New Delhi, Uttar Pradesh and other eastern states.

A few alternate routes impact traffic along MBEL Project. Travellers on long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states may use an alternative route along NH 27 that connects Udaipur to Kanpur via Chittorgarh-Kota-Jhansi.

Certain planned/ underway road network developments in the vicinity of MBEL Project that are likely to positively impact the traffic flow, include (i) completion of the Jaipur Ring Road; and (ii) completion of pending sections on the Agra Ring Road.

The map below illustrates the location of the MBEL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the MBEL Project include tourism in the State of Rajasthan, which is a key driver of passenger traffic, movement of cement-grade limestone and marble from Rajasthan to other parts of India, and movement of agricultural commodities such as grains, oilseeds and edible oil which is key driver of commercial traffic. Furthermore, in January 2021, the state government of Rajasthan released a policy on Manufactured Sand which provides an industry status to the units producing it for construction work and reduces dependency on riverbed sand. The new policy is expected to revive the sand mining activities and the majority of the recoverable volumes related to sand mining traffic is expected to commence using the MBEL Project by Financial Year ended March 31, 2023, as more and more sand mines start operating. Furthermore, construction of Jewar airport and metro is expected to further increase traffic carrying construction-related commodities.

Traffic Volume

The table below sets forth the historical traffic data of MBEL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Amoli

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	4,449	44.28	4,951	48.82	5,660	52.04
LCV	863	8.59	451	4.45	303	2.79
Bus	879	8.75	902	8.89	1,273	11.70

Vehicle Type	FY2020		FY2021[(1)]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
2A	349	3.47	206	2.03	100	0.92
3A/ MAV	3,508	34.91	3,631	35.81	3,540	32.55
Total AADT	**10,048**	**100**	**10,141**	**100**	**10,876**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the MBEL Project was operational.

Toll Plaza at Ludhawai

Vehicle Type	FY2020		FY2021[(1)]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	5,202	47.33	5,821	52.74	6,916	56.81
LCV	1,045	9.51	463	4.19	330	2.71
Bus	903	8.22	926	8.39	1,241	10.19
2A	340	3.09	213	1.93	161	1.32
3A/ MAV	3,501	31.85	3,615	32.75	3,526	28.96
Total AADT	**10,991**	**100**	**11,038**	**100**	**12,174**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the MBEL Project was operational.

Substantially all of MBEL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹88.61 million, ₹93.48 million, ₹89.10 million, ₹88.55 million and ₹93.45 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹287.72) million and total liabilities including debt from lenders was ₹3,041.38 million.

Land

The land that underlies the MBEL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

4. **Nelamangala Devihalli Expressway Private Limited ("NDEPL")**

Overview of the Project and the Concession

On July 9, 2007, the NHAI and Lanco Devihalli Highways Limited (the erstwhile concessionaire) entered in a concession agreement whereby Lanco Devihalli Highways Limited was engaged, on a BOT basis, for four laning of the carriageway on the Nelamangala junction in Karnataka with an overall length of 80.3 kilometers (the "**NDEPL Project**"). Since Lanco

Devihalli Highways Limited was unable to meet its debt obligations under its financing agreements, NDEPL was substituted as the concessionaire for the concerned road.

Thus, NDEPL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the NDEPL Project in accordance with the NDEPL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the NDEPL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

NDEPL Project is situated in the southern state of Karnataka, connecting the city of Bengaluru to Mangalore via NH 75. By virtue of its location it caters to different types of movements with the largest traffic share being attributable to medium-distance travellers between Bengaluru and Mangalore for leisure and tourism.

Certain planned/ underway road network developments in the vicinity of NDEPL Project that are likely to impact the traffic flow, include (i) the upgradation (four-laning) of a portion of the corridor between Hassan and Mangalore (with the addition of three bypasses) which is expected to reduce the journey time; and (ii) the proposed construction of peripheral ring road around Bengaluru which would help provide seamless connectivity in the region.

The map below illustrates the location of the NDEPL Project and the corridor it covers:

According to the Traffic Study Consultant, the factors that contribute to traffic growth on the NDEPL Project include its proximity to Bengaluru, home to one of the world's fastest growing IT service sector. As a result, there is a high passenger traffic driven by local and regional movements connecting key urban centres of the Bengaluru region with Mangalore, Udupi and Hassan. Furthermore, the increase in disposable income is also expected to result in a growth of the tourism industry on Karnataka's western coast which contain hills, temples and beaches and which are accessible via the NDEPL Project. The presence of two petroleum bottling plants along the NDEPL Project, including their planned capacity expansions should further increase commercial traffic flow.

Traffic Volume

The table below sets forth the historical traffic data of NDEPL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Doddakarenahalli

Vehicle Type	FY2020		FY2021[1]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	14,458	70.76	15,656	75.82	16,509	80.79
LCV	2,775	13.58	2,476	11.99	1,241	6.07
Bus	1,442	7.06	570	2.76	974	4.77
2A	806	3.94	987	4.78	711	3.48
3A/ MAV	952	4.66	960	4.65	999	4.89
Total AADT	**20,433**	**100**	**20,649**	**100**	**20,434**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the NDEPL Project was operational.

Toll Plaza at Karbylu

Vehicle Type	FY2020		FY2021[1]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	10,301	67.69	11,285	73.63	12,376	79.39
LCV	2,155	14.16	1,902	12.41	901	5.78
Bus	1,240	8.15	599	3.91	806	5.17
2A	605	3.98	656	4.28	553	3.55
3A/ MAV	918	6.03	884	5.77	952	6.11
Total AADT	**15,219**	**100**	**15,326**	**100**	**15,588**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the NDEPL Project was operational.

Substantially all of NDEPL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹80.34 million, ₹85.05 million, ₹78.77 million, ₹73.25 million and ₹79.14 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹636.23) million and total liabilities including debt from lenders was ₹4,351.70 million.

Land

The land that underlies the NDEPL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

5. **Walayar Vadakkencherry Expressways Private Limited ("WVEPL")**

Overview of the Project and the Concession

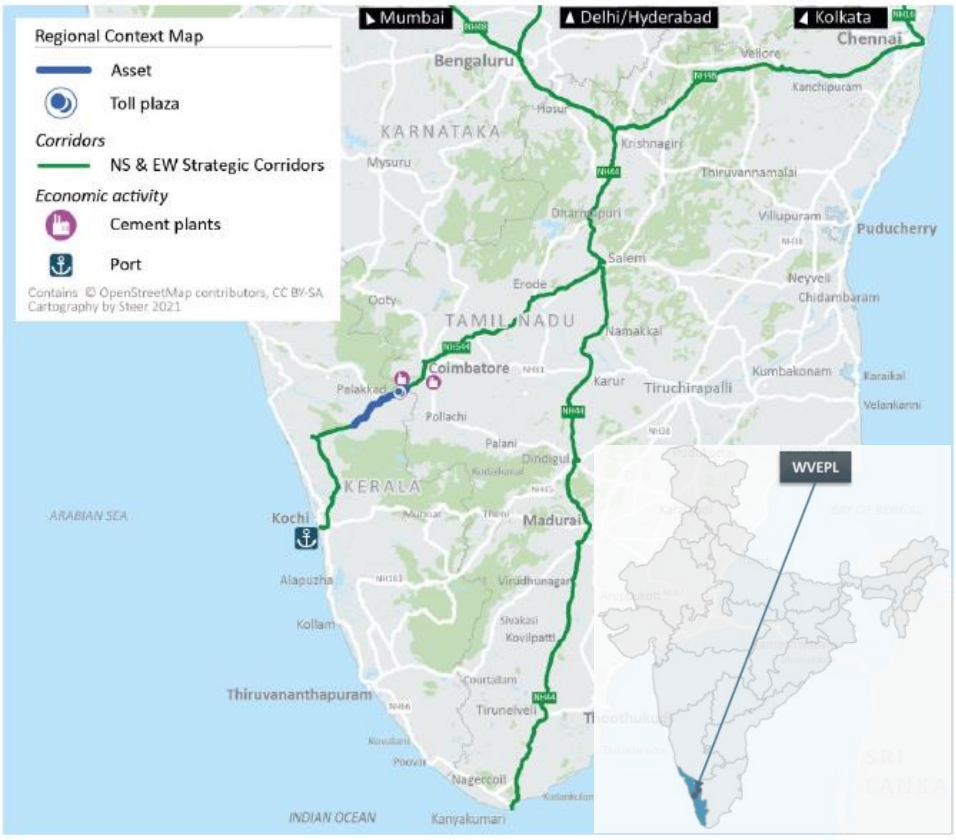
On September 17, 2012, the NHAI and M/s KNR Walayar Tollways Private Limited (the erstwhile concessionaire) entered in a concession agreement whereby M/s KNR Walayar Tollways Private Limited was engaged, on a DBFOT basis, for four laning of the carriageway on the Walayar-Vadakkencherry section of NH 544 (erstwhile NH 47) in Kerala with an overall length of 53.5 kilometers (the "**WVEPL Project**"). CH-III entered into a share purchase agreement to acquire 100% of M/s KNR Walayar Tollways Private Limited and the acquisition was completed on September 29, 2020. Subsequently, M/s KNR Walayar Tollways Private Limited's name was changed to WVEPL.

Thus, WVEPL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the WVEPL Project in accordance with the WVEPL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the WVEPL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

WVEPL Project connects Walayar, on the border of the southern Indian states of Tamil Nadu and Kerala, and Vadakkancherry in Kerala. Forming a critical part of NH 544 (erstwhile NH 47), WVEPL Project lies on the arterial entry route into Kerala, connecting the major cities of Salem, Erode and Coimbatore in Tamil Nadu with major towns/ ports of Thrissur and Kochi in Kerala.

Certain planned/ underway road network developments in the vicinity of WVEPL Project that are likely to impact the traffic flow, include the construction and completion of the Kuthiran tunnel section, which is expected to be completed in 2022. This is expected to provide an impetus to the long-distance commercial traffic flow along the WVEPL Project.
The map below illustrates the location of the WVEPL Project and the corridor it covers:



According to the Traffic Study Consultant, the significant factor that contributes to traffic on the WVEPL Project is that it forms an integral part of NH 544 which is the only four laned national highway that provides connectivity and a point of entry into Kerala from Tamil Nadu. There are also several industrial settlements along the WVEPL Project including Malabar Cements, one of the state's largest public sector cement production undertaking which drive commercial traffic on the project. Kanjikode, situated in the middle of the WVEPL Project contain manufacturing hubs for companies such as Bharat Earth Movers, Pepsico, Marico, United Breweries and Empee Distilleries.

Traffic Volume

The table below sets forth the historical traffic data of WVEPL across its toll plaza at Chullimada Hamlet (Pampampallam) according to the Traffic Study Consultant for the periods indicated:

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	10,634	60.54	6,401	54.86	7,971	56.72
LCV	2,363	13.45	1,492	12.79	1,544	10.99
Bus	971	5.53	240	2.06	366	2.60
2A	964	5.49	934	8.00	1,231	8.76
MAV	2,631	14.98	2,599	22.27	2,939	20.91
OSV	3	0.02	2	0.02	3	0.02
Total AADT	**17,566**	**100**	**11,668**	**100**	**14,054**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the WVEPL Project was operational.

Substantially all of WVEPL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹79.98 million, ₹90.70 million, ₹82.79 million, ₹75.84 million and ₹85.22 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹1,447.17) million and total liabilities including debt from lenders was ₹5,531.63 million.

Land

The land that underlies the WVEPL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

6. **Farakka-Raiganj Highways Limited ("FRHL")**

Overview of the Project and the Concession

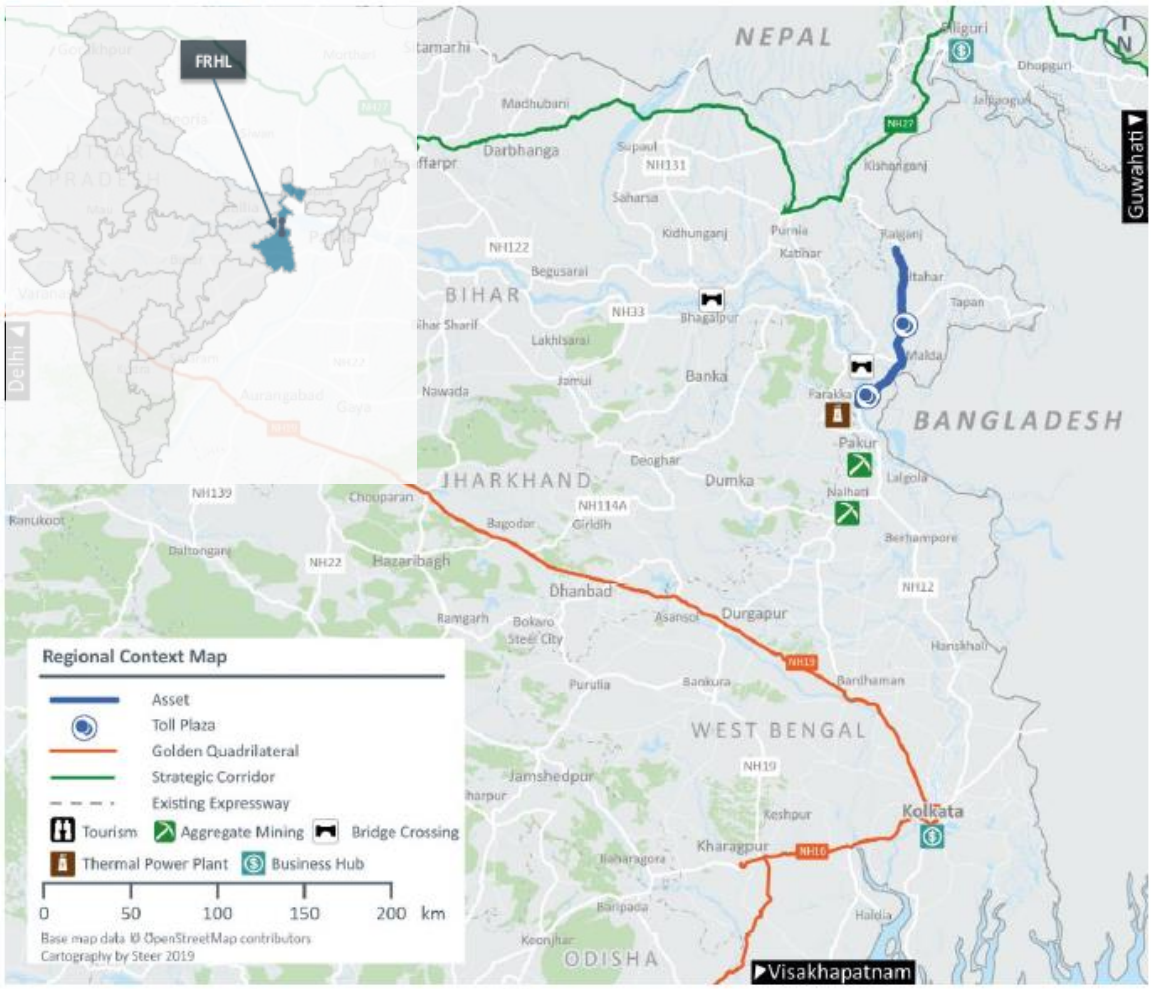
On July 19, 2010, the NHAI and FRHL entered in the FRHL Concession Agreement whereby FRHL was engaged, on a BOT basis, for four laning of the carriageway on the Farakka-Raiganj junction in West Bengal with an overall length of 100.1 kilometers (the "**FRHL Project**"). FRHL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the FRHL Project in accordance with the FRHL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the FRHL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

FRHL Project is situated in the eastern state of West Bengal, connecting the cities of Farakka and Raiganj. It also forms a part an integral link for traffic movement to the neighbouring countries of Bangladesh, Nepal and Bhutan. Traffic on the project is primarily commercial traffic carrying goods to different parts of the state of West Bengal, the north-eastern states, adjoining western states (Bihar and Jharkhand) and some southern states (such as Andhra Pradesh and Tamil Nadu). Travellers on long-distance trips connecting Kharagpur and Siliguri may use an alternative route along NH 14 via the Bhagalpur bridge and this is the only alternate route situated west of the FRHL Project to cross the Ganga river.

Certain planned/ underway road network developments that are likely to positively impact the traffic flow on the FRHL Project, include (i) recent completion of the pending road stretches on the project between Farakka and Dalkhola bypass (including Raiganj-Dalkhola and the Dalkhola bypass); (ii) completion of the Farakka Barrage bridge; and (iii) completion of the Sahibganj bridge.

The map below illustrates the location of the FRHL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the FRHL Project include movement of stone to Bangladesh and parts of India, and movement of agricultural commodities such as cotton, rice and vegetables which is a key driver of commercial traffic. Furthermore, on account of India's Act East Policy, which aims to boost India's strategic, economic and cultural ties with the Southeast Asian countries, the FRHL Project is strategically located between India and Bangladesh and provides connectivity to international land ports on the India-Bangladesh border.

Traffic Volume

The table below sets forth the historical traffic data of FRHL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Lakshmipur

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	2,822	27.17	3,670	34.53	3,538	31.59
LCV	861	8.29	770	7.25	737	6.58
2A/Bus	1,317	12.68	1,289	12.13	1,367	12.20

Vehicle Type	FY2020		FY2021(1)		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
3A	1,039	10.00	972	9.15	1,077	9.62
MAV	4,347	41.85	3,927	36.95	4,482	40.01
Total AADT	**10,386**	**100**	**10,628**	**100**	**11,202**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the FRHL Project was operational.

Toll Plaza at Gazole

Vehicle Type	FY2020		FY2021(1)		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	4,283	39.09	4,808	43.60	4,533	39.91
LCV	658	6.01	572	5.19	597	5.26
2A/Bus	1,679	15.32	1,545	14.01	1,753	15.44
3A	999	9.12	928	8.41	1,036	9.12
MAV	3,337	30.46	3,175	28.79	3,438	30.27
Total AADT	**10,956**	**100**	**11,028**	**100**	**11,357**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the FRHL Project was operational.

Substantially all of FRHL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹180.46 million, ₹184.78 million, ₹193.01 million, ₹178.31 million and ₹216.74 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹4,385.28) million and total liabilities including debt from lenders was ₹17,006.77 million.

Land

The land that underlies the FRHL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

7. **Western UP Tollway Limited ("WUPTL")**

Overview of the Project and the Concession

On September 9, 2005, the NHAI and M/s Western UP Tollway Limited (the erstwhile concessionaire) entered in a concession agreement whereby M/s Western UP Tollway Limited was engaged, on a BOT basis, for four laning of the carriageway of Meerut to Muzaffarnagar section of NH 334 (erstwhile NH 58) in Uttar Pradesh with an overall length of

77.8 kilometers (the "**WUPTL Project**"). On January 19, 2016, CH-I had entered into a share purchase agreement to acquire 100% of the shareholding of WUPTL from its erstwhile shareholders.

WUPTL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the WUPTL Project in accordance with the WUPTL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the WUPTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

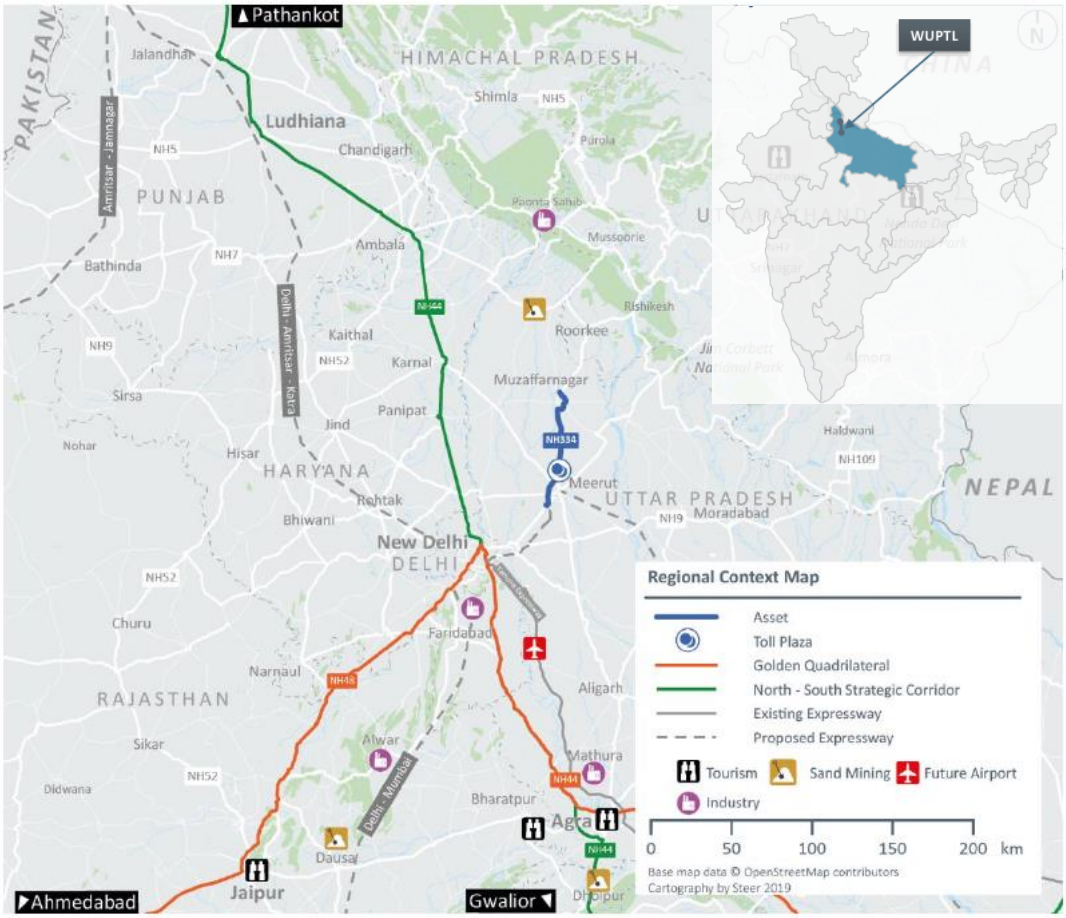
Corridor and Network Description

WUPTL Project is situated in western Uttar Pradesh, connecting the cities of Meerut and Muzaffarnagar. It primarily caters to short distance travellers travelling between Delhi – National Capital Region (NCR) and these cities for work, leisure or short trips and medium distance travellers travelling between Delhi – National Capital Region (NCR) and the popular tourist destinations of Uttarakhand, since the WUPTL Project is the primary route connecting these.

A few alternate routes impact traffic along WUPTL Project. The Upper Ganga Canal (UGC) road which connects Muradnagar to Khatauli (and further north up to Uttarakhand) is an alternate road that especially helps light vehicles (such as CJV, LCVs) to bypass the toll plaza and the congested Muradnagar-Modinagar-Meerut feeder stretch leading to the WUPTL Project. Another possible alternate route between Delhi – National Capital Region (NCR) and Uttarakhand is the Delhi-Baghpat-Shamli-Saharanpur section of NH 709B. Further, the Delhi-Saharanpur-Dehradun Expressway is another potential alternate route along the WUPTL Project. However, the proposed 210 kilometers expressway is expected to be completed only in 2026.

Certain planned/ underway road network developments that are likely to impact the traffic flow on the WUPTL Project, include completion of the Ganga expressway.

The map below illustrates the location of the WUPTL Project and the corridor it covers:



According to the Traffic Study Consultant, because the WUPTL Project provides a key link to major religious and tourists destinations in Uttarakhand such as Haridwar, Mussoorie and Rishikesh, the traffic on the project is predominately passenger traffic. Furthermore, a large number of amenities, restaurants and hotel chains are located along the WUPTL,

increasing passenger traffic due to tourists. With the revival of sand mining activities, the majority of the recoverable volumes related to sand mining traffic is expected to commence using the WUPTL Project by Financial Year ended March 31, 2023, as more and more sand mines start operating. Further, the commissioning of Delhi Meerut Expressway has resulted in a significant increase in traffic volumes in Financial Year ended March 31, 2022.

Traffic Volume

The table below sets forth the historical traffic data of WUPTL across its toll plaza at Siwaya according to the Traffic Study Consultant for the periods indicated:

Vehicle Type	**FY2020**		**FY2021[(1)]**		**FY2022**	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	15,920	76.66	11,691	75.40	20,562	83.56
LCV	1,264	6.09	1,050	6.77	1,007	4.09
2A/Bus	2,417	11.64	1,515	9.77	1,774	7.21
3A/MAV	1,165	5.61	1,249	8.06	1,265	5.14
Total AADT	**20,766**	**100**	**15,505**	**100**	**24,608**	**100**

Source: *Traffic Reports.*

Note:

The data for April 2020 only includes the days during which the WUPTL Project was operational.

Substantially all of WUPTL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹134.47 million, ₹131.65 million, ₹122.58 million, ₹126.25 million and ₹134.82 million, respectively.

Capital Structure

As of October 31, 2022, total equity was (₹305.76) million and total liabilities including debt from lenders was ₹3,815.41 million.

Land

The land that underlies the WUPTL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

8. Ghaziabad Aligarh Expressway Private Limited ("GAEPL")

Overview of the Project and the Concession

On May 20, 2010, the NHAI and GAEPL entered in the GAEPL Concession Agreement whereby GAEPL was engaged, on a BOT basis, for four laning of the carriageway on the Ghaziabad-Aligarh section of NH 91 in Uttar Pradesh with an overall length of 125.2 kilometers (the "**GAEPL Project**"). GAEPL has the sole and exclusive right to demand, collect and appropriate tolls payable by vehicles using the GAEPL Project in accordance with the GAEPL Concession Agreement and at the rates set out in the National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended. For further details on the GAEPL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

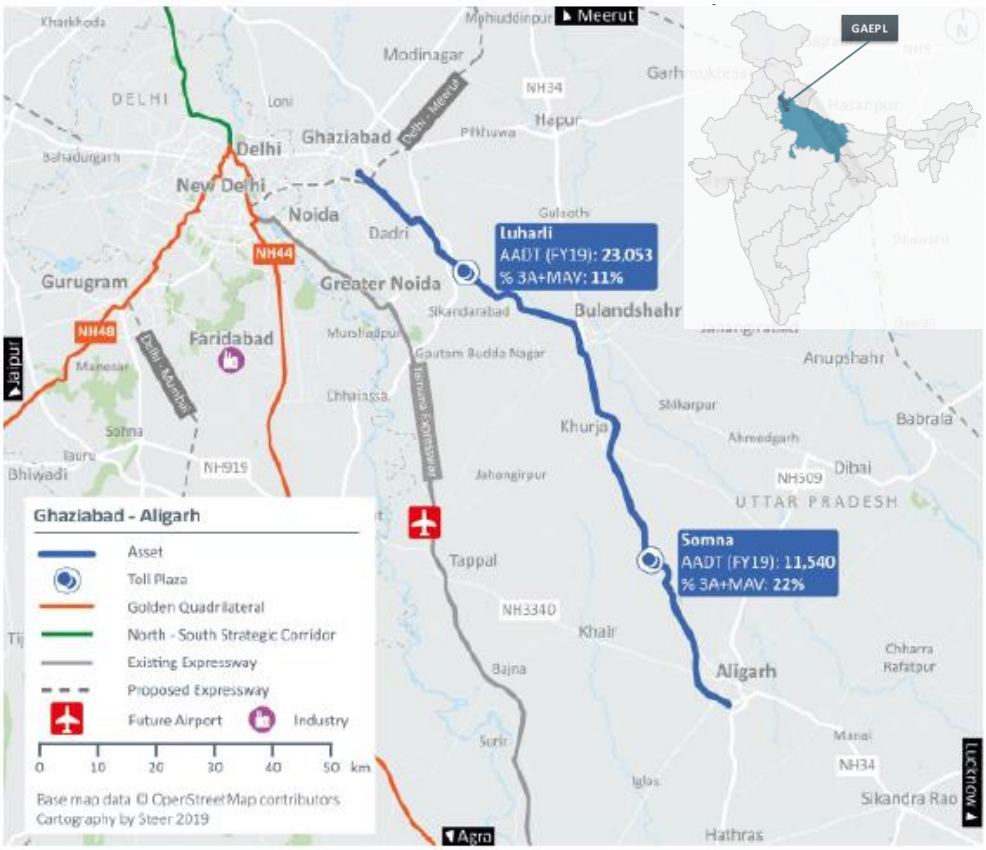
GAEPL Project is part of the strategically important north-east corridor connecting New Delhi and northern parts of India to major urban centres in Uttar Pradesh and eastern parts of India, such as Lucknow, Kanpur, Patna, Kolkata. In particular,

GAEPL Project is situated in western Uttar Pradesh, connecting the cities of Ghaziabad and Aligarh through Khurja and Bulandshahr.

On account of the planned construction to expand the existing four lanes to six lanes, the traffic movement on the project between Khurja and Aligarh would have an option to use the alternate state highway through Pahasu and Chattari. There is no toll on the Pahasu alternate, and the traffic can bypass GAEPL's toll plaza at Somna while taking this route. For medium-distance travellers especially those traversing the region southwest of the GAEPL Project, there are several state highways which have been recently upgraded, thereby improving the overall quality of local network. These provide cheaper, often free, routes to access industrial cities like Sikandrabad and Ghaziabad. There are also a few alternate routes for traffic between Delhi and Lucknow and those travelling from northern India to southern parts of the country.

Certain planned/ underway road network developments that are likely to impact the traffic flow on the GAEPL Project, include (i) expansion of our existing four lanes to six lanes; (ii) four-laning of the Aligarh-Kannau road; and (iii) completion of the Ganga expressway.

The map below illustrates the location of the GAEPL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the GAEPL Project include large-scale industries located in towns along the project such as Sikandrabad, Khurja and Aligarh which specialise in manufacturing ceramics and hardware and these generate significant commercial traffic. The proposed Khurja thermal power project expected to be completed by Financial Year 2024 in Bulandshahr will generate large amounts of fly ash which is used in the construction and manufacturing of cement and bricks, further supporting commercial traffic. As Uttar Pradesh is the most populous state in India with several urban centres located on the project, including Ghaziabad, the GAEPL Project also serves a large volume of local and regional light vehicular traffic, carrying both passengers and agriculture commodities.

Traffic Volume

The table below sets forth the historical traffic data of GAEPL across its toll plazas according to the Traffic Study Consultant for the periods indicated:

Toll Plaza at Luharli

Vehicle Type	FY2020		FY2021[(1)]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	16,663	68.57	15,519	69.94	17,516	71.34
LCV	2,283	9.39	1,905	8.59	1,672	6.81
2A/ Bus	2,770	11.40	2,304	10.38	2,667	10.86
3A/ MAV	2,584	10.63	2,456	11.07	2,694	10.97
OSV	2	0.01	4	0.02	3	0.01
Total AADT	**24,302**	**100**	**22,188**	**100**	**24,552**	**100**

Source: Traffic Reports.

Note:

The data for April 2020 only includes the days during which the GAEPL Project was operational.

Toll Plaza at Somna

Vehicle Type	FY2020		FY2021[(1)]		FY2022	
	(vehicles)	*(%)*	*(vehicles)*	*(%)*	*(vehicles)*	*(%)*
Car / Jeep / Van	6,482	54.11	6,013	55.52	6,206	56.38
LCV	1,329	11.09	1,002	9.25	824	7.49
2A/ Bus	2,000	16.70	1,817	16.78	2,037	18.50
3A/ MAV	2,168	18.10	1,997	18.44	1,940	17.62
OSV	-	-	1	0.01	1	0.01
Total AADT	**11,979**	**100**	**10,830**	**100**	**11,008**	**100**

Source: Traffic Reports.

Note:

The data for April 2020 only includes the days during which the GAEPL Project was operational.

Substantially all of GAEPL's operating revenues are derived from the toll receipts that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹234.63 million, ₹225.50 million, ₹205.89 million, ₹213.91 million and ₹218.52 million, respectively.

Capital Structure

As of October 31, 2022, total equity was ₹3,011.34 million and total liabilities including debt from lenders was ₹17,140.13 million.

Land

The land that underlies the GAEPL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

Description of TOT Toll Roads

1. Kotwa – Muzaffarpur Tollway Limited ("KMTL")

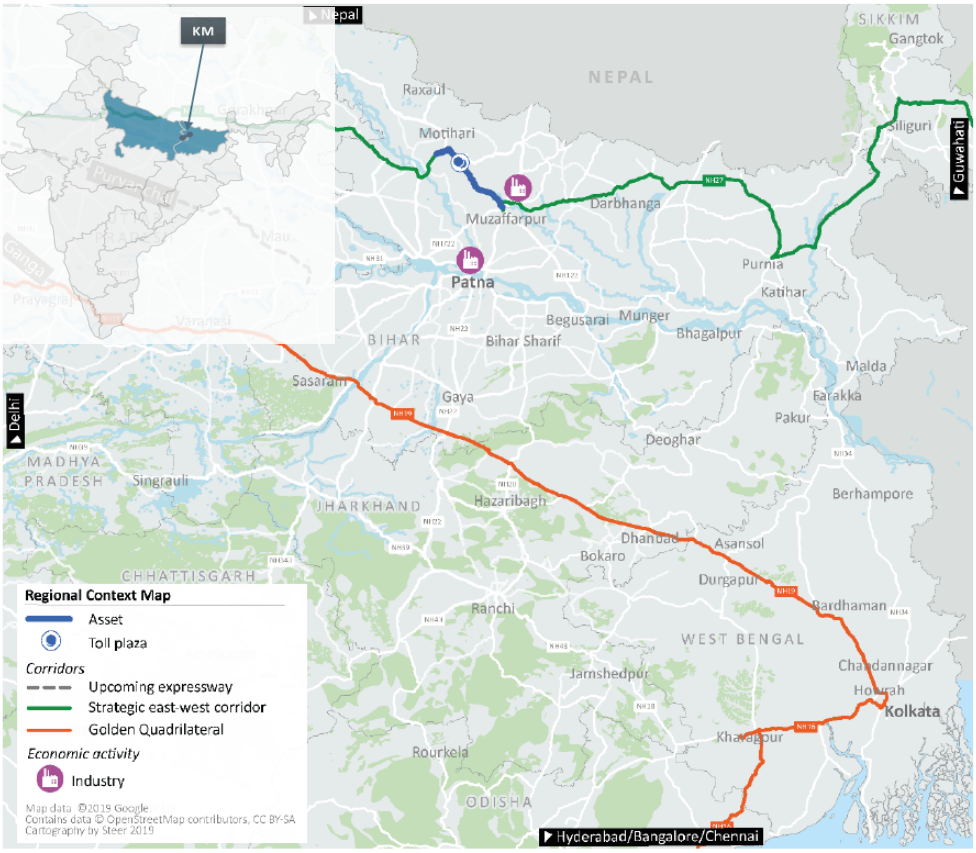
Overview of the Project and the Concession

On December 27, 2019, NHAI and KMTL entered in the KMTL Concession Agreement whereby KMTL was engaged, on a toll, operate and transfer ("**TOT**") basis, for the project highway in Bihar with an overall length of 80.0 kilometers (the "**KMTL Project**"). KMTL has the sole and exclusive right from the Appointed Date (as defined under the KMTL Concession Agreement) to undertake tolling activities. For further details on the KMTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

KMTL Project is situated in Bihar on the strategic East-West Corridor (NH 28). It primarily caters to three different types of strategic movements: (i) short to medium distance local trips mostly made by cars between Motihari, Chakia, Motipur and other local destinations mostly for work related purpose; (ii) medium distance trips made by light and heavy goods vehicles covering places such as Patna in the southern part of Bihar and Raxaul near the India-Nepal border thereby catering to the heavy movement of trucks between the two countries for trade purpose; and (iii) long distance trips undertaken by heavy goods vehicles to provide the east-west connectivity between states such as Uttar Pradesh, Uttarakhand and Delhi, and West Bengal and North-Eastern states. The KMTL Project also caters to movement of trucks to countries such as Bangladesh and Bhutan.

State Highway 74 acts as an alternate connection between Muzaffarpur and NH 27, with towns and villages on-route. Since the travel patterns on KMTL Project have matured over time, this alternate route is not expected to impact the traffic currently on KMTL.
The map below illustrates the location of the KMTL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the KMTL Project include movement of agricultural commodities, such as sugar and related products, rice, maize, dairy and other processed foods which are a key driver of commercial traffic, and important tourism destinations within Bihar, such as Bodhgaya and Nalanda. Muzaffarpur, situated on one end of the KMTL Project is the commercial hub of north Bihar, and it is well known for its lychee and mangoes which are supplied across the country. Furthermore, the Government of India's renewed focus on infrastructure development to further enhance the connectivity between the North-Eastern states and other states is expected to accelerate traffic growth along KMTL Project.

Traffic Volume

Historical traffic data for the KMTL Project is available for all toll vehicle categories starting in November 2020 up to March 2022. The table below sets forth the historical traffic data from the toll plaza at Parsoni Khem according to the Traffic Study Consultant for the periods indicated:

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
Passenger Vehicles							
Car / Jeep / Van	3,584	4,775	4,120	3,356	4,330	3,885	4,118
Buses	424	507	495	364	409	402	439
Total passenger vehicles	**4,008**	**5,282**	**4,615**	**3,720**	**4,739**	**4,287**	**4,557**
Goods Vehicles							
LCV	514	507	509	429	486	511	483
2A	1,141	1,047	1,032	949	1,051	1,112	1,042
3A	1,144	1,087	1,147	1,079	1,141	1,166	1,083
MAV	2,285	2,372	2,675	2,377	2,413	2,346	2,349
Total goods vehicles	**5084**	**5013**	**5363**	**4834**	**5091**	**5135**	**4957**
Total AADT	**9,092**	**10,295**	**9,978**	**8,554**	**9,830**	**9,422**	**9,514**

Source: Traffic Reports.

Substantially all of KMTL's operating revenues are derived from the tolls that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹94.02 million, ₹94.40 million, ₹83.47 million, ₹80.39 million and ₹86.65 million, respectively.

Capital Structure

As of October 31, 2022, total equity was ₹737.19 million (including share premium) and total liabilities including debt from lenders was ₹8,098.90 million.

Land

The land that underlies the KMTL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

2. Lucknow-Raebareli Tollway Limited ("LRTL")

Overview of the Project and the Concession

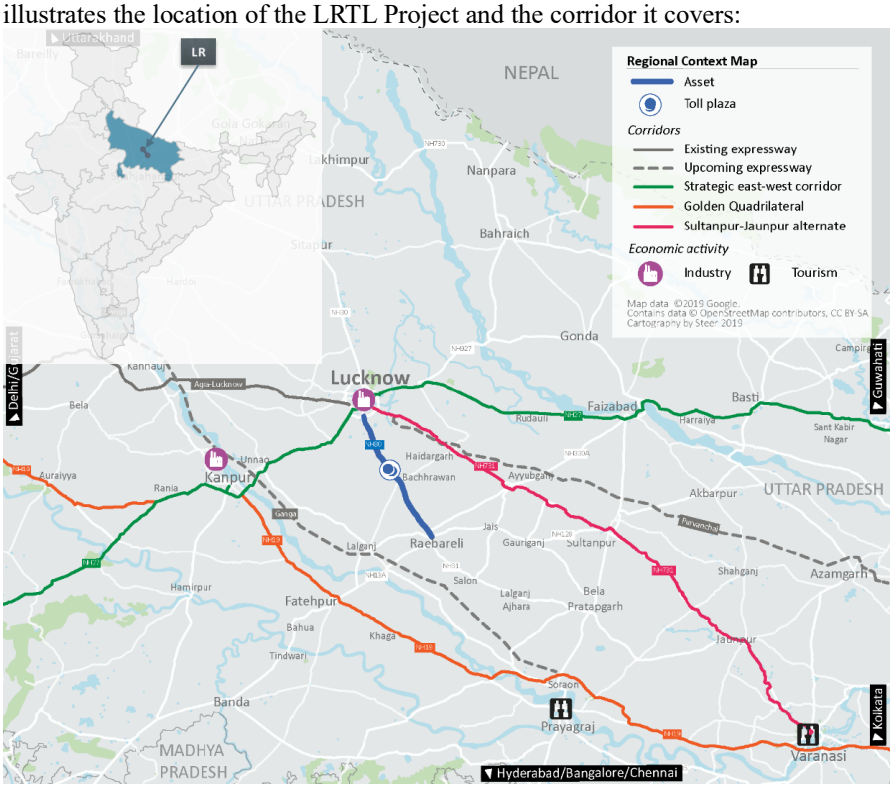
On December 27, 2019, NHAI and LRTL entered in the LRTL Concession Agreement whereby LRTL was engaged, on a TOT basis, for the project highway in Uttar Pradesh with an overall length of 70.0 kilometers (the "**LRTL Project**"). LRTL has the sole and exclusive right from the Appointed Date (as defined under the LRTL Concession Agreement) to undertake tolling activities and with effect from the O&M Handover Date (as defined under the LRTL Concession Agreement). For further details on the LRTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

The LRTL Project is situated in Uttar Pradesh and connects the state capital Lucknow to Raebareli in the southern central part of Lucknow. It primarily caters to two different types of strategic movements: (i) short distance local trips mostly undertaken by passenger vehicles for work, business and tourism between Lucknow, Raebareli, Prayagraj, Varanasi and Murzapur; and (ii) long distance trips undertaken by heavy trucks carrying commodities, such as agriculture and grocery items, metal, cement, petroleum and manufacturing items, between Punjab, Haryana, Uttar Pradesh, West Bengal and Jharkhand.

The key alternate to LRTL Project is the Lucknow-Sultanpur-Varanasi connection, which is currently under construction between Sultanpur and Varanasi. The Lucknow-Sultanpur section is complete and has been tolling since July 2019. Once the section between Lucknow and Varanasi is complete, it is expected that a proportion of traffic will shift away from the project. However, since the expected toll on this road is likely to be higher, only a small portion of traffic is expected to shift to this route.

The map below illustrates the location of the LRTL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the LRTL Project includes local and tourist passenger traffic to cities of religious importance - Varanasi (known for its famous ghats along the Ganga river) and Prayagraj (known for the confluence of the rivers Ganga, Yamuna and Saraswati (Triveni Sangam) Magh Mela and Kumbh Mela). The state capital, Lucknow located on one end of the LRTL Project is a significant traffic generator with the presence of major IT companies, automotive industry, handicrafts sector which accounts for 60% of the total exports from the state, education sector and research and development institutes. Raebareli, located on the other end of the LRTL Project drives commercial traffic since it contains some major industries such as the Rail Coach Factory at Lalganj, NTPC power plant at Unchahar and the MP Birla Cement Plant at Raebareli and Kundanganj.

Traffic Volume

Historical traffic data for the LRTL Project is available for all toll vehicle categories starting in November 2020 up to March 2022. The table below sets forth the historical traffic data from the toll plaza at Dakhina Sekhpur according to the Traffic Study Consultant for the periods indicated:

Vehicle Type	**October 2021**	**November 2021**	**December 2021**	**January 2022**	**February 2022**	**March 2022**	**FY2022 Adopted AADT**
Passenger Vehicles							
Car / Jeep / Van	10,379	11,995	11,271	9,595	11,345	10,074	10,692
Buses	662	682	691	627	638	646	651
Total passenger vehicles	**11,041**	**12,677**	**11,962**	**10,222**	**11,983**	**10,720**	**11,343**
Goods Vehicles							
LCV	677	616	607	532	591	562	585
2A	704	602	652	552	592	578	608
3A	480	442	542	521	623	518	497
MAV	1,210	976	1,141	976	1,063	1,012	1,022
Total goods vehicles	**3,071**	**2,636**	**2,942**	**2,581**	**2,869**	**2,670**	**2,712**
Total AADT	**14,112**	**15,313**	**14,904**	**12,803**	**14,852**	**13,390**	**14,055**

Source: Traffic Reports.

Substantially all of LRTL's operating revenues are derived from the tolls that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹55.83 million, ₹57.35 million, ₹52.75 million, ₹51.96 million and ₹52.56 million, respectively.

Capital Structure

As of October 31, 2022, total equity was ₹613.32 million (including share premium) and total liabilities including debt from lenders was ₹4,822.63 million.

Land

The land that underlies the LRTL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

3. Madurai Kanyakumari Tollway Limited, Kanyakumari-Etturavattam Tollway Limited, Salaipudhur-Madurai Tollway Limited and Nanguneri-Kanykakumari Tollway Limited (collectively referred to as "MK")

Overview of the Project and the Concession

On December 27, 2019, each of the entities of MK entered into individual concession agreements with NHAI whereby each of them was engaged, on a TOT basis, for the project highway in the Tamil Nadu with an overall length of approximately 243.0 kilometers (the "**MK Project**"). Each of these entities have the sole and exclusive right from the Appointed Date (as defined under the respective concession agreements) to undertake tolling activities on their individual stretches. For further details on these concession agreements, please see, "*Summary of the Concession Agreements*" on page 216.

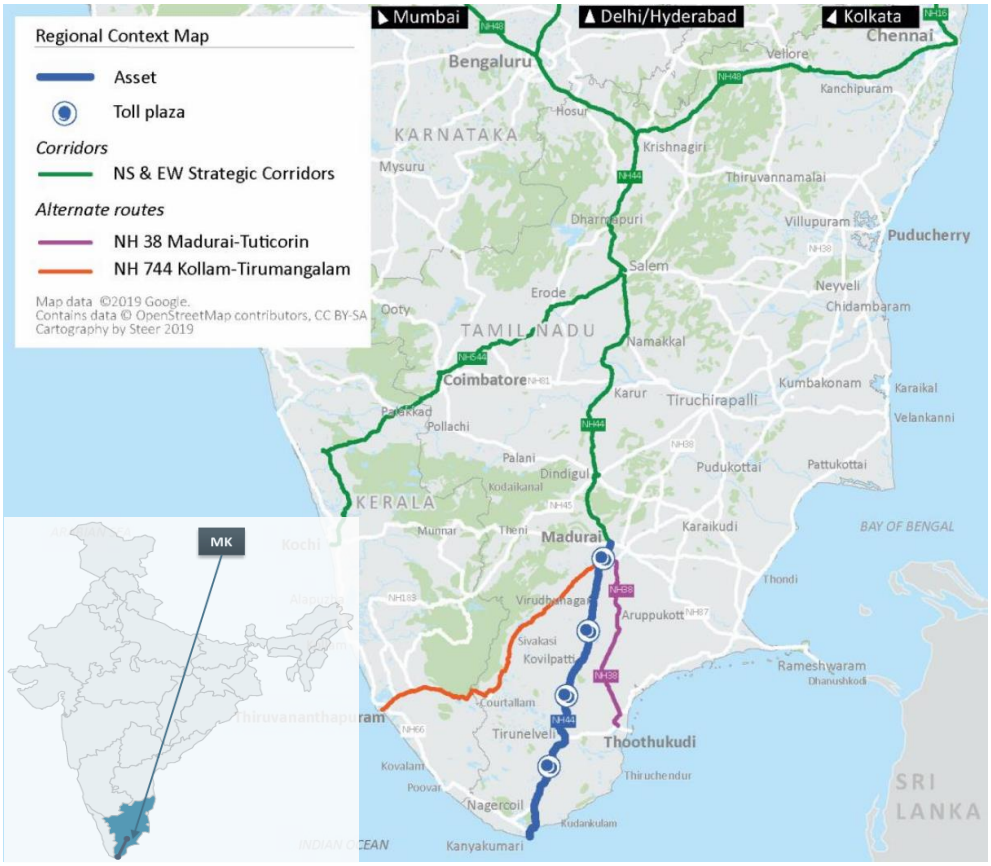
Corridor and Network Description

The MK Project is situated in the Tamil Nadu, connecting Madurai, northern Tamil Nadu and the states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The MK Project is situated at the southern end of NH 44, the traditional north-south corridor between north and south India, terminating at Kanyakumari. The asset primarily caters to three different types of strategic movements, namely (i) long distance trips between north India and southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end, (ii) medium distance trips between northern Tamil Nadu including Chennai, and southern Karnataka, Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram and (iii) short distance trips between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

There are several alternative routes for medium distance trips and micro diversions, which are local roads that allow motorists to bypass tolls, but no alternative routes for long distance trips. The only potential alternate route for long distance travellers, the NH 66, connecting Mumbai to Kanyakumari along the west coast, does not directly compete with the project as it passes through highly urban and congested areas in Kerala.

There are two major medium distance alternatives available: (i) the Madurai-Tuticorin expressway that connects Madurai to Tuticorin, primarily used by port traffic between the northern Tamil Nadu and the port of Tuticorin; and (ii) the route between Madurai and Kollam, through Rajapalayam, a competitive alternate un-tolled route for motorists travelling to the Courtallam and Kollam districts of Kerala.

There are two alternatives for micro diversions: (i) an urban road that provides a diversion around the Kappalur toll plaza through Uchapatti; and (ii) a rural road that diverts traffic around the Nanguneri toll plaza on its western side.
The map below illustrates the location of the MK Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the MK Project are its proximity to: (i) the north-south NH 44 corridor, which passes major economic centres in India; (ii) the Chennai-Kanyakumari industrial corridor that promotes port based economic development and which has no long distance alternatives; (iii) the special economic zones in Madurai and Tirunelveli, respectively, which house the Tamil Nadu Small Industries Corporation (a facility for food processing, textile and hardware industries) and LPG storage facilities, bottling plants and ancillary automotive manufacturing component units; and (iv) cement plants (Ramco Cements and India Cements) and limestone reserves along the corridor. These factors drive commercial traffic on the MK Project. Furthermore, Tamil Nadu is a leading producer of wind energy in India, with several new wind farms being commissioned in the region which will drive wind power linked goods traffic along the project.

The MK Project also provides a link between southern Tamil Nadu and Kerala to serve tourist traffic and passenger towards hill stations (Thekkady, Kodaikanal and Munnar), beaches in Kerala and renowned pilgrimage destinations like Rameswaram and Kanyakumari. Lastly, the highly urbanised nature of the region, including cities like Madurai, Tirunelveli and Trivandrum, and towns like Virudhunagar, Kovilpatti and Tuticorin, provide significant traffic for consumption-related retail activity.

Traffic Volume

Historical traffic data for the MK Project is available for all toll vehicle categories starting in November 2020 up to March 2022. The table below sets forth the historical traffic data of MK Project across its toll plazas according to the Traffic Study Consultant for the periods indicated:

(a) Toll Plaza at Kappalur

Vehicle Type	**October 2021**	**November 2021**	**December 2021**	**January 2022**	**February 2022**	**March 2022**	**FY2022 Adopted AADT**
Passenger Vehicles							
Car / Jeep / Van	17,811	16,767	18,320	15,651	16,891	18,079	17,811
Buses	2,958	2,807	2,920	2,644	2,924	2,933	2,958
Total passenger vehicles	**20,769**	**19,574**	**21,240**	**18,295**	**19,815**	**21,012**	**20,769**
Goods Vehicles							

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
LCV	1,634	1,346	1,608	1,435	1,561	1,644	1,634
2A	1,226	1,068	1,302	1,246	1,273	1,321	1,226
3A	578	450	593	552	577	608	578
MAV	855	704	858	798	912	949	855
Total goods vehicles	**4,293**	**3,568**	**4,361**	**4,031**	**4,323**	**4,522**	**4,293**
Total AADT	**25,062**	**23,142**	**25,601**	**22,326**	**24,138**	**25,534**	**25,062**

Source: Traffic Reports.

(b) Toll Plaza at Etturvattam

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
Passenger Vehicles							
Car / Jeep / Van	7,102	6,705	7,673	6,619	7,029	7,637	7,286
Buses	940	964	1,009	908	974	992	980
Total passenger vehicles	**8,042**	**7,669**	**8,682**	**7,527**	**8,003**	**8,629**	**8,266**
Goods Vehicles							
LCV	829	694	814	749	819	870	793
2A	795	654	807	788	853	876	811
3A	335	244	323	314	323	348	315
MAV	664	545	701	628	729	743	691
Total goods vehicles	**2,623**	**2,137**	**2,645**	**2,479**	**2,724**	**2,837**	**2,610**
Total AADT	**10,665**	**9,806**	**11,327**	**10,006**	**10,727**	**11,466**	**10,876**

Source: Traffic Reports.

(c) Toll Plaza at Salaipudhur

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
Passenger Vehicles							
Car / Jeep / Van	6,810	6,285	7,235	6,315	6,703	7,021	6,863
Buses	795	800	836	767	799	831	816
Total passenger vehicles	**7,605**	**7,085**	**8,071**	**7,082**	**7,502**	**7,852**	**7,679**
Goods Vehicles							
LCV	727	616	720	668	725	781	705
2A	673	581	704	684	747	762	711
3A	278	210	267	271	305	331	283
MAV	489	398	487	463	521	533	494
Total goods vehicles	**2,167**	**1,805**	**2,178**	**2,086**	**2,298**	**2,407**	**2,193**
Total AADT	**9,772**	**8,890**	**10,249**	**9,168**	**9,800**	**10,259**	**9,872**

Source: Traffic Reports.

(d) Toll Plaza at Nanguneri

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
Passenger Vehicles							
Car / Jeep / Van	8,545	8,043	9,607	7,913	8,624	8,750	8,776

Vehicle Type	October 2021	November 2021	December 2021	January 2022	February 2022	March 2022	FY2022 Adopted AADT
Buses	1,011	1,011	1,098	969	1,058	1,108	1,062
Total passenger vehicles	**9,556**	**9,054**	**10,705**	**8,882**	**9,682**	**9,858**	**9,838**
Goods Vehicles							
LCV	762	647	769	713	792	810	749
2A	639	572	648	618	655	676	650
3A	331	282	343	365	387	369	351
MAV	495	402	497	474	517	512	491
Total goods vehicles	**2,227**	**1,903**	**2,257**	**2,170**	**2,351**	**2,367**	**2,241**
Total AADT	**11,783**	**10,957**	**12,962**	**11,052**	**12,033**	**12,225**	**12,079**

Source: Traffic Reports.

Substantially all of the MK Project's operating revenues are derived from the tolls that it is entitled to collect.

	Gross Monthly Toll Revenue				
	November 2022	**December 2022**	**January 2023**	**February 2023**	**March 2023**
			(in ₹ million)		
Madurai Kanyakumari Tollway Limited	72.43	86.11	84.59	76.12	79.31
Kanyakumari-Etturavattam Tollway Limited	42.50	49.96	50.13	44.69	47.19
Salaipudhur-Madurai Tollway Limited	45.18	53.63	52.98	45.07	48.81
Nanguneri-Kanykakumari Tollway Limited	47.41	55.49	53.79	44.92	47.92

Capital Structure

	As of October 31, 2022	
	Total Equity	**Total liabilities including debt from lenders**
	(*in ₹ million*)	
Madurai Kanyakumari Tollway Limited	497.34	7,391.15
Kanyakumari-Etturavattam Tollway Limited	711.33	5,594.73
Salaipudhur-Madurai Tollway Limited	471.06	5,538.74
Nanguneri-Kanykakumari Tollway Limited	911.04	6,601.05

Note: Total equity includes share premium.

Land

The land that underlies the MK project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

4. Jhansi-Lalitpur Tollway Limited ("JLTL") and Jhansi-Vigakhet Tollway Limited ("JVTL")

Overview of the Project and the Concession

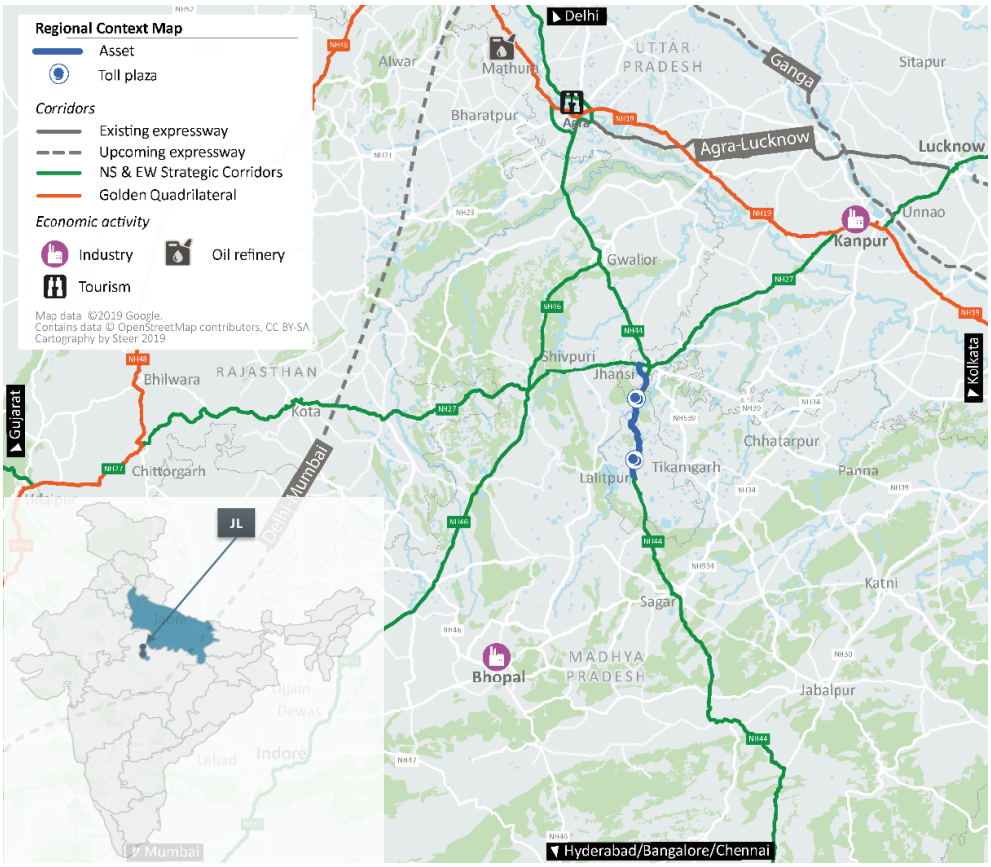
On December 27, 2019, NHAI and JLTL and JVTL entered in the JLTL Concession Agreement and JVTL Concession Agreement whereby JLTL and JVTL were engaged, on a TOT basis, for the project highway in Uttar Pradesh with an overall length of 99.0 kilometers (each referred to as the "**JLTL Project**" and "**JVTL Project**", respectively). JLTL and JVTL have the sole and exclusive right from the Appointed Date (as defined in the JLTL Concession Agreement and JVTL Concession Agreement, respectively) to undertake tolling activities (on their individual stretches) and with effect from the O&M Handover Date (as defined in the JLTL Concession Agreement and JVTL Concession Agreement, respectively). For further details on the JLTL Concession Agreement and JVTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

Both the JLTL Project and JVTL Project (collectively referred to as "**JL Project**") are situated in Uttar Pradesh, connecting Jhansi and Lalitpur on the NH44 (erstwhile NH 25 and 26). This route also connects major economic centres of New Delhi, Gwalior, Nagpur, Hyderabad, Bangalore and Chennai, as well as catering to the north-south movement between Jammu and Kashmir and Kanyakumari.

A few alternate routes impact traffic along JL Project. There is a local bypass present near Babina toll plaza, an intermediate lane passing through settled areas, which can only be used by CJV traffic. There is another alternate route between Jhansi and Sagar via Tikamgarh, which also bypasses the toll plaza. However, this alternate route is closed during the rainy season because of overflowing water on the low-level bridge near Orchha and thus it is not preferred by general traffic. For long distance travellers between New Delhi and Bangalore, there are two alternative routes - connecting Delhi-Agra-Gwalior-Jhansi-Lalitpur-Nagpur-Hyderabad-Bangalore and which pass through the JL Project and an alternate route connecting Delhi-Agra-Gwalior-Indore-Aurangabad-Bangalore. The former route (passing through the JL Project) is preferred because of its shorter length and better pavement quality. Furthermore, once the Delhi-Mumbai expressway is completed it may develop as an alternate route.

Certain planned/ underway road network developments in the vicinity of JL Project that are likely to positively impact the traffic flow, include the recently upgraded NH 44 (for seamless north-south connectivity).
The map below illustrates the location of the JL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the JL Project are the major settlements along the project, such as Jhansi and Gwalior. Jhansi is the only city present on both the east-west (NH 27)

and north-south corridors and drives passenger traffic. Commercial traffic on the project is driven by the presence of the Parichha thermal power plant (near Jhansi) and Lalitpur thermal power plants, diamond cement factory and stone crusher plants. With Uttar Pradesh's economy mainly based on agriculture, there is also a significant movement of agricultural commodities such as tomatoes, rice and potatoes. There is also a proposal to develop a defence park in Jhansi which would house automotive manufacturing units for military and police, forensics centres, aircraft and helicopter manufacturing and assembly lines, and drone manufacturing and testing facilities which will further drive commercial traffic.

Traffic Volume

Historical traffic data of the JL Project is available for all toll vehicle categories starting in November 2020 up to March 2022. The table below sets forth the historical traffic data of JL Project across its toll plazas according to the Traffic Study Consultant for the periods indicated:

(e) Toll Plaza at Babina

Vehicle Type	**October 2021**	**November 2021**	**December 2021**	**January 2022**	**February 2022**	**March 2022**	**FY2022 Adopted AADT**
Passenger Vehicles							
Car / Jeep / Van	2,755	2,951	3,024	2,724	3,220	2,975	2,872
Buses	164	160	174	155	186	158	163
Total passenger vehicles	**2,919**	**3,111**	**3,198**	**2,879**	**3,406**	**3,133**	**3,035**
Goods Vehicles							
LCV	255	217	236	204	225	231	220
2A	1,110	907	977	905	1,006	1,029	969
3A	1,522	1,267	1,315	1,164	1,340	1,307	1,248
MAV	1,778	1,672	1,779	1,585	1,696	1,708	1,611
Total goods vehicles	**4,665**	**4,063**	**4,307**	**3,858**	**4,267**	**4,275**	**4,048**
Total AADT	**7,584**	**7,174**	**7,505**	**6,737**	**7,673**	**7,408**	**7,083**

Source: Traffic Reports.

(f) Toll Plaza at Vigakhet

Vehicle Type	**October 2021**	**November 2021**	**December 2021**	**January 2022**	**February 2022**	**March 2022**	**FY2022 Adopted AADT**
Passenger Vehicles							
Car / Jeep / Van	2,096	2,380	2,398	2,164	2,671	2,344	2,284
Buses	153	142	160	140	172	140	148
Total passenger vehicles	**2,249**	**2,522**	**2,558**	**2,304**	**2,843**	**2,484**	**2,432**
Goods Vehicles							
LCV	233	193	214	187	207	215	201
2A	1,067	872	935	871	969	975	929
3A	1,456	1,258	1,278	1,170	1,336	1,303	1,230
MAV	1,709	1,585	1,706	1,526	1,614	1,636	1,541
Total goods vehicles	**4,465**	**3,908**	**4,133**	**3,754**	**4,126**	**4,129**	**3,901**
Total AADT	**6,714**	**6,430**	**6,691**	**6,058**	**6,969**	**6,613**	**6,333**

Source: Traffic Reports.

Substantially all of JL's operating revenues are derived from the tolls that it is entitled to collect. The gross monthly toll receipts for JLTL for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹68.44 million, ₹69.87 million, ₹67.38 million, ₹66.72 million and ₹71.91 million, respectively and for JVTL for November 2022, December 2022 January 2023, February 2023 and March 2023 were ₹47.83 million, ₹49.13 million, ₹47.10 million, ₹46.63 million and ₹50.10 million, respectively.

Capital Structure

As of October 31, 2022, total equity in JLTL and JVTL was ₹545.36 million and ₹411.50 million (including share premium) and total liabilities including debt from lenders was ₹5,100.43million and ₹3,374.49 million, respectively.

Land

The land that underlies the JL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

5. Hazaribagh Tollway Limited ("HTL")

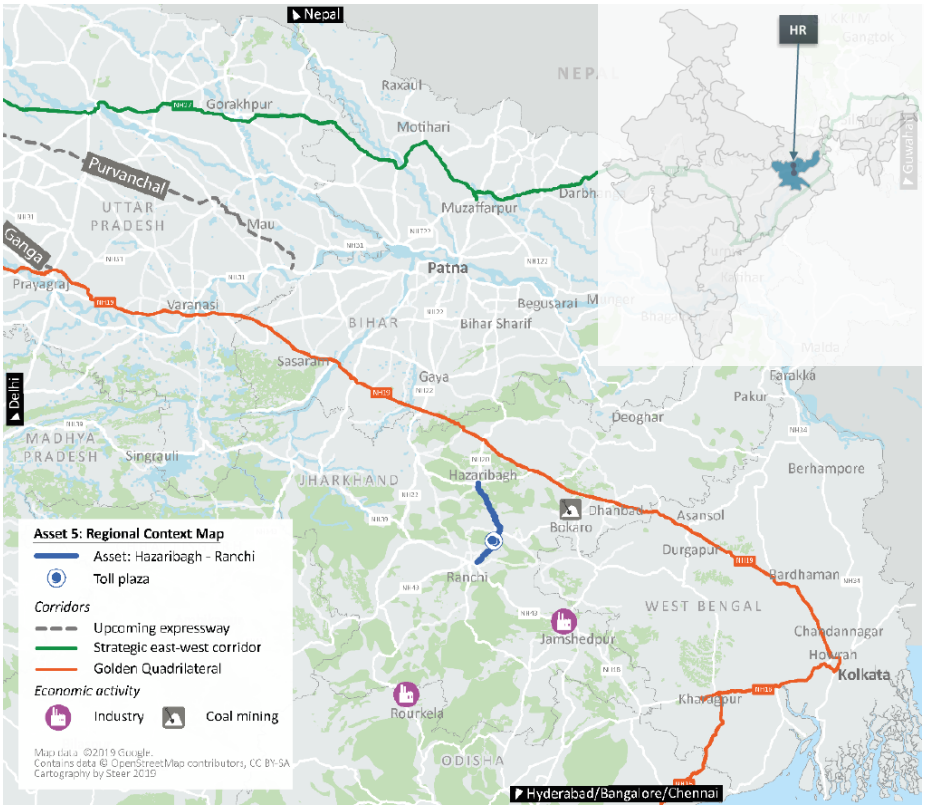
Overview of the Project and the Concession

On December 27, 2019, NHAI and HTL entered into the HTL Concession Agreement whereby HTL was engaged, on a TOT basis, for the project highway in Jharkhand with an overall length of 73.8 kilometers (the "**HTL Project**"). HTL has the sole and exclusive right from the Appointed Date (as defined in the HTL Concession Agreement) to undertake tolling activities and with effect from the O&M Handover Date (as defined in the HTL Concession Agreement). For further details on the HTL Concession Agreement, please see, "*Summary of the Concession Agreements*" on page 216.

Corridor and Network Description

The HTL Project is situated in Jharkhand, connecting the capital, Ranchi, and Hazaribagh on the NH 33 (erstwhile NH 20). It caters to three different types of strategic movements: (i) short distance local trips mostly undertaken by passenger vehicles for tourism and leisure; (ii) medium distance trips between Bihar and the rest of Jharkhand connecting the mines and industries located in the region; and (iii) long distance trips between Bihar and West Bengal and southern and central states of India.

For short-medium distance traffic connecting Ranchi and the southern states to Ramgarh, there is an alternate route via Patratu on SH2 that bypasses the toll plaza. For Hazaribagh-Jamshedpur traffic, an alternate route is available at Kothar, near Ramgarh. Coal-carrying trucks usually take this route as it is shorter (23 kilometers) and untolled. However, since it is affected by local Naxal based insurgencies only local Jharkhand truckers use this alternate route.
The map below illustrates the location of the HTL Project and the corridor it covers:



According to the Traffic Study Consultant, the factors that contribute to traffic growth on the HTL Project are underpinned by heavy industry and natural resources located along the asset corridor in Jamshedpur, Dhanbad, Bokaro and Ranchi. Jharkhand has significant mineral reserves such as coal and iron ore that contribute approximately 40% of India's mineral deposits. It is also one of the largest producers of iron ore and copper in India as well as a substantial supplier of coal, bauxite, limestone and graphite, among other minerals. Furthermore, Jharkhand contributes approximately 20-25% of India's steel output, housing several steel mills in Patratu and Jamshedpur, such as Jindal Steel and TATA Steel. Additionally, limestone reserves (Ramgarh and Hazaribagh), Burnpur's cement plant (Patratu) and over 1,500 other industries including cement, coke and stone generate substantial, sustained commercial traffic.

Traffic Volume

Historical traffic data of the HTL Project is available for all toll vehicle categories starting in November 2020 up to March 2022. The table below sets forth the historical traffic data of HTL from its toll plaza at Pundag according to the Traffic Study Consultant for the periods indicated:

Vehicle Type	**October 2021**	**November 2021**	**December 2021**	**January 2022**	**February 2022**	**March 2022**	**FY2022 Adopted AADT**
Passenger Vehicles							
Car / Jeep / Van	8,562	9,994	9,643	7,995	9,739	9,044	9,618
Buses	541	618	626	486	575	576	570
Total passenger vehicles	**9,103**	**10,612**	**10,269**	**8,481**	**10,314**	**9,620**	**10,188**
Goods Vehicles							
LCV	479	493	547	481	556	562	511
2A	655	602	643	587	667	697	629
3A	451	466	471	440	482	501	460
MAV	1,684	1,575	1,725	1,742	1,777	1,785	1,639
Total goods vehicles	**3,269**	**3,136**	**3,386**	**3,250**	**3,482**	**3,545**	**3,239**
Total AADT	**12,372**	**13,748**	**13,655**	**11,731**	**13,796**	**13,165**	**13,427**

Source: Traffic Reports.

Substantially all of HTL's operating revenues are derived from the tolls that it is entitled to collect. The gross monthly toll receipts from the project for November 2022, December 2022, January 2023, February 2023 and March 2023 were ₹77.35 million, ₹79.02 million, ₹75.04 million, ₹73.76 million and ₹78.23 million, respectively.

Capital Structure

As of October 31, 2022, total equity was ₹683.94 million (including share premium) and total liabilities including debt from lenders was ₹9,881.44 million.

Land

The land that underlies the HTL project highway is owned by NHAI.

Ownership Structure

For information about the structure of ownership of the project by the Trust, please see, "*Formation Transactions in Relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*" on page 30 of this Final Placement Memorandum.

SUMMARY OF KEY AGREEMENTS

Summary of the Concession Agreements

The following are brief descriptions of the concession agreements entered into by the Initial Portfolio Assets. The descriptions and summaries of the concession agreements below are indicative and have been categorized based on the nature of the project, i.e. (i) TOT assets; (ii) BOT/DBFOT assets; and (iii) annuity assets, and they are not, nor do they purport to be, full, complete or exhaustive descriptions and summaries. Certain terms used in this section have the meaning as assigned to such terms in the respective concession agreements. Copies of these concession agreements have been made available for inspection at the principal place of business of the Cube Highways Trust at B-376, UGF, Nirman Vihar, New Delhi 110 092. For further details, please see 'Material Contracts and Documents for Inspection' on page 475.

TOT SPVs

Certain Initial Portfolio Assets, being, LRTL, JLTL, JVTL, KMTL, HTL, MKTL, KETL, SMTL and NKTL (collectively, the "**TOT SPVs**") hold projects which are based on the toll, operation, maintenance and transfer model and accordingly, have entered into concession agreements with NHAI.

The concession agreements for the TOT SPVs includes the following:

(i) the concession agreement executed between LRTL and NHAI dated December 27, 2019 (the "**LRTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the stretch in the state of Uttar Pradesh from 12.70 km to 82.70 km for a total length of 70 km and all project assets for a concession fee of ₹ 4,305,660,000;

(ii) the concession agreement executed between JLTL and NHAI dated December 27, 2019 (the "**JLTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Jhansi Lalitpur Package 1 stretch in the state of Uttar Pradesh from km 00+000 to 49+700 km for a total length of 49.700 km for a concession fee of ₹ 4,537,128,000;

(iii) the concession agreement executed between JVTL and NHAI dated December 27, 2019 (the "**JVTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Jhansi Lalitpur Package 2 stretch in the state of Uttar Pradesh from 49+700 km to 99+005 km for a total length of 49.305 km for a concession fee of ₹ 2,729,795,000;

(iv) the concession agreement executed between KMTL and NHAI dated December 27, 2019 (the "**KMTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Kotwa Muzzaffarpur stretch in the state of Bihar from km 440.000 to 520.000 km for a total length of 80.000 km for a concession fee of ₹ 6,881,478,000;

(v) the concession agreement executed between HTL and NHAI dated December 27, 2019 (the "**HTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Hazaribagh Ranchi stretch in the state of Jharkhand from km 41+500 to 115+290 km for a total length of 73+790 km for a concession fee of ₹ 9,378,502,000;

(vi) the concession agreement executed between MKTL and NHAI dated December 27, 2019 (the "**MKTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Madurai Kanyakumari Package 1 stretch in the state of Tamil Nadu from 00+000 km to 52+300 km for a total length of 52.300 km for a concession fee of ₹ 6,667,151,000;

(vii) the concession agreement executed between KETL and NHAI dated December 27, 2019 (the "**KETL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Madurai Kanyakumari Package 2 stretch in the state of Tamil Nadu from 52+300 km to 116+500 for a total length of 64.200 km for a concession fee of ₹ 4,609,806,000;

(viii) the concession agreement executed between SMTL and NHAI dated December 27, 2019 (the "**SMTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Madurai Kanyakumari Package 3 stretch in the state of Tamil Nadu from km 116+500 to km 180+000 for a total length of 63.500 km for a concession fee of ₹ 4,806,288,000; and

(ix) the concession agreement executed between NKTL and NHAI dated December 27, 2019 (the "**NKTL Concession Agreement**") for tolling operation, management, maintenance and transfer of the existing road comprising of the Madurai Kanyakumari Package 4 stretch in the state of Tamil Nadu from km 180+000 to km 243+470 for a total length of 63.470 km for a concession fee of ₹ 6,194,192,000.

The concession agreements entered into by the TOT SPVs are substantially similar. Accordingly, a summary of the key terms of the concession agreements entered into by the TOT SPVs has been set out below:

1. Operations & Maintenance:

The TOT SPVs are required, on and from the O&M Handover Date (as defined in the relevant concession agreements), to operate and maintain the project highway by themselves, or through O&M contractors and if required, modify, repair, improvements to the project highway held by them ("**Project Highways**") to comply with specifications and standards mentioned in the concession agreements, good industry practice, applicable laws and applicable permits as specified in the concession agreement and more specifically to comply with the following ("**Maintenance Requirements**"):

a) permitting safe, smooth and uninterrupted flow of traffic during normal operating conditions;

b) collecting and appropriating the fees, from the applicable date;

c) minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the project highway;

d) undertaking periodic preventive and routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and traffic control devices;

e) undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;

f) protection of the environment and provision of equipment and materials therefore;

g) preventing with the assistance of concerned law enforcement agencies, unauthorised entry to and exit from the project highway;

h) operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the project highway;

i) maintaining a public relations unit to interface with and attend to suggestions from the users, government agencies, media and other agencies;

j) adherence to the safety standards set out in the respective concession agreement; and

k) ensure conformity with maintenance requirements provided under the schedule to the concession agreements.

2. Change of Scope:

In accordance with the concession agreements, change of scope ("**COS**") means: (a) any change in the specifications and standards; (b) omission of any work from the scope of the project; provided that NHAI shall not omit any work under this provision in order to get it executed by any other person; (c) any additional works or services which are not included in the scope of the project, including any associated tests as per the respective concession agreements.

The payment for COS shall be made by NHAI. NHAI is required to make an advance payment to the TOT SPVs amounting to 20% of the cost of COS as agreed between the parties, and in the event of a dispute on the COS cost, 20% of the cost assessed by the independent engineer, as appointed under the concession agreement.

3. Insurance:

The TOT SPVs are required to maintain, at no cost to NHAI, during the concession period, insurance of such types and such maximum amounts as may be considered necessary or prudent in accordance with good industry practices to cover third party claims and force majeure events and as required under applicable law. NHAI is required to be designated as "co-insured" under such insurances. Such insurance must include a waiver of any right of subrogation of the insurers against, among others, NHAI. The failure by the TOT SPVs to maintain such insurance entitles NHAI to recover the cost of such insurance from the TOT SPVs.

4. Escrow Account:

The TOT SPVs are required to open an escrow account with an escrow bank and all funds, constituting the financing package, fee and other revenues in respect of project highway and all payments made by NHAI are required to be credited to such escrow

account. The concession agreements also provide for order of disbursement and order of appropriation of funds during the concession period and on termination.

5. Effect of force majeure:

Upon the occurrence of any force majeure event, as defined in the TOT SPVs Concession Agreements prior to appointed date, as provided for in the concession agreement, the period for achieving the appointed date would be extended by a period equal in length to the duration of the force majeure event.

If any force majeure event occurs after the appointed date and, the TOT SPVs are unable to collect fee despite making best efforts or it is directed by NHAI to suspend the collection thereof during the subsistence of such force majeure event, the concession period would be extended by a period, equal in length to the period during which the TOT SPVs were prevented from collection of fee on account thereof; provided that in the event of partial collection of fee where the daily collection is less than 90% of the average daily fee, as defined in the respective concession agreements, NHAI would extend the concession period in proportion to the loss of fee on a daily basis (loss of 25% in collection of fee as compared to the average daily fee for four days shall entitle the TOT SPVs to extension of one day in the concession period).

Allocation of costs arising out of Force Majeure

Upon occurrence of any force majeure event prior to the appointed date, the parties to the TOT SPVs Concession Agreements shall bear their respective costs and no party shall be required to pay to the other party any costs thereof. Upon occurrence of a force majeure event after the appointed date, the costs incurred and attributable to such event and directly relating to the project ("**Force Majeure Costs**") shall be allocated and paid as follows:

- upon occurrence of a Non-Political Event, as defined in the TOT SPVs Concession Agreement, the parties shall bear their respective Force Majeure Costs and neither party shall be required to pay to the other party any costs thereof;

- upon occurrence of an Indirect Political Event, as defined in the TOT SPVs Concession Agreement, all Force Majeure Costs attributable to such Indirect Political Event, and not exceeding the insurance cover for such Indirect Political Event, shall be borne by TOT SPVs, and to the extent Force Majeure Costs exceed such insurance cover, one half of such excess amount shall be reimbursed by NHAI to TOT SPVs; and

- upon occurrence of a Political Event, as defined in the TOT SPVs Concession Agreement, all Force Majeure Costs attributable to such Political Event shall be reimbursed by NHAI to TOT SPVs.

Force Majeure Costs may include interest payments on debt. O&M expenses, any increase in the cost of construction works on account of inflation and all other costs directly attributable to the force majeure event, but shall not include loss of fee revenues or debt repayment obligations, and for determining such costs, information contained in the Financial Package, as defined in the TOT SPVs Concession Agreement, may be relied upon to the extent that such information is relevant.

Termination
If force majeure event subsists for a period of 120 days within a continuous period of 365 days, either party to the respective concession agreement would be entitled to terminate the concession agreement.

6. Compensation for breach of Concession Agreement

The party in material breach or default of the concession agreement is required to compensate the non-defaulting party for all direct costs suffered by the non-defaulting party, as a result of such material breach or default. No compensation would be payable for material breach or default in respect of items for which damages are expressly provided for in the respective concession agreement (or for any consequential losses incurred by NHAI in case of the default by the TOT SPVs).

Extension of Concession Period

a) If a material default or breach of the concession agreement by NHAI leads to suspension of or reduction in collection of fee, NHAI is required to, in addition to payment of compensation, extend the concession period with such extension being equal in duration to the period by which the collection of fee remained suspended.

b) In the event of reduction in collection of fee where the daily collection is less than 90% of the Average Daily Fee, as defined in the respective concession agreement. NHAI is required to, in addition to payment of compensation, extend the concession period in proportion to the loss of fee on a daily basis.

7. Termination

If any of the defaults specified under the concession agreement occur (the **"TOT SPV Defaults"**), and the TOT SPVs fail to cure the same within the cure period set thereunder, or where no cure period is specified within a cure period of 60 days, the TOT SPV would be deemed to be in default of the concession agreement. Some of the key TOT SPV Defaults are specified below:

a) the performance security, as specified in the relevant concession agreement, is encashed/appropriated and the TOT SPV fails to replenish or provide fresh performance security within a cure period of 15 (fifteen) days;

b) subsequent to the replenishment or furnishing of fresh performance security in accordance with concession agreement, the SPVs fails to cure, within a cure period, the concessionaire default for which whole or part of the performance security was appropriated;

c) the SPVs abandons or manifests intention to abandon the operation and maintenance without the prior written consent of NHAI;

d) the SPVs fails to roll over, renew and furnish new bank guarantee performance security subject to and in accordance with concession agreement, at least three months prior to expiry of subsisting bank guarantee;

e) the TOT SPV is in breach of the maintenance requirements or the safety requirements, as specified in the concession agreement;

f) a breach of any of the project agreements by the SPVs has caused a material adverse effect;

g) the SPVs repudiate the concession agreement or otherwise takes any action or evidences or conveys an intention not to be bound by the concession agreement;

h) the TOT SPV has failed to make any payment to NHAI within the period specified in the concession agreement;

i) the TOT SPV creates any encumbrance in breach of the concession agreement;

j) a change in ownership has occurred in breach of the provisions of the respective concession agreement;

k) there is a transfer, pursuant to law either of (i) the rights and/or obligations of the TOT SPV under any of the project agreements, or of (ii) all or part of the assets or undertaking of the TOT SPV, and such transfer causes a material adverse effect as specified in the concession agreement;

l) an execution levied on any of the assets of the SPVs has caused a material adverse effect;

m) the SPVs is adjudged bankrupt or insolvent, or if a trustee or receiver is appointed for the SPVs or for the whole or material part of its assets that has a material bearing on the project;

n) the SPVs has been, or is in the process of being liquidated, dissolved, wound-up, amalgamated or reconstituted in a manner that would cause, in the reasonable opinion of NHAI, a material adverse effect

o) any representation or warranty of the TOT SPV which is, as of the date of the concession agreement, found to be materially false, incorrect or misleading;

p) any petition for the winding up of the TOT SPV is passed or is admitted by a court of competent jurisdiction and a provisional liquidator or receiver is appointed and such order has not been set aside within 90 days of the date thereof or TOT SPV is ordered to be wound up by a court, except if there is an amalgamation or reconstruction, and the property, assets and undertaking of the TOT SPV are transferred to the amalgamated or reconstructed entity and such entity has unconditionally assumed the obligations of the TOT SPV under the concession agreement and provided that: (i) such entity has the technical capacity and operating experience to perform its obligations under the respective concession agreement; (ii) such entity has the financial standing to perform its obligations under the respective concession agreement and has a credit worthiness at least as good as that of the TOT SPV; and (iii) each of the project agreements remains in full force and in effect.

q) SPVs submits to NHAI any statement, notice or other document, in written or electronic form, which has a material effect on NHAI's rights, obligations or interests and which is false in material particulars;

r) SPVs have failed to fulfil any obligation, for which failure termination has been specified in concession agreement;

s) SPVs commits a default in complying with any other provision of this concession agreement if such default causes a material adverse effect on NHAI;

t) an escrow default has occurred and the SPVs fails to cure the default within a cure period of 15 days;

Upon occurrence of the TOT SPV Default and expiry of the relevant cure period (or 60 days where no cure period is specified), NHAI is entitled to terminate the concession agreement.

NHAI's Default: In the event any of the defaults specified below occur (the "**NHAI Defaults**"), and NHAI fails to cure such default within a cure period of 90 days or such longer period as has been expressly provided in the concession agreement, NHAI would be deemed to be in default: Some of the key NHAI Defaults are as follows:

a) NHAI commits a material default in complying with any of the provisions of the concession agreement and such default has a material adverse effect on the TOT SPV (as defined in the relevant concession agreement);

b) NHAI repudiates the concession agreement or otherwise takes any action that amounts to or manifests an irrevocable intention not to be bound by the concession agreement; or

c) the state government commits a material default in complying with the provisions of the respective state support agreement if such default has a material adverse effect on the TOT SPV and the breach continues for a period of 90 days from the date of notice given in this behalf by the TOT SPV to NHAI.

Upon occurrence of NHAI Default and expiry of the 90 (ninety) day cure period or such longer period as prescribed, the Concessionaire shall be entitled to terminate the respective concession agreement.

8. Indemnity:

Indemnity by TOT SPVs

The TOT SPVs are required to fully indemnify NHAI and the NHAI Indemnified Persons (as defined in the TOT SPVs Concession Agreements) from and against any and all loss and/or damages arising out of or with respect to:

a) any loss, damage, cost and expense, whether arising out of any breach by the TOT SPVs of any of its obligations under the concession agreement or any related agreement or on account of any defect or deficiency in the provision of services by the TOT SPVs to any user or from any negligence of the TOT SPV;

b) failure of the TOT SPVs to comply with applicable laws and applicable permits, (as defined in the relevant concession agreement);

c) payment of taxes required to be made by the TOT SPVs in respect of the income or other taxes of the TOT SPV's contractors, suppliers and representatives;

d) non-payment of amounts due as a result of materials or services furnished to the TOT SPVs or any of its contractors which are payable by the TOT SPVs or any of its contractors; and

e) claims of infringement of any domestic or foreign patent rights, copyrights or other intellectual property, proprietary or confidentiality rights with respect to any materials, information, design or process used by the TOT SPV or by the TOT SPV's contractors.

NHAI Indemnity

NHAI is required to indemnify the TOT SPVs against any and all suits, proceedings, actions, demands and claims from third parties for any loss, damage, cost and expense of whatever kind and nature arising out of (i) defect in title and/or the rights of NHAI in the land comprised in the site, and/or (ii) breach by NHAI of any of its obligations under the concession agreements or any related agreement, which materially and adversely affect the performance by the TOT SPVs of its obligations under the concession agreements unless by reason of the TOT SPV's own negligence or omission.

BOT/DBFOT SPVs

Initial portfolio assets including JMTL, MBEL, WUPTL, NDEPL, FRHL, WVEPL, DATRPL and GAEPL (collectively, the "**BOT/DBFOT SPVs**") holding projects based on build, operate transfer ("**BOT**") and design, build, finance, operate, transfer ("**DBFOT**") model and accordingly, have entered into concession agreements with NHAI ("**BOT/DBFOT SPVs Concession Agreements**"), as set out below:

(i) the concession agreement executed between JMTL and NHAI dated September 23, 2005 (the "**JMTL Concession Agreement**") for improvement, operation and maintenance, rehabilitation and strengthening of existing 2-lane road and widening to 4-lane divided highway of Mahua-Jaipur section of NH-11 from km 120.000 to km 228.000 in the state of Rajasthan on BOT basis under NHDP Phase - IIIA;

(ii) the concession agreement executed between WUPTL and NHAI dated September 9, 2005 (the "**WUPTL Concession Agreement**") for design, engineering, financing, procurement, construction, completion, operation and maintenance of existing 2 lane road and widening to 4 lane divided highway of Meerut Muzaffarnagar section of NH 58 from km 52.250 to km 131 in the State of Uttar Pradesh on a BOT basis under NHDP Phase – IIIA;

(iii) the concession agreement executed between MBEL and NHAI dated October 13, 2005 (the "**MBEL Concession Agreement**") for design, engineering, financing, procurement, construction, completion, operation and maintenance of existing 2 lane road and widening to 4 lane divided highway of km 63.000 to km 120.000 of NH-11 (Bharatpur-Mahua section) in the state of Rajasthan on a BOT basis under NHDP Phase IIIA;

(iv) the concession agreement executed between DATRPL and NHAI dated July 16, 2010 (the "**DATRPL Concession Agreement**") for six-laning of Delhi-Agra section of NH-2 from 20.500 km to 200.00 km (179.500 km length) in the state of Haryana/ Uttar Pradesh under NHDP phase V on a BOT basis;

(v) the concession agreement executed between Lanco Devihalli Highways Limited and NHAI dated July 9, 2007 and endorsed in favour of NDEPL pursuant to the endorsement agreement dated January 11, 2021 entered into between NDEPL and NHAI, and as further amended or supplemented (the "**NDEPL Concession Agreement**") for design, engineering, construction, development, finance, operation and maintenance of Nelamangala Junction on NH-4 with NH-48 to Devihalli from 28.200 km to 110.000 km of NH-48 in the state of Karnataka under NHDP Phase IIIA on a BOT basis;

(vi) the concession agreement executed between FRHL and NHAI dated July 19, 2010 (the "**FRHL Concession Agreement**") for four-laning of Farakka-Raiganj section of NH-34 from 295.00 km to 398.00 km in the state of West Bengal under NHDP phase III as a DBFOT toll basis;

(vii) the concession agreement executed between WVEPL and NHAI dated September 17, 2012 (the "**WVEPL Concession Agreement**") for four-laning of Walayar-Vadakkancherry section in Kerala (182.250 km to 240.000 km of NH-47) – package NS-2/BOT/KL-2 on DBFOT (Toll) basis under NHDP Phase II in the state of Kerala; and

(viii) the concession agreement executed between GAEPL and NHAI dated May 20, 2010 (the "**GAEPL Concession Agreement**") for the design, engineering, construction, development, finance, operation and maintenance of the Ghaziabad Aligarh section of NH-91 from km 23.600 to km 140.200 in the state of Uttar Pradesh under NHDP Phase III on a BOT basis.

The BOT/DBFOT SPVs Concession Agreements are substantially similar. Accordingly, a summary of the key terms of the BOT/DBFOT SPVs Concession Agreements has been set out below:

1. Operations and Maintenance

BOT/DBFOT SPVs are required to, operate and maintain the project, either by itself or through a contractor, including by modifying, repairing or otherwise making improvements to the project to comply with the requirements set out in the BOT/DBFOT SPVs Concession Agreement, the minimum maintenance requirements set out in Schedules to the BOT/DBFOT SPVs Concession Agreement, good industry practices and applicable laws and permits. The BOT/DBFOT SPVs' operations and maintenance obligations include:

a) permitting the safe, smooth and uninterrupted flow of traffic during normal operating conditions;

b) charging, collecting and retaining fee in accordance with the BOT/DBFOT SPVs Concession Agreement;

c) minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the project by providing rapid and effective responses and maintaining liaison procedures with emergency services;

d) undertaking routine maintenance, including repairs of potholes, cracks, concrete joints, drains, line markings, lighting and signage;

e) undertaking major maintenance, including resurfacing of pavements, repairs to structures, repairs and refurbishment of tolling systems, hardware and other equipment;

f) carrying out periodic preventive maintenance to the project including the tolling system;

g) preventing, with the assistance of the concerned law enforcement agencies, unauthorized entry to and exit from the project;

h) preventing, with the assistance of the concerned law enforcement agencies, encroachments on the project and preserving the right of way of the project;

i) maintaining a public relations unit to interface with and attend to suggestions from users of the project, the media, government agencies and other external agencies; and

j) adhering to the safety standards as set out in the BOT/DBFOT SPVs Concession Agreement.

2. Change in Scope

The concessioning authorities are entitled to issue a change in scope order and require the BOT/DBFOT SPVs to perform additional work and services, or delete any portion of the works and services to be performed by the BOT/DBFOT SPVs, provided that such changes do not require any increase / reduction in expenditure exceeding 5% of the total project cost as provided in the BOT/DBFOT SPVs Concession Agreement and do not adversely affect the COD of the Project ("**CoS**"). In the BOT/DBFOT SPVs Concession Agreements executed with NHAI, the cost of the CoS is required to be borne by NHAI if the CoS involves an increase in the bill of quantities, and NHAI can recover the amounts as certified by the independent consultant if the CoS involves a decrease in the bill of quantities. NHAI may require the BOT/DBFOT SPVs to undertake CoS pending resolution of the dispute between the parties regarding the costs.

3. Insurance

BOT/DBFOT SPVs are required to maintain at no cost to the concessioning authority, during the construction and operation period under the BOT/DBFOT SPVs Concession Agreement, insurance of such types and such amounts as may be considered necessary in accordance with good industry practice and as required under the financing documents and applicable law. Such insurance must include a waiver of any right of subrogation of the insurers against, among others, the concessioning authority. The failure by BOT/DBFOT SPVs to maintain such insurance will entitle the concessioning authority to recover the cost of such insurance from such BOT/DBFOT SPV.

4. Escrow Account

The funds from the project lenders, fee collected and disbursements or payments by the concessioning authority in exercise of its rights under the BOT/DBFOT SPVs Concession Agreement, subject to any deductions and appropriation, will be deposited into the escrow account. The bank/escrow agent is required make payments from the escrow account in the order of priority set out thereunder each month, or proportionately if not due in that particular month, during the concession period. Such order cannot be modified without the prior written consent of the concessioning authority.

5. Indemnities

BOT/DBFOT SPVs are required to indemnify the concessioning authority, its officers, servants, agents, subsidiaries and contractors (the "**Indemnified Persons**") against any and all loss and damages arising out of the BOT/DBFOT SPVs failure to: (i) comply with applicable laws and permits; (ii) make payment of taxes relating to its contractors, suppliers and representatives, income or other taxes required to be paid by the BOT/DBFOT SPVs without reimbursement under the BOT/DBFOT SPVs Concession Agreement; or (iii) make payment of amounts due resulting from materials or services provided to the BOT/DBFOT SPVs or its contractors which are payable by any such party. In addition, the BOT/DBFOT SPVs are required to indemnify the Indemnified Persons from and against any and all damages they may suffer as a result of demands, claims, suits or proceedings arising out of claims of infringement of any patent rights, copyrights or other intellectual property, proprietary or confidentiality rights with respect to any material, information, design or process used by the BOT/DBFOT SPVs or its contractors.

6. Miscellaneous

The concession agreements entered into by the BOT/DBFOT SPVs contain clauses in relation to force majeure, compensation of breach of agreements and termination which are substantially similar to the clauses in the concession agreements entered into by the TOT SPVs. For details, please see the section entitled "*Summary of Key Agreements – Summary of Concession Agreements*" on page 216.

APEL (Annuity Asset)

APEL entered into a concession agreement dated March 20, 2006 for performance and execution by of all design, engineering, financing, procurement, construction, completion, operation and maintenance of the project highway which includes (i)

strengthening of the existing 4 lane section of NH-7 from km 135.469 to km 211.000 in accordance with specifications and standards mentioned in Schedule D of the concession agreement; and (ii) providing traffic safety items from km 135.469 to km 211.000 as per specifications and standards mentioned in Schedule D and Schedule L of the concession agreement ("**APEL Concession Agreement**"). The concession has been awarded on BOT (Annuity) basis. The key terms of the APEL Concession Agreement are as follows:

1. Operations & Maintenance

APEL is required to operate and maintain the project highway by itself, or through O&M contractors and if required, modify, repair, improvements to the project highway to comply with specifications and standards mentioned in Schedule D of the APEL Concession Agreement, minimum maintenance requirements set forth in Schedule L of the APEL Concession Agreement, good industry practices, applicable laws and applicable permits and more specifically to comply with the following:

a) permitting safe, smooth and uninterrupted flow of traffic during normal operating conditions;

b) allowing NHAI to levy, demand, collect and appropriate the fees;

c) minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the project highway;

d) undertaking routine maintenance including prompt repairs of potholes, cracks, concrete joints, drains, line marking, lighting and signage;

e) undertaking major maintenance such as resurfacing of pavements, repairs to structures, and hardware and other equipment;

f) carrying out periodic preventive maintenance to project highway;

g) preventing with the assistance of concerned law enforcement agencies unauthorised entry to and exit from the project highway;

h) preventing with the assistance of the concerned law enforcement agencies encroachments on the project highway including site and preserve the right of way of the project highway; and

i) adherence to the safety standards set out in Schedule S of the APEL Concession Agreement.

2. Performance Security

APEL has provided to NHAI a bank guarantee dated March 6, 2006 (and its amendment dated March 18, 2006) for ₹ 305,720,000 being 5% of the total project cost from Union Bank of India valid up to March 31, 2009 (the "**Performance Security**"). As per the APEL Concession Agreement, the Performance Security shall be reduced to ₹ 183,432,000, being 3% of the total project cost after achievement of the financial close by APEL.

3. Annuity

Under the APEL Concession Agreement, APEL is entitled to annuity from the occurrence of COD, for the period set out in the schedule to the APEL Concession Agreement along with a letter of credit as a security, from a scheduled commercial bank. NHAI has agreed and undertaken under the APEL Concession Agreement to pay to APEL, on each annuity payment date a sum of ₹ 565,200,000.

4. Consideration

In consideration of the grant of the concession, APEL is required to pay (in advance within 90 days of the commencement of the year), to NHAI a sum of ₹ 1 per annum during the term of the APEL Concession Agreement.

5. Change in scope of work

NHAI is entitled to request further improvements to the project assets and project highway, subject to a limit of 10% of the total project cost, during the operations period in the form of a COS order which is required to make the project highway comply with the latest specifications and standards mentioned in Schedule D of the APEL Concession Agreement, and good industry practice, applicable laws and applicable permits during the entire operations period as set forth in the APEL Concession Agreement ("**Value Additions**"). The cost of the Value Additions is required to be borne by NHAI.

6. Limitations on shareholding changes

The APEL Concession Agreement requires that the equity shareholding of the original consortium members, and their associates, as specified in such agreement, in the issued and paid up equity share capital of APEL shall not be less than (a) 51% during the construction period and for 3 years following COD; and (b) 26% during the balance operations period.

7. Insurance

APEL is required to maintain, at no cost to NHAI, during the construction and operation period under the APEL Concession Agreement, insurance of such types and such amounts as may be considered necessary in accordance with good industry practices and as required under the financing documents and applicable law. Such insurance must include a waiver of any right of subrogation of the insurers against, among others, NHAI. The failure by APEL to maintain such insurance entitles NHAI to recover the cost of such insurance from APEL.

8. Escrow Account

APEL is required to open an escrow account with an escrow bank and all funds, constituting the financing package for meeting the total project cost, are required to be credited to such escrow account. During operations period all annuity, bonus, termination payment and any other payment which becomes payable by NHAI to APEL is required to be exclusively deposited therein. The APEL Concession Agreement also provides for order of disbursement and order of appropriation of funds in case of termination of such agreement.

9. Indemnities

APEL is required to indemnify NHAI, its officers, servants, agents, subsidiaries and contractors (the "**NHAI Indemnified Persons**") against any and all loss and damages arising out of the APEL's failure to: (i) comply with applicable laws and permits; (ii) make payment of taxes relating to its contractors, suppliers and representatives, income or other taxes required to be paid by APEL without reimbursement under the APEL Concession Agreement; or (iii) make payment of amounts due resulting from materials or services provided to APEL or its contractors which are payable by any such party. In addition, APEL is required to indemnify NHAI Indemnified Persons from and against any and all damages they may suffer as a result of demands, claims, suits or proceedings arising out of claims of infringement of any patent rights, copyrights or other intellectual property, proprietary or confidentiality rights with respect to any material, information, design or process used by APEL or its contractors. APEL is required to make every reasonable effort to restrain or secure the suspension of any temporary restraint order or preliminary injunction that may be granted in any suit, claim or proceedings. If any part of the project is held to constitute an infringement, APEL is required to also promptly make every reasonable effort to secure a license for NHAI, at its own cost, failing which, APEL is required to, at its own expense and without affecting the specifications and standards mentioned in Schedule D of the APEL Concession Agreement, replace the affected work, or part or process thereof with non-infringing work or parts or processes, or modify the same so that it becomes non-infringing.

10. Effect of force majeure event:

If a force majeure event, as defined in the APEL Concession Agreement subsists for a period of 180 days or more within a continuous period of 365 days, either party may in its sole discretion terminate the APEL Concession Agreement by giving 30 days termination notice to the other party.

If any force majeure event occurs: (a) before COD, the dates set forth in the Scheduled Project Completion Date (*as defined in the APEL Concession Agreement)*, and the concession period can be extended by the period for which such force majeure event shall subsist; (b) after the COD, APEL is required to continue to make all reasonable efforts to operate and maintain the Project Highway. The APEL Concession Agreement does not provide for extension of the Concession Period in such a scenario.

11. Termination

<u>APEL's event of default</u>

The APEL Concession Agreement may be terminated on the occurrence of APEL's default or NHAI's default. APEL will be deemed to be in default if:

a) it fails to achieve any milestones (as described in the APEL Concession Agreement) within the period set out in the APEL Concession Agreement and such failure is not cured within 180 days from the date of its occurrence;

b) it is in material breach of the APEL Concession Agreement;

c) it defaults as a result of its failure to comply with the terms and conditions of the APEL Concession Agreement, except in respect of defaults with cure periods, and the it fails to rectify the default (i) within one month of notice by NHAI (or such longer period of notice, if NHAI so decides); or (ii) after NHAI permits APEL to put forward a programme with details for remedying any breach within 15 days of notice by NHAI;

d) it creates any encumbrance, charge or lien, except as permitted under the APEL Concession Agreement;

e) the single entity / consortium, as applicable, selected for the project is required to hold (i) 51% during the construction period and for 3 years after the commercial operations date of the project; (ii) 26% for the rest of the operations period. If there is a change in shareholding and the same is not rectified within 90 days of its occurrence it will constitute an event of default under APEL Concession Agreement;

f) there is a transfer of either (i) the rights and/or obligations of APEL under any of the project agreements; or (ii) of all or a material part of the assets or undertaking of APEL except for such transfer which, in the reasonable opinion of NHAI, does not affect the ability of APEL to perform, and APEL has the financial and technical capacity to perform its material obligations under the project agreements;

g) a resolution is passed by the shareholders of APEL for its voluntary winding up;

h) APEL is adjudged bankrupt or insolvent or if a trustee or receiver is appointed for APEL or for any of its property that has a material bearing on the project;

i) any petition for the winding up of APEL is admitted by a court of competent jurisdiction or APEL is ordered to be wound up by the court;

j) it is in material breach of any of the project agreements;

k) an event of default by APEL under any of the financing documents or any of the senior lenders to the project has recalled its loan under any of the financing documents;

l) unless such abandonment (i) is as a result of an occurrence of a force majeure event and such force majeure event is continuing or (ii) results from a breach of obligations by NHAI; and/or

m) APEL delays any payment that is due under the APEL Concession Agreement and the delay exceeds 90 days.

NHAI's event of default:

APEL may terminate the APEL Concession Agreement by giving 90 days' notice in writing to NHAI. NHAI will be deemed to be in default of the APEL Concession Agreement if:

a) NHAI is in material breach of the APEL Concession Agreement, causing a material adverse effect on the APEL and such breach is not rectified or effective steps are not taken by NHAI for curing such breach within 90 days of receipt of notice;

b) NHAI repudiates the APEL Concession Agreement or otherwise evidences its irrevocable intention not to be bound by it; or

c) The government or any governmental agency has acted or omitted to act thereby creating circumstances that have a material adverse effect on the performance of the APEL's obligations and have failed to cure such material adverse effect within 90 days of receipt of notice by NHAI; or NHAI has delayed in making any payment due under the APEL Concession Agreement and such delay exceeds 90 days.

In the event of termination, NHAI may be required to pay certain termination payments to APEL, subject to the cause for termination and as set out in the APEL Concession Agreement. Termination payments become due and payable to APEL within 30 days of a demand being made by APEL. If NHAI fails to disburse the full termination payments within 30 days, the amount remaining unpaid is required to be disbursed along with interest for the period of delay on such amount. Termination payments are required to be made by way of credit to the escrow account.

INFORMATION CONCERNING THE UNITS

Unitholding of the Trust

Particulars	Number of Units
Ordinary Units	
Ordinary Units issued and outstanding prior to this Offer	**910,086,940***
Ordinary Units issued and outstanding after this Offer	**1,290,346,112[#]**
Subordinate Units	
Subordinate Units outstanding prior to and after this Offer	**15,75,00,000***

**The first allotment of Ordinary Units and the Initial Tranche Subordinate Units has been made to the Sponsors and their associates on the date of closing under the Share Purchase Agreements in accordance with the Share Purchase Agreements (for further details, please see the section entitled "Related Party Transactions – Share Purchase Agreements" on page 278) after the Bid/ Offer Closing Date and prior to the Allotment of Ordinary Units pursuant to the Offer.*

[#]Subject to Allotment of Ordinary Units by the board of directors of the Investment Manager

Unitholders holding more than 5% of the Ordinary Units^

Sr. No.	Name of Unit Holders	Pre-Offer*		Post-Offer**	
		Number of Ordinary Units	Percentage of holding (%)	Number of Ordinary Units	Percentage of holding (%)
1.	Cube Highways and Infrastructure Pte. Ltd.	16,32,07,807	17.93	10,35,17,584	8.02
2.	Cube Highways and Infrastructure II Pte. Ltd.	14,02,82,874	15.41	12,37,56,208	9.59
3.	Cube Highways and Infrastructure III Pte. Ltd.	31,26,84,878	34.36	24,65,78,212	19.11
4.	Cube Mobility Investments Pte. Ltd.	26,92,56,286	29.59	26,92,56,286	20.87
5.	BCI IRR India Holdings Inc	--	--	23,90,33,801	18.52
6.	Seventy Second Investment Company LLC	--	--	7,74,19,854	6.00

**The first allotment of Ordinary Units has been made to the Sponsors and their associates on the date of closing under the Share Purchase Agreements , in accordance with the Share Purchase Agreements (for further details, please see the section entitled "Related Party Transactions – Share Purchase Agreements" on page 278) after the Bid/ Offer Closing Date and prior to the Allotment of Units pursuant to the Offer.*

***Including adjustments for the Ordinary Units transferred by the Selling Unitholders in the Offer and subject to Allotment of Ordinary Units by the board of directors of the Investment Manager.*

^The unitholding of different schemes of a mutual fund investing as Eligible Investors in the Offer has not been aggregated.

Unitholding of the Sponsors

Ordinary Units

CH-I and CH-III, being the Sponsors, have been allotted Ordinary Units of the Trust pursuant to the Share Purchase Agreements, after the Bid/Offer Closing Date and prior to Allotment of Ordinary Units in the Offer. Further, the Selling Unitholders, that include the Sponsors, have offered a portion of their Ordinary Units in the Offer for Sale, subject to the Sponsors collectively holding Ordinary Units aggregating to 15% of the total issued and outstanding Ordinary Units on a post-Offer basis.

Subordinate Units

CH-I and CH-III, being the Sponsors, have been allotted the Initial Tranche Subordinate Units of the Trust pursuant to the Share Purchase Agreements, after the Bid/Offer Closing Date and prior to Allotment of Ordinary Units in the Offer. The terms of the Initial Tranche Subordinate Units have been set out in the Trust Deed and the key terms are provided below:

(a) The terms and conditions of the Initial Tranche Subordinate Units shall be effective from the date that such units are allotted. The Initial Tranche Subordinate Units shall have their own distinct Internal Securities Identification Number ("**ISIN**") which shall not be the same as the ISIN of the Ordinary Units.

(b) The Initial Tranche Subordinate Units shall be allotted to the Sponsors of the Trust.

(c) The Subordinate Unitholders shall not be entitled to any distribution rights or other economic rights or any other rights available in relation to the Ordinary Units.

(d) The Subordinate Unitholders shall not be entitled to any voting rights in relation to the Trust and/or its Project SPVs. Further, the Subordinate Unitholders shall not be entitled to receive notices of or participate in, any meeting of the

Unitholders holding Ordinary Units, including the annual meeting of Unitholders, in their capacity as holders of the Initial Tranche Subordinate Units, unless it is proposed to vary the terms of the Initial Tranche Subordinate Units. It is clarified that, subject to applicable law and except as required for the purposes of paragraph 8.3 of Schedule III of the Trust Deed, the Subordinate Unitholders shall not be considered, for the purposes of the rights of unitholders under Regulation 22 of the InvIT Regulations.

(e) The Sponsors shall not transfer the Initial Tranche Subordinate Units to any entity which is not a sponsor of the Trust or an Associate of the Sponsors.

(f) The Initial Tranche Subordinate Units shall remain unlisted at all times.

(g) The lock-in requirements as prescribed under Regulation 12(3) of the InvIT Regulations, shall not be applicable in context of the Initial Tranche Subordinate Units since such Initial Tranche Subordinate Units will only be held by the Sponsors.

(h) Subject to compliance with Applicable Law, the Initial Tranche Subordinate Units shall become entitled to same rights as the Ordinary Units of the Trust and be reclassified as Ordinary Units ("**Reclassified Units**"), pursuant to a resolution passed by the board of the Investment Manager, in tranches upon achievement of certain pre-defined performance metrics by the Initial Portfolio Assets of the Trust subsequent to the Offer (the "**Performance Parameters**"), as applicable for each tranche of Initial Tranche Subordinate Units and as set out in the Trust Deed. This would result in an increase in the number of issued and outstanding Ordinary Units of the Trust and a concurrent decrease in the number of issued and outstanding Initial Tranche Subordinate Units.

(i) *Entitlement and Reclassification*

a. Within 10 days of the occurrence of an Entitlement Event (*as defined in the Trust Deed*), the Investment Manager shall convene a meeting of the Audit Committee which shall perform an assessment of the actual performance of the Initial Portfolio Assets (based on audited financials of the respective Initial Portfolio Assets) against the relevant Performance Parameters. The Audit Committee, based on the assessment, will make an appropriate recommendation to the IM Board. Such recommendation will include the number of Initial Tranche Subordinate Units that will be reclassified into Ordinary Units.

b. Within 10 days of the Audit Committee meeting, the IM Board, based on the recommendations of the Audit Committee, if approved, shall take note of the fact that the relevant tranche of Initial Tranche Subordinate Units is now entitled to the same rights as Ordinary Units and pass a resolution for reclassification of the relevant tranche of Initial Tranche Subordinate Units to Ordinary Units and for making the appropriate stock exchange intimations. In the event that the Audit Committee recommends to the IM Board that the Entitlement Event has not occurred in respect of the relevant tranche of Initial Tranche Subordinate Units, such Initial Tranche Subordinate Units shall not be entitled to any rights of Ordinary Units and not be reclassified into Ordinary Units.

c. Further, immediately after the meeting of the IM Board, the Trust shall give a written notice to the Subordinate Unitholders indicating the occurrence of the Entitlement Event and the number of Initial Tranche Subordinate Units that will be reclassified to Ordinary Units.

d. Subsequently, the Trust, acting through the Investment Manager, shall inform the Registrar and the Depositories of such entitlement and reclassification and request the Depositories to make the relevant entries in the accounts of the relevant Sponsor(s).

e. Within 48 hours of the reclassification of the Subordinate Units, the Investment Manager shall notify the Unitholders of such reclassification by sending an email to the registered email-id of the Unitholders and shall make appropriate intimations to the stock exchanges, as required under applicable law.

(j) The entitlement of rights to the Initial Tranche Subordinate Units and reclassification of the Initial Tranche Subordinate Units or any tranche thereof shall not amount to:

i. reduction of unit capital of the Trust;
ii. buyback/redemption of the Initial Tranche Subordinate Units;
iii. extinguishment or cancellation of the Initial Tranche Subordinate Units; or
iv. conversion of the Initial Tranche Subordinate Units.

(k) The Reclassified Units will be *pari-passu* in all respects with the Ordinary Units and will have the same ISIN as the Ordinary Units.

(l) The Reclassified Units shall be listed and tradable on the stock exchange(s) on the receipt of the final listing and trading approval from the stock exchanges.

Unitholding of the Investment Manager, Project Manager and Trustee

The Trustee, Investment Manager and Project Manager do not hold any Units and shall not acquire any Units in this Offer.

Unitholding of the directors of the Investment Manager

As on the date of this Final Placement Memorandum, none of the directors of the Investment Manager hold any Units or propose to hold any Units in the Trust.

Sponsor lock-in

In terms of the InvIT Regulations, the Sponsors are required to, collectively, hold not less than 15% (fifteen per cent) of the Ordinary Units on a post-Offer basis. CH-III holds 246,578,212 Ordinary Units, aggregating to 19.11% of the Ordinary Units on a post-Offer basis, out of which 193,551,917 Ordinary Units held by CH-III, aggregating to 15% of the Ordinary Units on a post-Offer basis, shall be locked-in for a period of three years from the date of listing of the Ordinary Units. Further, the unitholding of Ordinary Units of the Sponsors, exceeding 15% (fifteen per cent) on a post-Offer basis, shall be locked-in for a period of not less than one year from the date of listing of the Ordinary Units.

USE OF PROCEEDS

The Offer comprises a Fresh Issue by the Trust and an Offer for Sale by the Selling Unitholders.

The Offer for Sale

The Selling Unitholders will be entitled to the proceeds of the Offer for Sale. The Trust will not receive any proceeds from the Offer for Sale.

The Fresh Issue

The proceeds of the Fresh Issue available to the Trust will be ₹ 38,025.92 million (the "**Issue Proceeds**"). Further, subsequent to the listing of the Ordinary Units pursuant to the Offer, the Trust proposes to avail the InvIT Loan which will also be utilised towards providing loans to certain Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions and Cube Group, capital expenditure and creation of debt service reserve account for the InvIT Loan. For details in relation to the InvIT Loan, please see the section entitled "*Financial Indebtedness and Deferred Payments"* on page 232.

The Issue Proceeds will be utilised towards providing loans to certain Initial Portfolio Assets for (i) repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions and Cube Group, (ii) capital expenditure, and (iii) creation of debt service reserve account for the InvIT Loan, general purposes including funding of expenses of the InvIT (including interest on InvIT Loan) and refinance fees and the Offer expenses.

Requirements of Funds

The Issue Proceeds are proposed to be utilised in accordance with the details provided in the following table:

(In ₹ million)

S. No.	Particulars	Amount
(i)	Providing loans to certain Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions and the Cube Group (including all accrued interest), certain capital expenditure and creation of debt service reserve account for the InvIT Loan	34,743
(ii)	General Purposes including funding of expenses of the InvIT (including interest on InvIT Loan) and refinance fees	3,268
(iii)	Offer Expenses	15

The Investment Manager believes that providing loans to the Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed from certain banks and financial institutions and the Cube Group, will help reduce outstanding indebtedness of the Trust (including debt from Cube Group) on a consolidated basis and assist the Trust in maintaining a favourable debt-equity ratio, which will enable the Trust to raise further resources in the future to fund potential business development opportunities and plans to grow and expand its business in the future thereby enabling the Trust to meet its commitment towards distributions to the Ordinary Unitholders.

The fund requirements mentioned above and the proposed deployment are based on the estimates of the Investment Manager and have not been appraised by any bank, financial institution or any other external agency. The fund requirements may vary due to factors beyond the Investment Manager's control, such as market conditions, competitive environment, interest rate and exchange rate fluctuations. Consequently, the fund requirements are subject to revisions, in the future, at the discretion of the Investment Manager.

Details of Utilisation of the Issue Proceeds

The details of utilisation of the Issue Proceeds are set forth herein below:

Providing loans to certain Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions and Cube Group, certain capital expenditure and creation of debt service reserve account for the InvIT Loan

The Trust proposes to utilise an estimated aggregate amount of ₹ 34,743 million from the Issue Proceeds and ₹ 98,500 million from the proceeds of the InvIT Loan (together, the "**Issue and Loan Proceeds**") to provide loans to the Initial Portfolio Assets for, repayment or pre-payment of debt, including any accrued interest, availed by the Initial Portfolio Assets from certain banks, financial institutions and the Cube Group, certain capital expenditure and creation of debt service reserve account for the InvIT Loan. The Issue Proceeds are proposed to be utilized by the Trust to provide Subordinate Trust Financing to the Project SPVs.

Sr. No.	Name of the lender(s)/ debenture holder(s)	Principal Amount Outstanding as on October 31, 2022 (in ₹ million)	Interest outstanding as on October 31, 2022 (in ₹ million)
JMTL			
1.	ICICI Bank Limited	2,059.60	0.45
2.	Cube Infrastructure Investment Pte. Ltd (Non-convertible Debentures)	19.35	2.60
MBEL			
1.	Cube Infrastructure Investment Company Pte. Ltd (Non-convertible Debentures)	772.94	35.70
WUPTL			
1.	Axis Bank Limited	831.30	-
2.	Cube Infrastructure Investment Company Pte. Ltd (Non-convertible debentures)	2,202.81	385.92
APEL			
1.	Cube Highways and Infrastructure Pte. Ltd (Optionally convertible debentures)	130.00	23.28
2.	Cube Infrastructure Investment Pte. Ltd (Non-convertible debentures)	1,250.00	183.53
HTL			
1.	State Bank of India	6,600.81	2.23
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	2,789.44	537.46
JLTL			
1.	State Bank of India	3,233.89	1.09
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	1,405.27	279.27
JVTL			
1.	State Bank of India	1,926.73	0.65
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	926.13	171.55
KETL			
1.	State Bank of India	3,211.98	1.09
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	2,298.25	387.47
KMTL			
1.	State Bank of India	4,825.53	1.63
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	2,987.19	509.71
LRTL			
1.	State Bank of India	3,036.64	1.03
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	957.07	213.69
MKTL			
1.	State Bank of India	4,615.32	1.56
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	2,436.95	471.49
NKTL			
1.	State Bank of India	3,579.39	1.21
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	3,043.59	571.27
SMTL			
1.	State Bank of India	3,342.01	1.13
2.	Cube Mobility Investment Pte. Ltd. (Optionally convertible debentures)	2,146.15	374.21
FRHL			
1.	State Bank of India	8,874.20	-
2.	Cube Highways and Infrastructure II Pte. Limited (Optionally convertible debentures)	6,531.05	1,311.66
WVEPL			
1.	Axis Bank Limited	1,925.36	-
2.	Cube Highways and Infrastructure III Pte. Ltd. (Optionally convertible debentures)	3,033.78	131.77
NDEPL			
1.	State Bank of India	2,648.23	19.01

Sr. No.	Name of the lender(s)/ debenture holder(s)	Principal Amount Outstanding as on October 31, 2022 (in ₹ million)	Interest outstanding as on October 31, 2022 (in ₹ million)
2.	Cube Highways and Infrastructure I-D Pte Ltd (Optionally convertible debentures)	1,151.76	241.28
DATRPL			
1.	Axis Bank Limited and Aseem Infra	7,573.60	-
2.	Morgan Stanley India (Non - convertible debentures)	3,462.20	54.47
3.	State Bank of India - Mangum (Non-convertible debentures)	2,077.32	
4.	Axis Bank Limited (Non - convertible debentures)	2,077.32	
5.	Aseem Infra (Non – convertible debentures)	1,978.40	
6.	Cube Highways and Infrastructure III Pte. Ltd. (Optionally convertible debentures)	11,222.65	197.90
GAEPL			
1.	Unsecured loans availed from Cube Group	9,350.00	-

The repayment or prepayment of indebtedness availed by the Initial Portfolio Assets, as set out above, shall be based on various factors, including: (i) any conditions attached to the loan restricting the Trust's ability to repay or prepay the loan and time taken to fulfil such requirements; (ii) levy of any pre-payment premium or penalties; (iii) provisions of any laws, rules, regulations and contracts governing such borrowings; and (iv) other commercial considerations, including the interest rate on the loan facility or the interest rate on the debt securities and the amount of the loan outstanding.

Further, certain portion of the Issue and Loan proceeds is proposed to be utilised for (i) partly funding the 6-laning of the GAEPL Project as required under the GAEPL Concession Agreement and the settlement agreement dated April 8, 2022 executed amongst GAEPL and NHAI; and (ii) the creation of the debt service reserve account as required in terms of the InvIT Loan Agreement.

For further details on borrowing availed by the Initial Portfolio Assets, the loan proposed to be provided to the Initial Portfolio Assets by the Trust and the InvIT Loan Agreement, please see the section entitled "*Financial Indebtedness and Deferred Payments*" on page 232.

General purposes

In terms of the InvIT Regulations, the Investment Manager shall, at its discretion, deploy the balance Issue Proceeds (excluding the Offer Expenses) aggregating to ₹ 3,268 million towards general expenses for the operation of the Trust, subject to such utilization not exceeding 10% of the Issue Proceeds, in compliance with the InvIT Regulations. The general purposes for which the Trust proposes to utilise Issue Proceeds include meeting exigencies and expenses incurred in the ordinary course of business. In addition, the Trust may utilise the Issue Proceeds towards other expenditure (in the ordinary course of business) considered expedient and as approved by the Investment Manager or the Trustee, as the case may be, subject to compliance with applicable law.

In case of a shortfall in Issue Proceeds, the Investment Manager may, in compliance with the InvIT Regulations, have the flexibility to meet such shortfall including, by utilising the Trust's internal accruals or availing facilities from lenders. The Investment Manager, in accordance with the investment objectives of the Trust, policies of the board of directors of the Investment Manager and the InvIT Regulations, will have flexibility in utilising any surplus amounts.

Offer Expenses

The total expenses of this Offer are ₹ 15 million ("**Offer Expenses**"). The Offer Expenses consist of fee payable to Escrow Collection Bank, Unit Escrow Agent and Registrar and Unit Transfer Agent and certain other incidental and miscellaneous expenses for undertaking the formation transactions and for allotment of the Ordinary Units and listing the Ordinary Units on the Stock Exchanges. The Offer Expenses shall be borne by the Trust, the Investment Manager, and/or the Selling Unitholders in the manner agreed among them.

FINANCIAL INDEBTEDNESS AND DEFERRED PAYMENTS

The details of indebtedness of the Trust as at October 31, 2022, together with a brief description of certain material covenants of the relevant financing agreements, are provided below:

Sr. No.	Name of the Initial Portfolio Asset	Pre-Offer Principal Amount outstanding, as on October 31, 2022 (in ₹ million)	Post-Offer Principal Amount outstanding (in ₹ million)*
1.	***APEL***		
	Listed non-convertible debentures	567.00	567.00
	Unsecured loans availed from CH-I (optionally convertible debentures)	130.00	205.00
	Unsecured loans from Cube Infrastructure Investment Pte. Ltd. (non-convertible debentures)	1,250.00	1,250.00
	Total Borrowings	**1,947.00**	**2,022.00**
2.	***DATRPL***		
	Axis Bank Limited and Aseem Infra	7,573.60	7,515.66
	Morgan Stanley India (Non - convertible debentures)	3,462.20	3,435.95
	State Bank of India - Mangum (Non-convertible debentures)	2,077.32	2,061.57
	Axis Bank Limited (Non - convertible debentures)	2,077.32	2,061.57
	Aseem Infra (Non – convertible debentures)	1,978.40	1,963.40
	Cube Highways and Infrastructure III Pte. Ltd. (Optionally convertible debentures)	11,222.66	11,222.66
	Reliance Infrastructure Limited (Non – convertible debentures)	3,346.25	1,920.74
	Total Borrowings	**31,737.75**	**30,181.55**
3.	***FRHL***		
	Secured loans availed from banks and financial institutions	8,874.20	8,815.94
	Unsecured loans from the CH-II (optionally convertible debentures)	6,531.05	6,531.05
	HCC Concessions Limited (non-convertible debentures)	127.93	-
	Total Borrowings	**15,533.18**	**15,346.99**
4.	***GAEPL***		
	Secured loans availed from banks and financial institutions	5,005.84	6,948.34
	Unsecured loans from Cube Group	9,350.00	9,350.00
	Total Borrowings	**14,355.84**	**16,298.34**
5.	***HTL***		
	Secured loans availed from banks and financial institutions	6,600.81	6,498.38
	Unsecured loans from Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	2,789.44	2,789.44
	Total Borrowings	**9,390.25**	**9,287.82**
6.	***JLTL***		
	Secured loans availed from banks and financial institutions	3,233.89	3,184.96
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	1,405.27	1,405.27
	Total Borrowings	**4,639.16**	**4,590.23**
7.	**JMTL**		
	Secured loans availed from banks and financial institutions	2,059.59	1,951.40
	Unsecured loans from CH-I (Non-convertible debentures)	19.35	19.35
	Total Borrowings	**2,078.94**	**1,970.75**
8.	**JVTL**		
	Secured loans availed from banks and financial institutions	1,926.74	1,907.03
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	926.13	926.13
	Total Borrowings	**2,852.87**	**2,833.16**
9.	**KETL**		

Sr. No.	Name of the Initial Portfolio Asset	Pre-Offer Principal Amount outstanding, as on October 31, 2022 (in ₹ million)	Post-Offer Principal Amount outstanding (in ₹ million)*
	Secured loans availed from banks and financial institutions	3,211.98	3,187.68
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	2,298.25	2,298.25
	Total Borrowings	**5,510.23**	**5,485.93**
10.	***KMTL***		
	Secured loans availed from banks and financial institutions	4,825.53	4,763.58
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	2,987.19	2,987.19
	Total Borrowings	**7,812.72**	**7,750.77**
11.	***LRTL***		
	Secured loans availed from banks and financial institutions	3,036.64	2,974.65
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	957.07	957.07
	Total Borrowings	**3,993.71**	**3,931.72**
12.	***MBEL***		
	Listed non-convertible debentures	1540.00	1,470.00
	Unsecured loans from Cube Infrastructure Investment Company Pte. Ltd. (non-convertible debentures)	772.95	772.94
	Total Borrowings	**2,312.95**	**2,242.94**
13.	***MKTL***		
	Secured loans availed from banks and financial institutions	4,615.32	4,507.42
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	2,436.95	2,436.95
	Total Borrowings	**7,052.27**	**6,944.37**
14.	***NDEPL***		
	Secured loans availed from banks and financial institutions	2,648.23	2,644.90
	Unsecured loans from CH-ID (optionally convertible debentures)	1,151.76	1,151.76
	Total Borrowings	**3,799.99**	**3,796.66**
15.	***NKTL***		
	Secured loans availed from banks and financial institutions	3,579.39	3,577.47
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	3,043.59	3,043.59
	Total Borrowings	**6,622.98**	**6,621.06**
16.	***SMTL***		
	Secured loans availed from banks and financial institutions	3,342.02	3,320.81
	Unsecured loans from the Cube Mobility Investment Pte. Ltd. (optionally convertible debentures)	2,146.16	2,146.15
	Total Borrowings	**5,488.18**	**5,466.96**
17.	***WUPTL***		
	Secured loans availed from banks and financial institutions	831.30	446.28
	Unsecured loans from the Cube Infrastructure Investment Company Pte Ltd (Non- Convertible debentures)	2,367.81	2,367.81
	Total Borrowings	**3,199.11**	**2,814.09**
18.	***WVEPL***		
	Secured loans availed from banks and financial institutions	1,925.36	1,906.06
	Unsecured loans from the CH-III (optionally convertible debentures)	3,033.78	3,033.78
	Unsecured loan from KNR Constructions Limited	420.99	420.99
	Total Borrowings	**5,380.13**	**5,360.83**

**As on the date of this Final Placement Memorandum*

For further details of the equity share capital of each of the Initial Portfolio Assets, please see the section entitled "*Formation Transactions in relation to the Trust*" on page 25.

Principal terms of the borrowings availed by the Initial Portfolio Assets:

1. *Security:* Borrowings availed by the Initial Portfolio Assets, are secured by, amongst others:

   (a) a first charge over all immovable properties (present and future) except the project assets;

   (b) a first charge over all moveable properties (present and future) except the project assets;

   (c) pledge of a certain specified percentage of the equity shares of the Initial Portfolio Assets until the final settlement date;

   (d) a first charge on all intangible assets including but not limited to goodwill, rights, undertaking and uncalled capital, present and future, excluding the project assets; and

   (e) a first charge of all accounts, revenues and receivables from the project or otherwise, project's book debts, operating cash flows, commissions or revenues of whatever nature, after such revenues and receivables are deposited in the relevant escrow account.

2. *Pre-payment:* The Initial Portfolio Assets may prepay the borrowings availed by them in full or in part without the payment of any prepayment penalty, if, amongst other things, (i) the revised applicable interest rate due to spread reset is not acceptable and such prepayment is made within 90 days of spread reset notice from the lender agent with the applicable notice as may be provided under the relevant financing documents; (ii) prepayment is made out of the proceeds of insurance claims; (iii) prepayment is made out of any project agreements; and (iv) prepayment is made out of InvIT proceeds, as applicable. Under certain of our borrowing agreements, in the event of prepayment from any other source, prepayment penalty ranging between 1.0% - 2.0% of the amount prepaid shall be charged. Further, under certain of our borrowing arrangements, the Initial Portfolio Assets may also be required to intimate or seek consent of the lenders of such prepayment.

3. *Restrictive Covenants:* Borrowing arrangements entered into by the Initial Portfolio Assets contain certain standard restrictive covenants affecting the Initial Portfolio Assets, which prevent them from undertaking certain actions, including, but not limited to:

   (i). formulation of any scheme of amalgamation or reconstruction;

   (ii). entering into borrowing arrangements either secured or unsecured with any bank or financial institution or otherwise or accept deposits other than the bank borrowings for meeting the working capital requirements;

   (iii). effecting any change in their respective capital structure, management control and shareholding pattern;

   (iv). selling or disposing off or creating charge, security or encumbrances on the security charged to the respective lender in favour of any other bank, financial institutions, company, firm, individual or person; and

   (v). undertaking guarantee or indemnity obligations on behalf of any other person.

4. *Events of Default:* Borrowing arrangements entered into by the Initial Portfolio Assets contain standard events of default affecting the Initial Portfolio Assets, including:

   (i). failure to pay any sum under the financing agreements;

   (ii). application of the loan proceeds to any purpose other than the purpose(s) for which it had been availed;

   (iii). any event that may have a material adverse effect, in the opinion of the lenders;

   (iv). breach of obligations in the performance of the financial covenants under the relevant financing agreements;

   (v). winding up or insolvency of the borrower;

   (vi). default in the performance or observance of the material covenants that may have a material adverse effect on the respective project; and

   (vii). failure to maintain any of the insurance as described under the insurance contracts;

5. *Consequences of* default: In terms of the borrowing arrangements entered into by the Initial Portfolio Assets, the following, amongst others, are the consequences of default:

   (i). cancellation or suspension of the available commitments;

   (ii). acceleration of repayment obligations and declaration of amounts outstanding to be forthwith due and payable;

   (iii). enforcement of security interests; and

   (iv). exercise of other remedies as permitted or available under the borrowing arrangements.

This is an indicative list of the terms of the borrowings availed by the Initial Portfolio Assets and there may be additional terms, conditions and requirements under the various borrowing arrangements entered into by the Initial Portfolio Assets. Where applicable and in relation to any debentures issued by the Initial Portfolio Assets, the term 'lenders' may include the relevant debenture trustee and/or the debenture holders.

Given the nature of these borrowings and the terms of prepayment, the aggregate outstanding borrowing amounts may vary from time to time.

Principal terms of the borrowing to be availed by the Trust

The Trust has executed a facility agreement dated July 30, 2022, as amended by way of an amendment agreement dated December 23, 2022 ("**InvIT Loan Agreement**") for the purposes of the InvIT Loan. Pursuant to the disbursement of the InvIT Loan (subsequent to the Listing) the aggregate consolidated borrowings and deferred payments of the Trust may be more than 25% of the aggregate of the InvIT Assets. The key terms of the InvIT Loan are as follows:

Facility	1. Rupee term loan facility for an amount not exceeding ₹ 100,000 million ("**RTL Facility**"). 2. Working capital facility in the form of bank guarantee facility for an amount not exceeding ₹ 2,000 million ("**WC Facility**").
Purpose	Each drawdown of the RTL Facility is required to be applied for the following and no other purposes: 1. Repayment of the Existing Facilities (as defined in the InvIT Loan Agreement and other than the Existing Facilities availed by MBEL and APEL); 2. Repayment of the Sponsor-Promoter Debt (as defined in the InvIT Loan Agreement), subject to satisfactory certification from an independent chartered accountant of repute, confirming the past utilization of the Sponsor-Promoter Debt, by the relevant Project SPVs; and 3. Creation of upfront reserve, other than for the purposes of debt service reserve account (DSRA). The Trust shall apply the proceeds of the WC Facility for the following purposes: 1. For making deposit with Government Authority/other Authorities as performance security and for any other purpose as per the relevant concession agreement of the relevant Project SPVs, or for any other purpose, with prior written approval from the lenders, but not towards commitment for DSRA; and 2. For providing performance security for bidding/acquisition of road projects that form part of Permitted Acquisitions (as defined in the InvIT Loan Agreement).
Loan Tenor	20 years from the initial drawdown date, i.e., March 31, 2022
Interest Rate	Linked to SBI MCLR, with spread rates linked to the credit rating of the Trust
Security	The obligations of the Trust under the facilities, all interest and other monies in respect thereof shall be secured by a security interest including, but not limited to following: 1. A first ranking *pari passu* security interest, by way of hypothecation on the following: a. on all moveable assets and the receivables of the Trust in relation to the Project SPVs, present and future including but not limited to: i. all receivables of the Trust from the Project SPVs; ii. loans and advances made by the Trust to Project SPVs except for APEL and MBEL ("**Excluded SPVs**"); iii. the interest and principal repayment of loans advanced by the Trust to Project SPVs; iv. dividends and any other amounts to be paid / payable by the Project SPVs to the Trust;

	v. inventories, contractual rights, securities, patents, trademarks, other intellectual property, equipment and/or insurances (in each instance, if any); and vi. all other current assets of the Trust, including all the Trust's tangible and intangible assets, including but not limited to its goodwill, undertaking and uncalled capital, both present and future. b. all the accounts (other than the debt service reserve account) and all other bank accounts of the Trust in which the free cashflows from the Project SPVs owned by the Trust will be deposited/ credited or any other account opened / maintained by the Trust in relation to such Project SPVs. 2. A first ranking exclusive security interest, by way of hypothecation on the DSRA, in respect of the senior debt facility, standing to the credit of DSRA; 3. A first ranking *pari passu* security interest by way of indenture of mortgage, over all movable and immoveable assets of the Trust and assignment thereunder of all loans and advances (and all rights, title, security, and interest thereunder) made by the Trust to Project SPVs except for the Excluded SPVs, including the rights under the substitution agreements, escrow agreements of the Project SPVs and all other project documents; 4. An agreement to assign the loans advanced by the Trust to the Project SPVs (except for the Excluded SPVs) and securities created by the Trust (including right of substitution and termination and invocation of the provisions of the escrow agreements in case of default by such Project SPVs except for the Excluded SPVs) in relation to such loans granted by the Trust; 5. A pledge of all bonds, non-convertible debentures, or any other security (except the equity shares) of Project SPVs (other than the Excluded SPVs) held by the Trust; 6. A pledge of 100% equity shares on a fully diluted basis of all Project SPVs (except for the Excluded SPVs). 7. A negative lien, other than on permitted disposals, on the immovable and movable assets (including current assets and cash flows) of the Project SPVs except for the Excluded SPVs, subject to the rights of the relevant authorities under the respective concession agreements; 8. A corporate guarantee from all the Project SPVs, except the Excluded SPVs, to the extent permitted and not restricted under the relevant concession agreement; 9. A shortfall undertaking from Project SPVs except by the Excluded SPVs, in relation to upstreaming of funds and/or direct payments to lenders towards dues owed and payable by the Trust in relation to the Senior Debt Facility Tranche I; 10. A non-disposal undertaking by Cube Highways (as defined in the InvIT Loan Agreement) regarding the non-disposal of certain Units of the Trust, which shall be released upon expiry of a period of three years from the date of initial drawdown; 11. A pledge of bonds, non-convertible debentures, or any other security (except equity shares) of the Excluded SPVs held by the Trust and pledge over 100% equity shares of APEL and pledge over 99.97% equity shares of MBEL and a pledge over 100% of the equity shares of the other Excluded SPVs; and 12. A contractual arrangement to ensure that the security trustee is appointed as the irrevocable agent of the Trust under the loans and advances proposed to be granted by the Trust to all the Project SPVs, except the Excluded SPVs.
Prepayment Premium	1% of the principal amount proposed to be prepaid. There may be no prepayment charges if the Trust notifies the lenders of its intention to pre-pay (in full or in part) within 30 days from (a) the date of reset of the Spread (as defined in the InvIT Loan Agreement) in accordance with the InvIT Loan Agreement; or (b) the anniversary of the drawdown date, and makes such pre-payment within 90 days from the date of such notice.
Mandatory Prepayment	The Trust shall mandatorily prepay the loan amount in the following events, amongst other things: 1. Credit rating of the Trust awarded by specified credit rating agencies falls below 'A'; or

	2. The Senior Debt Facility Tranche I (as defined in the InvIT Loan Agreement) ceases to have a valid credit rating from any specified credit rating agency; or 3. Any application/petition is filed for corporate insolvency resolution or bankruptcy or dissolution or liquidation or winding up against any Project SPV under the Insolvency & Bankruptcy Code, 2016 or any other such prevailing applicable law and such application results in a Project SPVs Negative Impact (as defined in the InvIT Loan Agreement); or 4. Cessation of business by any of the Project SPV(s) and such event results in a downgrade in the credit rating of the Borrower to AA- or below as determined by any credit rating agency; or 5. Termination of any concession agreement and upon such termination, the credit rating of the Trust as determined by any specified credit rating agency falls below the AAA Credit Rating; or 6. Receipt of expiration payment in connection with any clearance or under any of the project documents; or 7. Any material asset sale of any Project SPV as per provisions of the financing documents, other than any sale in the normal course of business cumulatively to the extent of ₹ 5,00,00,000 per annum and not more than ₹ 1,00,00,000 per annum per Project SPV; or 8. Any favourable claim received under any specified insurance contract (by the Trust and/or the Project SPVs); or 9. Expropriation or other takeover event by any Government Authority of the assets of the Trust or Project SPVs; or 10. Any favorable arbitral or judicial award in connection with any of the project documents; or 11. Consolidated debt to enterprise value of the Trust exceeds 49%, unless the same is rectified to the satisfaction of the lenders.
Debt Service Reserve Account ("DSRA")	The Trust shall have agreed and undertaken to establish the DSRA with an amount equivalent to the amount of the repayment instalment and the interest payable in the next 3 months to the lenders in terms of the Senior Debt Facility Tranche I and in accordance with the provisions of the financing documents and relevant escrow agreements. In the event of downgrade in the external credit rating of the Trust by a credit rating agency to AA or below, which is continuing, the Trust shall have ensured that the debt service reserve amount is an amount equivalent to principal and interest payable in respect of the Senior Debt Facility Tranche I during the subsequent 2 fiscal quarters. The debt service reserve amount can be held in the form of permitted investments or bank guarantee without any recourse to the Trust and/or Project SPVs from scheduled commercial bank with a minimum rating of AA or above. Such debt service reserve amount is required to be maintained by a specified Project SPV in the form of permitted investments.
Other conditions	*Events of Default:* The following events, among other things, shall constitute an event of default: 1. Non-payment of any instalment, principal or interest amount when due; 2. Non-performance or observance or breach of material covenants and financial covenants of the financing documents, including use of the proceeds of the Senior Debt Facility Tranche I for any purpose other than those set out in the InvIT Loan Agreement; 3. Incorrectness of any material representation, statement or warranty made by the Trust or any of the Project SPVs in any of the financing documents (or in any document delivered by or on behalf of the Trust); 4. Execution or distress being enforced or levied against whole or substantial part of the the Trust's property comprising the security interest or against the whole or substantial part of the assets of any of the Project SPVs that results in a Project SPVs Negative Impact (as defined under the InvIT Loan Agreement); 5. Any change in the general nature of the business or scope of the business, or change in the activities of the Trust or the Project SPVs, which adversely impacts the Trust's ability to meet its payment obligations under the financing documents; 6. Cessation of business by the Trust or cessation of business or abandonment of projects by any of the Project SPVs (in the case of the Project SPVs, where such cessation or abandonment results in a downgrade of the credit rating of the Trust to AA- or below, as determined by a specified credit rating agency); 7. Non-creation of security within the stipulated time;

	8. Any key managerial person of the Trust or the director of the Investment Manager is declared as wilful defaulter and not removed from their position as a key managerial person or from the IM Board, as applicable; 9. Termination of any concession agreement by the relevant authority or the relevant Project SPVs, or the occurrence of an event of default under any concession agreement which is not cured, where such termination or event of default results in a downgrade of the credit rating of the Trust to AA- or below; 10. Failure to obtain a no-objection certificate from the relevant authorities regarding approval of the terms of the Project SPVs Financing Documents (as defined under the InvIT Loan Agreement) and re-financing/repayment of the existing facilities by the Project SPVs, and approval of the Trust as a senior lender of the project SPVs in terms of the concession agreements in respect of the debt extended by the Trust to the Project SPVs; 11. Downgrade of the external credit rating of the Trust, as determined by a specified credit rating agency, below A; and 12. Breach of any project documents/InvIT documents by any party thereto which adversely affects the ability of the Trust to perform its obligations under the financing documents. Consequences *of Event of Default* Upon the occurrence of event of default and declaration as such by the lenders; the lenders may, among other things, exercise the following rights: 1. Right to levy additional interest at the rate of 1% p.a. from the date of default till the time such default is cured; 2. Accelerate or part accelerate the maturity of the facility and declare all outstanding amounts payable by the Trust; 3. Enforcement of security; 4. Right to enter upon and take possession of the assets of the Trust comprised within the Security or to transfer the assets of the Trust in favour of the Secured Parties (as defined under the InvIT Loan Agreement) or such other person by way of lease, leave and license, sale or otherwise; 5. Right to suspend further drawdown under the facility or to declare their respective undrawn commitment as cancelled; 6. Right to instruct the Project SPVs and the Trust to transfer the funds available in the escrow accounts 7. Right to set off and to appropriate deposits held or owing by the lenders to or for the credit or the account of the Trust against an on account of any matured liabilities of the Trust 8. Right to classify the loans as (i) special mention account for a default continuing for a period of 1-30 days, (ii) special mention account for a default continuing for a period of 31 to 60 days, and (iii) special mention account for a default continuing for a period of 61 to 90 days or the right to classify the loan as a "non-performing asset" if the default has not been remedied by the Trust for a period of 90 days; and 9. Exercise one or more of the actions or rights under extant and applicable laws and regulatory guidelines.

The proceeds from the InvIT Loan will be up to ₹ 98,500 million (the "**InvIT Loan Proceeds**"). The InvIT Loan Proceeds will be utilised towards providing loans to certain Initial Portfolio Assets for amongst other things, repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions and the Cube Group.

The InvIT Loan Proceeds are proposed to be utilised in accordance with the details provided in the following table:

(In ₹ million)

S. No.	Particulars	Amount
(i)	Providing loans to certain Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed by them from certain banks and financial institutions	66,755
(ii)	Providing loans to certain Initial Portfolio Assets for repayment or pre-payment of debt, including any accrued interest, availed by them from the Cube Group (including any accrued interest), funding of any capital expenditure for the Initial Portfolio Assets and creation of debt service reserve account	31,745

This Final Placement Memorandum does not, directly or indirectly, relate to any invitation, offer or sale of any securities, instruments or loans (including listed non-convertible debentures, bonds or other debt securities, if any) that may be issued by the Trust after the listing of the Ordinary Units. Any person or entity investing in such issue or transaction by the Trust should

consult its own advisors. Neither the Placement Agents, nor their associates or affiliates have any responsibility or liability for such issue or transaction by the Trust.

The Trust also proposes to avail additional debt subsequent to the listing of the Ordinary Units, the terms of which, may be finalized post-listing.

Principal terms of borrowings proposed to be availed by each of the Initial Portfolio Assets from the Trust ("Trust Loan")

The debt financing proposed to be provided by the Trust to each of the Project SPVs comprises

(i) unsecured subordinate loans; and
(ii) loans which, subject to the approval of the concessioning authority and the senior lenders, may be classified as (1) debt owned to a senior lender; or as (2) loans which are not classified as debt owed to a senior lender, which are secured by a first-ranking exclusive charge, *pari passu* to the charge created to secure the debt owed to the other senior lenders on, *inter alia* (a) the escrow account of such Project SPV; (b) the rights, title, interest, claims and demands of the relevant Project SPV in its concession agreement, other project agreements, insurance policies and project clearances; and (c) all other movable assets of the relevant Project SPVs.

The Project SPVs propose to avail such debt financing by way of the Trust Loan Agreements. The Issue Proceeds will be utilized to provide unsecured subordinate loans. Senior loans and the other secured loans are proposed to be provided by the Trust out of the proceeds of the InvIT Loan and further debt availed by the Trust (after the listing of the Ordinary Units) and are subject to consents, conditions and compliance with law, as may be applicable.

The principal terms of the Trust Loan Agreements are as follows:

Facility	i. Senior loan/secured loan of ₹ 7,615 crores (collectively, the "**Secured Loan**")*; and ii. Subordinated unsecured loan of ₹ 8,500 crores ("**Subordinate Loan**"). **The loans classified as secured loan will be disbursed upon receipt of all approvals of the concessioning authority and the senior lenders. Further, the relevant Trust Loan Agreements in relation to the debt to be availed by GAEPL and DATRPL which may be classified as debt owed to a senior lender are proposed to be executed upon receipt of approval of the concessioning authority and the senior lenders, as may be required.*
Summary of financing documents proposed to be executed by the Initial Portfolio Assets	For Secured Loan: • Loan Agreements • Security trustee agreements • Escrow agreements* • Supplementary escrow agreements* • Unattested deed of hypothecations along with the corresponding power of attorneys • Substitution agreements* For Subordinate Loan, subordinated loan agreements shall be entered into. **The escrow agreements, supplementary escrow agreements and substitution agreements in relation to the Secured Loan are proposed to be executed subsequent to the first disbursement of the Secured Loan.*
Purpose	**Secured Loan:** Towards refinancing of the outstanding amounts under the existing debt arrangements of the relevant Initial Portfolio Asset **Subordinate Loan:** Towards refinancing/redemption of the facilities availed by the relevant Initial Portfolio Asset from the Cube Group or any other purpose as may be agreed between the Trust and the relevant Initial Portfolio Asset.
Terms of Repayment	**Secured Loan:** As per the repayment schedule specified under the facility agreement or earlier in accordance with the terms of the relevant facility agreement, only if (A) on the relevant principal repayment date(s), sufficient cashflows are available with the Initial Portfolio Asset (which are available and permitted to be utilised towards repayment of such principal amounts, without such utilisation being in or resulting in a breach of the financing documents) to make such payments in full or part or (b) the Trust or its representative has sent a letter to the Initial Portfolio Asset requesting it to make payment on the relevant repayment date which shall be, to the extent commercially feasible in line with the repayment schedule of the InvIT Loan.

	If the relevant Initial Portfolio Asset is unable to pay any portion of the principal amount due to the unavailability of sufficient cashflows, such an event shall not be a default or event of default under the facility agreement. If the Trust / Trust's representative has sent an intimation to the relevant Initial Portfolio Asset requesting it to make payment on the relevant repayment date, and the relevant Initial Portfolio Asset fails to make payment on the said repayment date, it shall be an event of default under the facility agreement, whether or not such failure is due to the unavailability of sufficient cashflows. **Subordinate Loan:** Initial Portfolio Assets shall repay the principal amount to the Trust on such date(s) as may be agreed between the Initial Portfolio Assets and the Trust from time to time as and when surplus cash is available at the Initial Portfolio Assets or in any case not later than the last day of the concession period (as defined in the concession agreement) and to the extent commercially feasible in line with the repayment schedule of the InvIT Loan.
Interest Rate	**Secured Loan:** The Secured Loan shall carry interest at rates in the range of 11 to 13% per annum which may be reset on any interest reset date. **Subordinate Loan:** Such rates as may be agreed between the Trust and the Initial Portfolio Assets from time to time (subject to a benchmarking report being obtained for interest rate at every such instance) and such interest shall be payable from time to time subject to: (i) withholding of applicable taxes, if any, and (ii) availability of surplus cash flows at the Initial Portfolio Asset.
Security for Secured Loan	• First ranking exclusive charge on the Project Receivables (as defined in the facility agreements), both present and future; • First ranking exclusive charge over the escrow account (or any accounts in substitution thereof) of the relevant Initial Portfolio Asset opened in relation to its project and all receivables deposited therein from time to time; • First ranking exclusive charge or assignment over the rights, title and interest, claims and demands of the relevant Initial Portfolio Asset in (i) the concession agreement; (ii) any insurance policies taken out by the relevant Initial Portfolio Asset; (iii) the clearances in respect of its project; and (iv) each other project agreement, in each instance, pursuant to and in accordance with the provisions of the concession agreement and to the extent as provided in the Substitution Agreement (as defined in the facility agreements); and • First ranking exclusive charge on all other movable assets of the relevant Initial Portfolio Asset, both present and future (other than the project assets).
Premature Payment for Secured Loan	• The relevant Initial Portfolio Asset shall be entitled to prepay the outstanding facility in full or in part, without any prepayment penalty, only with the prior written consent of the Trust and to the extent commercially feasible in line with the repayment schedule of the InvIT Loan. The relevant Initial Portfolio Asset shall not be entitled to prepay the outstanding facility in its entirety ahead of the repayment schedule, except with the prior written consent of the Trust's representative or pursuant to the conditions for mandatory pre-payment under the relevant facility agreement. However, arrears which have not been paid as per the repayment schedule shall be permitted to be paid, and any prepayments not resulting in complete prepayment / repayment of the facility, shall be permitted in accordance with the terms of the financing documents. • The relevant Initial Portfolio Asset shall mandatorily repay the facility in full or in part, without payment of any prepayment premium from the proceeds (to the extent indicated below, net of all taxes, costs and expenses incurred in claiming/recovering such amounts) from any event as mentioned in the Secured Loan facility agreement, such as: - any proceeds from the sale / disposal of any material project assets (other than the proceeds from sale / disposal in the normal course of business to the extent of ₹ 10 million in a financial year); - any expiration payment received in connection with any clearance under any project agreement, to the extent of the expiration payment; - any insurance proceeds received pursuant to claims made, as set out in the facility agreement to the extent not applied by it towards repair, renovation, restoration, reinstatement or replacement of the project assets, provided such amount is in excess of ₹ 20 million per claim. This shall not apply to proceeds of insurance in relation to business interruption leading to the loss of revenue or profit, as long as the servicing of the facility on the respective due dates, has continued during the period of business interruption including up to receipt of insurance claims, workers/employee liability insurance, public liability/personal injury insurance, directors and officers insurance, or any third party insurance proceeds;

	- the proceeds resulting from the expropriation or other takeover event by any Governmental Authority of the project assets of the relevant Initial Portfolio Asset, to the extent of the proceeds received; - the proceeds, resulting from an arbitral or judicial award in connection with any project agreement of the relevant Initial Portfolio Asset, as set out in the facility agreement; - all proceeds of any Termination Payments (as defined in the facility agreement); and - all proceeds of buy-out payments received from the NHAI under the relevant concession agreement or other project agreements.
Representations and Warranties	Some of the key representations and warranties made by the relevant Initial Portfolio Asset, which are deemed to be repeated by the relevant Initial Portfolio Asset on each date until the final settlement date, are, amongst others, as follows: • it is a company, duly incorporated and validly existing under the laws of India and has all corporate powers and all material governmental licenses, authorizations, consents and approvals required to carry on its business and the project; • the execution, delivery and performance by it of the financing documents and the consummation of the transactions contemplated hereby by the relevant Initial Portfolio Asset is within its corporate powers and have been duly authorized by all necessary corporate action and the obligations expressed to be assumed by the relevant Initial Portfolio Asset under each financing document are legal, valid, binding and enforceable against it; • the execution, delivery and performance of the financing documents do not and will not contravene or conflict with (i) the certificate of incorporation or (ii) its articles or memorandum of association or (iii) the concession agreement or any other project agreement; (iv) any provision of any law, regulation, judgment, injunction, order, decree, approval or clearance binding upon it; and (v) any instrument or agreement binding upon it or any of its assets; • the project is being carried out, owned, developed, was constructed and is operated in compliance with all applicable laws; and • The relevant Initial Portfolio Asset is in compliance with all applicable laws in material respects.
Events of Default for Secured Loan	Some of the key events or circumstances upon the occurrence of any of which the Trust will be entitled to declare an event of default by providing a written notice to the relevant Initial Portfolio Asset are, amongst others, as follows: • Non-payment of principal: The relevant Initial Portfolio Asset defaults in the payment of the principal amounts under the facility on the dates on which such principal amounts are due and payable, in accordance with the facility agreement. • Non-payment of interest: The relevant Initial Portfolio Asset defaults in the payments, when due and payable, in accordance with the facility agreement, to the Trust, of any interest payment owing in relation to the facility. • Non-performance: The relevant Initial Portfolio Asset defaults or commits a material breach in the performance of any condition, obligation or agreement (other than a default covered under any other provisions of clauses for payment default) under any financing document and the same is not cured in the opinion of the Trust within a period of 30 days. • Cross-default: An event of default (howsoever defined or described) occurs and is continuing under the InvIT Senior Debt, as defined in the facility agreement. • Security: The security required to be created under the terms of the facility agreement is not created and perfected within the timelines stipulated therein or the occurrence of any material event or circumstance that is prejudicial to or materially imperils or materially depreciates the security created or to be created.
Consequences of Event of Default under the loan agreements pertaining to the Secured Loan	• If an event of default has occurred, the Trust / Trust's representative may, *inter alia*, accelerate the repayment of the outstanding amounts under the facility and all other amounts outstanding in relation thereto by delivery of a written notice to the relevant Initial Portfolio Asset (the "**EOD Notice**"). Upon receipt of the EOD Notice, all amounts outstanding under the facility (including accrued interest) shall become due and payable by the relevant Initial Portfolio Asset with immediate effect and shall be repaid immediately upon the issue of the EOD Notice. The Trust and/or the Investment Manager shall be entitled to cancel the undrawn facility and/or pursue any other legal remedy for any other relief as may be available to them under applicable law and any financing document. • On and from the occurrence of an event of default, the Trust / Trust's representative shall have the right to enforce the security towards repayment of the outstanding amounts owed / payable to the finance parties, as defined in the facility agreement, and enforce its rights under the memorandum of hypothecation. • Notwithstanding the foregoing, upon occurrence of an event of default (other than certain specified defaults), the Trust / Trust's representative may waive such event of default at its

	sole discretion subject to the terms specified under the facility agreement. Certain events of default may only be waived by the Trust's representative. On the occurrence and during the continuation of an event of default, the Trust shall take any action under the financing documents only with the prior written consent of the Trust's representative.
Rights of the Lenders' Representatives pertaining to the Secured Loan	The Trust (in its capacity as the lender in respect of the Secured Loan) has appointed SBICAP Trustee Company Limited (the "**Lender's Representative**"), to act as the lenders' representative for the benefit of the Trust (in its capacity as the lender in respect of the Secured Loan), under and in respect of the relevant concession agreement and any financing document to which the Lender's Representative is required to be a party in its capacity as the lenders' representative of the Trust (in its capacity as the lender in respect of the Secured Loan).
Governing Laws & Jurisdiction	India

Post-Offer Indebtedness of the Trust

The post-Offer consolidated borrowings and deferred payments of the Trust will be formulated and approved by the Investment Manager in accordance with the Borrowing Policy. Upon full utilization of the Issue Proceeds, and drawdown of additional debt, the indebtedness and deferred payments of the Trust, on a consolidated basis, shall not exceed ₹ 109,643 million, subject to any additional indebtedness incurred after Allotment of Ordinary Units and listing of Ordinary Units in accordance with applicable law.

Leverage

In accordance with and subject to the InvIT Regulations, the provisions of the Trust Deed, and the borrowing policy adopted by the Investment Manager, the aggregate consolidated borrowings and deferred payments of the Trust may be up to 70% of the aggregate of the InvIT Assets, subject to the conditions prescribed under Regulation 20 of the InvIT Regulations.

For details of the capital structure of the InvIT Assets, including any borrowings or deferred payments with respect to the InvIT Assets prior to the Offer and post-Offer, on a standalone and consolidated basis, please refer to the sections entitled "*Formation Transactions in relation to the Trust – Acquisition of the Initial Portfolio Assets by the Trust and acquisition of the Initial Tranche Subordinate Units by the Sponsors*", "*Financial Indebtedness and Deferred Payments*" and "*Audited Special Purpose Combined Financial Statements*" on pages 30, 232 and 345, respectively.

Status of lender consents

The Initial Portfolio Assets have availed debt from certain third-party lenders and consents from the respective lenders are required for and in connection with the Offer. As on the date of the Placement Memorandum, the Initial Portfolio Assets had received consents from the relevant lenders in relation to the Offer.

These consents are subject to certain conditions, including no change in the equity shareholding of the Investment Manager during the term of the financing arrangement, the sponsor group (as specified by the relevant lender) continuing to be the sponsors of the Trust and holding at least 51% of the Units of the Trust during the term of the financing arrangement and creation of pledge and non-disposal undertaking over a specified percentage of the securities of certain Project SPVs. Also see the section entitled "*Risk Factors – The transfer of the Project SPVs to the Trust under the Share Purchase Agreements may result in certain risks*" on page 85.

Borrowing Policy

The Investment Manager shall ensure that all funds borrowed in relation to the Trust are in compliance with the InvIT Regulations. Accordingly, the Investment Manager has formulated a borrowing policy to outline the process for borrowing monies in relation to the Trust. For further details, please see the section entitled "*Corporate Governance – Investment Manager – Policies of the Board of Directors of the Investment Manager in relation to the Trust – Borrowing Policy of the Trust*" on page 152.

DISTRIBUTION

Statements contained in this section entitled "Distribution" that are not historical facts are forward-looking statements. Such statements are subject to certain risks and uncertainties that could cause actual results to differ materially from those that may be projected. Under no circumstances should the inclusion of such information herein be regarded as a representation, warranty or prediction with respect to the accuracy of the underlying assumptions by the Trustee, the Sponsors, the Investment Manager, the Placement Agents or any other person. Bidders are cautioned not to place undue reliance on these forward-looking statements that are stated only as at the date of this Final Placement Memorandum. For details in relation to such forward-looking statements, please see the section entitled "Forward-Looking Statements" on page 18.

The net distributable cash flows of the Trust (the "**Distributable Income**") are based on the cash flows generated by it, including from the underlying operations undertaken by the special purpose vehicles and any holding companies held by the Trust (together, the "**Portfolio Assets**") and any return of capital in accordance with the Distribution Policy. For details of the business and operations presently undertaken by the Portfolio Assets, please see the section entitled "*Business*" on page 172. Presently, cash flows receivable by the Trust may be in the form of dividend, interest income, gains, principal repayment or other income received from the Portfolio Assets in relation to any debt sanctioned by the Trust, or a combination of both.

In terms of the InvIT Regulations, not less than 90% of the net distributable cash flows of the Initial Portfolio Assets (net of any applicable taxes including withholding taxes), shall be distributed to the Trust / Holdco in proportion of its holding in such Initial Portfolio Assets, subject to applicable provisions in the Companies Act, 2013, as amended or the Limited Liability Partnership Act, 2008, as amended, and not less than 90% of the net distributable cash flows of the Trust shall be distributed to the Unitholders holding Ordinary Units. With regard to distribution of net distributable cash flows by the Holding Companies t o the Trust, 100% of cash flows received by the Holding Companies from underlying SPVs shall be distributed to the Trust (net of any expenses and applicable Taxes including withholding Taxes) and with respect to the cash flows generated by a Holding Company on its own, not less than 90% of such net distributable cash flows shall be distributed by the Holding Company to the Trust (net of applicable Taxes including withholding Taxes).

The Trust shall declare and distribute at least 90% with an endeavour to distribute 100% of the Distributable Income to the Ordinary Unitholders, not less than once every financial year, with an endeavour to distribute at least once every half year or quarter of a financial year. However, if any infrastructure asset is sold by the Trust or the Portfolio Assets, or if the equity shares or interest in the Portfolio Assets are sold by the Trust; and if the Trust (acting through the Investment Manager) proposes to re-invest the sale proceeds into another road infrastructure asset within one year, it shall not be required to distribute any sales proceeds to the Trust or to the Ordinary Unitholders. Further, if the Trust (acting through the Investment Manager) proposes not to invest the sale proceeds into any other road infrastructure asset within one year or any other time period specified under the InvIT Regulations, it shall be required to distribute the same in accordance with the InvIT Regulations. In accordance with the InvIT Regulations, distributions by the Trust shall be made no later than 15 days from the date of such declarations. The distribution, when made, shall be made in Indian Rupees. Further, the actual amount received by the Ordinary Unitholders will be subject to taxes and other statutory deductions as applicable. In terms of the InvIT Regulations, if the distribution is not made within 15 days of declaration, the Investment Manager shall be liable to pay interest to the Ordinary Unitholders at the rate of 15% per annum or such other rate as may be specified under applicable law, until the distribution is made. Such interest shall not be recovered in the form of fees or any other form payable to the Investment Manager by the Trust. Any amount remaining unclaimed or unpaid out of the distributions declared by the Trust shall be transferred to the 'Investor Protection and Education Fund' constituted by the SEBI, in such manner as may be specified by the SEBI. The Investment Manager shall be responsible for deducting all types of taxes on all payment made by Investment Manager and deposit with the relevant governmental agency. Unitholders holding Subordinate Units of the Trust shall not be entitled to any distribution rights, economic rights or any other rights available in respect of Ordinary Units in relation to their Subordinate Units.

Given that there is currently no regulatory framework that has been prescribed for the redemption, buy back of units of the Trust or reduction of capital, no distributions shall be made to the Ordinary Unitholders by way of redemption or buy back of units, return of unit capital or reduction of unit capital, prior to a period of four years from the date of Allotment.

It is clarified that unitholder holding Subordinate Units (*as defined in the InvIT Documents*) of the Trust shall not be entitled to any distribution rights or other economic rights in relation to their Subordinate Units.

For details on the risks relating to distribution, please see the section entitled "*Risk Factors*" on page 63.

Distribution Policy

Method of calculation of Distributable Income

The Distributable Income and the net distributable cash flows of any Portfolio Asset shall be calculated in accordance with the InvIT Regulations and any circular, notification or guidance issued thereunder. Presently, the Trust proposes to calculate distributable income in the manner provided below:

I. Calculation of net distributable cash flows at each SPV level:

Description
Profit after tax as per profit and loss account (standalone) (A)
Add: Depreciation, impairment and amortisation as per profit and loss account. In case of impairment reversal, same needs to be deducted from profit and loss.
Add/less: Loss/gain on sale / transfer / disposal / liquidation of infrastructure assets, investments, other assets of the SPVs (if applicable)
Add: Proceeds from sale / transfer / disposal / liquidation of infrastructure assets, investments, other assets of the SPVs (if applicable), adjusted for the following: • related debts settled or due to be settled; • directly attributable transaction costs; • proceeds reinvested or planned to be reinvested as per Regulation 18(7)(a) of the InvIT Regulations.
Add: Additional borrowings (including debentures / other securities) (external as well as borrowings from Trust) adjusted for the following: • any prepayment of borrowings if deemed necessary by the Investment Manager; • any identified end use as specified in the lender agreement or as deemed necessary by the Investment Manager
Less: Repayment of accrued interest/principal component of senior and additional debt as approved by NHAI
Add: Amount invested by the Trust in the SPV.
Add: Any amount received from toll or annuities not recognised as income for the purposes of working out the profit after tax
Less: Any amount payable to third parties as deemed necessary by the Investment Manager, including but not limited to NHAI, any engineering, procurement and construction contractors, if such amount has not already been considered for the determination of profit after tax
Add: Interest (or other similar payments) on borrowings (loan, debentures or other instruments) provided by the Trust
Add: Amount received from settlement of any claims. including from NHAI or any engineering, procurement and construction contractors, to the extent not already considered in profit after tax and adjusted for (i) any amount payable to any other group entity / third party as per their contractual agreement(s) and/or (ii) any tax obligation arising from the receipt of such claims
Less: Capital expenditure (if any)
Less: Any amount retained for future earnout payments to Walayar Vadakkencherry Expressways Private Limited, DA Toll Road Private Limited, Farakka Raiganj Highways Limited and Ghaziabad Aligarh Expressway Private Limited as per their contractual agreement(s)
Add/less: Any other item of non-cash expense / non cash income (net of actual cash flows for these items), including but not limited to • any decrease/increase in carrying amount of an asset or a liability recognised in profit and loss account on measurement of the asset or the liability at fair value; • interest cost as per effective interest rate method (difference between accrued and actual paid) • deferred tax, lease rents recognised on a straight line basis; • unwinding of interest cost on interest free loan or other debentures; • portion reserve for major maintenance which has not been accounted for in profit and loss statement; • reserve for debenture/ loan redemption.
Less: Net cash set aside (i) to comply with reserve requirements under the loan agreements (including but not limited to DSRA and MMRA) or as decided by the IM Board from time to time, adjusted for amount released from DSRA/MMRA or any other reserve in lieu of providing bank guarantee, and/or (ii) on a prudential basis for repayments of borrowings etc., as appropriate.
Add/Less: Other adjustments, including but not limited to net changes in security deposits, working capital, deferred / prepaid income or deferred / prepaid expenditure, at the SPV.
Less: Any cash reserve deemed necessary by the board of directors of the Investment manager ("**IM Board**") for expenses which may be due in the next financial year but for which there may not be commensurate cash available by the date such expenses become due
Less: Any other adjustment to be undertaken by the Investment Manager to ensure that there is no double counting of the same item for the above calculations
Total Adjustments (B)
Net Distributable Cash Flows (C)=(A+B)

II. Calculation of net distributable cash flows at the consolidated Trust level:

Description
Cash flows received from the SPVs in the form of interest (net of applicable taxes, if any)
Add: Cash flows received from the SPVs in the form of dividend (net of applicable taxes, if any)
Add: Cash flows received from the SPVs towards the repayment of the debt issued to the SPVs by the Trust or redemption of debentures issued by the SPVs to the Trust
Add: Proceeds from the SPVs for any capital reduction / buy back / redemption subject to Applicable Laws (net of applicable Taxes, if any)

Description
Add: Proceeds from sale or transfer or liquidation or redemption or otherwise realization of investments, assets or shares of/interest in SPVs (net of applicable taxes and / or directly attributable transaction costs, if any)
Add: Proceeds from sale of assets of the SPVs not distributed pursuant to an earlier plan to re-invest, if such proceeds are not intended to be invested subsequently
Add: Any other income accruing at the Trust level and not captured above, including but not limited to interest / return on surplus cash invested by the Trust
Total cash inflow at the Trust level (A)
Less: Any payment of fees, interest and expense incurred at the Trust level, including but not limited to the Investment Manager fees, security trustee fees, annual fees for traffic, technical and other studies and fees for annual valuation.
Less: Any capital expenditure at any SPV level where sufficient cash is not available
Less: Costs/retention associated with sale of assets of the SPVs, including transaction costs paid on sale of the assets of the SPVs
Add: Additional borrowings (including debentures / other securities) adjusted for the following: • any prepayment of borrowings if deemed necessary by the Investment Manager; • any identified end use as specified in the lender agreement or as deemed necessary by the Investment Manager.
Less: Repayment of external debt
Less: Income tax (if applicable) at the standalone Trust Level (including capital gains taxes on sale of assets / share in SPVs / other investments) (net of any tax refunds)
Less: Related debts settled or due to be settled from sale proceeds of SPVs
Less: Investment in shares or debentures of SPVs or other similar investments or lending to SPVs
Less: Proceeds reinvested or planned to be reinvested in accordance with Regulation 18(7)(a) of the InvIT Regulations
Less: Net cash set aside (i) to comply with reserve requirements under the loan agreements (including but not limited to DSRA and MMRA) adjusted for amount released from DSRA/MMRA or any other reserve in lieu of providing bank guarantee, and/or (ii) on a prudential basis for repayments of borrowings etc., as appropriate.
Less: Any cash reserve deemed necessary by the IM Board for expenses which may be due but for which there may not be commensurate cash available by the date such expenses become due
Less: Any other adjustment to be undertaken by the Investment Manager to ensure that there is no double counting of the same item for the above calculations
Total Adjustments (B)
Net Distributable Cash Flows (C) = (A+B)

For the purpose of calculation of the Distributable Income, the cash flows of the Trust shall be classified in two parts:

1. dividend, interest, treasury income and capital gains of the Trust ("**Income Bucket A**"). All expenditures of the Trust (including, amongst others interest expenses and fees payable to the Investment Manager, the "**Expenditures**"), shall be paid out of Income Bucket A, proportionately towards various income streams; and

2. capital repayments to the Trust ("**Income Bucket B**"). Any capital outflows (including, amongst other, principal repayments by the Trust on its borrowings and capital infusions into the Initial Portfolio Assets, the "**Capital Outflows**") shall be paid out of Income Bucket B. In case any expenses are directly attributable to this bucket, then the same can be reduced directly from this bucket.

In the event the cash flows in Income Bucket A are not sufficient to meet the Expenditures set out above, such Expenditures shall be paid of Income Bucket B. Similarly, in the event the cash flows in Income Bucket B are not sufficient to meet the Capital Outflows set out above, such Capital Outflows shall be paid of Income Bucket A. The Distributable Income calculated on basis of Income Bucket A shall be further classified as interest, dividend, gains, other income in the ratio of the inflows. It is clarified that the unitholders holding Subordinate Units of the Trust shall not be entitled to any distribution rights or other economic rights in relation to their Subordinate Units.

Amendment

Any amendment or variation to the Distribution Policy shall be undertaken by the IM Board, in compliance with applicable law. Notwithstanding the above, the Distribution Policy will stand amended to the extent of any change in applicable law, including any amendment to the InvIT Regulations, without any action from the Investment Manager or approval of the Unitholders of the Trust.

DISCUSSION AND ANALYSIS BY THE DIRECTORS OF THE INVESTMENT MANAGER OF THE FINANCIAL CONDITION, RESULTS OF OPERATIONS AND CASH FLOWS OF THE INITIAL PORTFOLIO ASSETS OF THE TRUST

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with the sections entitled "Summary of Combined Financial Statements" and "Audited Special Purpose Combined Financial Statements" on pages 33 and 345, respectively. This discussion contains forward-looking statements and involves numerous risks and uncertainties, including, but not limited to, those described in the section entitled "Risk Factors" on page 63. Actual results could differ materially from those contained in any forward-looking statements and for further details regarding forward-looking statements, kindly refer to the section titled "Forward-Looking Statements" on page 18. The Audited Special Purpose Combined Financial Statements are prepared in accordance with Ind AS, which differs in certain respects from Indian GAAP, IFRS and U.S. GAAP. Our fiscal year ends on March 31 of each year, and references to a particular fiscal are to the twelve months ended March 31 of that year. For the sole purposes of the Special Purpose Combined Financial Statements, references to "we", "us" and "our" is to the Initial Portfolio Assets on a combined basis. Unless stated otherwise or the context otherwise requires, industry and market data used in this section has been obtained or derived from the CRISIL Report dated June 2022 with respect to the assessment of the roads sector in India, publicly available information as well as industry publications and sources, including from various government publications and websites.

Overview

Cube Highways Trust is an Indian infrastructure investment trust sponsored by Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd. (collectively referred to as the "**Sponsors**"), established with the objective of acquiring and operating road assets in India and registered under the InvIT Regulations. We believe that, based on our robust financial position and support from our Sponsors, we are well positioned to take advantage of the growth potential of India's highways sector and make consistent distributions to our Ordinary Unitholders.

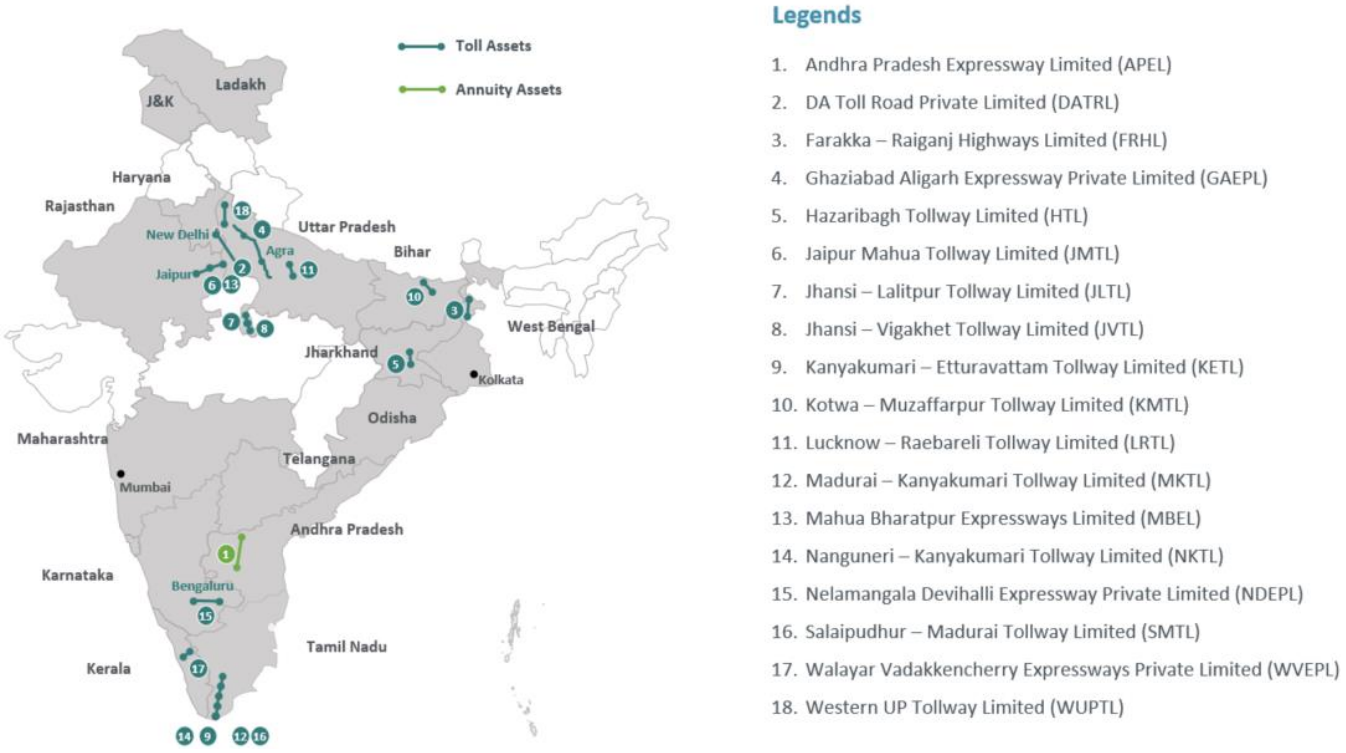
The Cube Group is engaged in implementing the public-private partnership ("**PPP**") model in the country's highways sector to operate and manage highway projects in association with the central and state governments. The Cube Group is a 100% institutionally-owned platform backed by a diversified investor base, including ISQ Asia Aggregator Pte. Ltd., Platinum Rock B 2014 RSC Limited (as trustee of the Platinum Stone A 2014 Trust) and Japan Highways International B.V.

The Settlor has set up Cube Highways Trust, which, has acquired 100.00% of the issued and paid-up equity share capital in each of the Project SPVs of the Initial Portfolio Assets (other than Mahua Bharatpur Expressways Limited, in which the Trust has acquired 99.97% of the issued and paid-up equity share capital). These Project SPVs together operate 18 road assets, aggregating to 1,423.6 kilometers, located across 11 states in India.

The Initial Portfolio Assets had a weighted average residual concession life (weighted on the basis of residual life-time pre-MM EBITDA) of 22.10 years as on October 31, 2022 and a weighted average operating history (weighted on the basis of Fiscal

2023 estimated pre-MM EBITDA, assuming COD and appointed date as the beginning date for BOT/DBFOT and TOT assets, respectively) of 8.03 years as on October 31, 2022.

The map below sets forth the location of our projects in the Initial Portfolio Assets:



Factors Affecting Our Results of Operations

Our business, prospects, results of operations and financial condition have been, or are expected to continue to be, affected by a number of factors, including the following:

Fluctuating Revenue from Toll Road Projects

Tariff terms for our BOT and TOT Roads are determined by the relevant government entity at the time of bidding and notified in the official gazette. In accordance with the concession agreements, adjustments to the tariff terms are based on fixed formulas that are linked to inflation indices in a relevant year, which may be positive or negative. However, there are no provisions in our concession agreements protecting us against increases in interest rates or our operating costs. Therefore, the relevant Project SPV's profitability and its ability to meet debt service payments are significantly influenced by traffic volumes and the toll that can be levied on users of the road. Traffic volume may be affected by a number of factors beyond our control, including general economic conditions, alternate routes, alternate means of transportation, location of toll plazas, weather conditions, demographic changes, fuel prices, reduction in commercial or industrial activities in the regions served by the roads and natural disasters. Our lenders may have the right to periodically reset our interest rates, which may increase based on their review of our credit profile and perceived risks in our operations or a change in their cost of funding due to the overall interest rate regime. Even if we invoke the inflation adjustment clauses in some of our concession agreements, the increase may not be adequate to offset the negative impact of increases in interest rates or operating costs.

Under the relevant concession agreements, our Project SPVs have rights to construct and operate the road projects exclusively for fixed periods of time and we receive annuities or collect tolls, as the case may be, for the use of our roads. However, we may be faced with competition from new roads developed by state governments that are in the immediate vicinity of our roads and as such, are not within our control. There can be no assurance that our road projects will compete effectively against such roads that connect the same locations. Any material decrease in the actual traffic volume as compared to our forecasted traffic volume could have a material adverse effect on our cash flows from our tolling projects, which in turn can adversely affect our business, prospects, financial condition and results of operation.

Impact of COVID-19 on Projects

The Project SPVs received directives from NHAI to temporarily suspend tolling on project roads due to COVID-19 during the nationwide lockdown from March 25, 2020 to April 19, 2020. With the gradual opening up of economic activities since the

resumption of tolling on April 20, 2020, traffic on the projects recovered quickly and crossed pre-COVID levels. However, the effects of the second wave of the COVID-19 pandemic had negatively impacted many of our projects temporarily, reduced traffic volume and consequently reduced our revenue for those periods. As a result, the Project SPVs comprising our TOT Roads notified the concessioning authority (i.e., NHAI) of their intention to invoke the force majeure clause under their respective concession agreements, claiming a relief for loss of revenue suffered on account of the lockdown and consequent suspension of toll collection imposed during the second wave. Further, Project SPVs also sought extensions of their respective concession agreements on account of the loss of revenue attributable to the lockdown imposed during the second wave.

Interest Rate Fluctuations

As our infrastructure business is capital intensive, our projects are funded to a large extent by debt, and as a result we are exposed to interest rate risks. Any increase in interest expense may have an adverse effect on our results of operations and financial condition. Our current debt facilities carry interest at variable rates as well as fixed rates with the provision for periodic reset of interest rates. As of October 31, 2022, the majority of our indebtedness was subject to variable interest rates. Considering the capital-intensive nature of the infrastructure business, an increase in interest expense at the Project SPV level is likely to have a significant adverse effect on our financial results.

Strategic expansions through acquisitions including under the Right of First Offer

The Investment Manager intends to develop and expand our Initial Portfolio Assets by capitalizing on opportunities provided by the Sponsors to undertake strategic acquisitions of completed and mature road assets. For details, please see the section entitled "*Business – Business Strategy – Calibrated expansion of the portfolio*" on page 177. Towards this objective, in addition to the Initial Portfolio Assets, the Investment Manager will also have the ability to acquire new projects through (i) a right of first offer with CH-I and CH-III in accordance with the ROFO Agreement and the Valuation Policy; and (ii) through other acquisitions in terms of the Investment Policy, on an arm's length basis. Any acquisitions will have a direct impact on our revenue growth as well as having a corresponding increase in any operating and financial expenses that we will incur. The Investment Manager will also consider potential acquisitions of road projects from third parties other than through the Right of First Offer. Any acquisitions in the future are expected to be financed by incurring additional debt and/or through the issuance of fresh Units, which could affect our cash flows or could lead to dilution of holdings of existing holders that do not maintain their percentage interests upon the issuance of fresh Units.

General economic conditions in India and the level of investment and activity in the infrastructure sector

Other than Andhra Pradesh Expressway Limited, which is an annuity asset, the Project SPVs derive almost all of their revenue from toll-road operations. Demand for toll roads is primarily dependent on sustained economic development in the regions that they operate in and government policies relating to infrastructure business. As a result, our performance and growth are dependent on the performance of the Indian economy, which, in turn, depends on various factors. The Indian economy has been affected by the recent global economic uncertainties, volatility in interest rates, currency exchange rates, commodity and electricity prices, adverse conditions affecting agriculture and various other macroeconomic factors. According to CRISIL, after contracting in the first half of fiscal year ended March 31, 2021 due to the COVID-19 pandemic, the economy rebounded in the second half of the year. The economy is in recovery mode, with GDP expanding 20.1% on-year in the first quarter of fiscal year ended March 31, 2022, 8.4% in the second quarter and 5.4% in the third quarter.

Recent Indian governments have been focused on encouraging private participation in the infrastructure sector. Furthermore, for the fiscal year ended March 31, 2022 NHAI construction was expected to be in the range of 4,300-4,600 kms (12-13 km per day) and to rise steadily to approximately 14-15 km per day by fiscal year 2026. (*Source: CRISIL Report*) However, there can be no assurance that similar policies and investment will be continued in the future. The rate of economic liberalization could decrease, and specific laws and policies affecting foreign investment, currency exchange rates and other matters affecting investment in India could change as well. In the road sector, there can be no assurance that the GoI's engagement with and outreach to private sector operators, including us, will continue in the future. A significant change in India's economic liberalization and deregulation policies, in particular, those relating to the road sector, could disrupt business and economic conditions in India generally and our business in particular. Additionally, an increase in trade deficit or a decline in India's foreign exchange reserves could negatively impact interest rates and liquidity, which could adversely impact the Indian economy and our business.

Dependence on support from governmental schemes and policies

Significant changes in a government policy for the road infrastructure sector could have a significant effect on our revenues, expenditure and growth prospects as they relate to future projects (if any). For instance, in January 2014, the Cabinet Committee on Economic Affairs approved a proposal to facilitate the substitution of concessioners in ongoing and completed national highway projects. As per the proposal, existing concessioners were permitted to completely divest their equity in on-going or completed projects. Both Nelamangala Devihalli Expressway Private Limited and DA Toll Road Private Limited were acquired through this route. The results of operations of future projects are likely to be affected by budgetary allocations made by various central and state government agencies for the infrastructure sector. Furthermore, trends in particular government's approach to

infrastructure such as, slowdowns in the volume of BOT or TOT projects for which concessions are granted, may affect our business, financial condition and results of operations. Policies relating to tolling methodologies, exemptions and changing political or social imperatives can also affect our business.

Operational Enhancement, Maintenance Cost Optimization and Post-Acquisition Capital Structure Optimization

Our profitability is dependent on our ability to undertake efficient operational enhancements, optimize maintenance costs and create robust capital structures for our projects. For example, we use technology, analytics and local community outreach to help ensure best-in-class user experience which drives the willingness to pay by our road users. In addition, we leverage technology and analytics to improve operational compliances while reducing costs. For instance, we have adopted RoadAID, an in-house software developed by us which provides us with real time updates on multiple aspects including routine maintenance and road works management, asset inventory and incidence/accident management. To boost our organization's efficiency, we have integrated SAP technology to help automate repetitive tasks and have also planned the integration of the RoadAID software with SAP technology, which will help disseminate timely information and alerts to the relevant personnel through dashboard notifications and periodic mailers. Furthermore, we also use cameras to track vehicles and authenticate and reconcile e-collections to prevent toll leakage. We also undertake community development and engagement initiatives help forge relationships with local communities. These operational enhancements allow to improve user experiences which may in turn also increase revenue. Any issues in deploying such technologies or a failure to maintain strong relationships with local communities may adversely affect our operations and results of operations.

We seek to use disciplined, prudent and innovative capital structure management to unlock value by reducing cost of debt and maximizing free cash flow. However, the availability of credit and cost of financing in India is also a significant factor, and if there is any adverse development leading to an increase in the cost of financing or decrease in availability of funds from lenders, we may have difficulty accessing the financial markets, which could make it more difficult or expensive to obtain funding.

Competition

We face competition from other road operators, financial investors and other InvITs in acquiring and managing profitable concessions for future projects. The competition for road projects varies depending on the size, nature and complexity of the project and on the geographical region in which the project is to be executed. Some competitors may have greater financial resources, economies of scale and operating efficiencies than us.

Tax benefits for road infrastructure sector in India

Certain Project SPVs are entitled to certain benefits under Section 80-IA of the Income Tax Act, 1961, as amended, if certain conditions are satisfied. However, the benefits to these Project SPVs may expire at various points of time. Any expiry, termination or GoI withdrawal of these tax benefits could result in an increase in the our tax expenses, thereby adversely affecting our results of operations and cash flows.

Purpose and basis of accounting and preparation of special purpose Ind AS financial statements

Our special purpose combined financial statements comprise the Combined Balance Sheet as at October 31, 2022, March 31, 2022, March 31, 2021 and March 31, 2020, the Combined Statement of Profit and Loss (including other comprehensive income), the Combined Statement of Changes in Equity and the Combined Statement of Cash Flows for seven months period ended October 31, 2022, years ended March 31, 2022, March 31, 2021 and March 31, 2020 including a summary of significant accounting policies and other explanatory information ("**Special Purpose Combined Financial Statements**").

Our Special Purpose Combined Financial Statements were authorized for issuance by Investment Manager in their meeting held on January 20, 2023.

The Special Purpose Combined Financial Statements are special purpose financial statements and have been prepared by the Investment Manager to meet the requirements of the InvIT Regulations for inclusion in the Placement Memorandum and this Final Placement Memorandum prepared or to be prepared by the Investment Manager in connection with the proposed private placement of Ordinary Units of the Trust to be listed on the Stock Exchanges in accordance with the requirements of the InvIT Regulations. As a result, the Special Purpose Combined Financial Statements may not be suitable for any other purpose.

In accordance with the requirement of the InvIT Regulations, because the Trust was formed on December 7, 2021 and has been in existence for less than three financial years, and the historic financial statements of the Trust are not available for the entire portion of the reporting period, the Special Purpose Combined Financial Statements have been prepared and disclosed for the periods when such historical combined financial statements were not available. Hence, as required by the InvIT Regulations, the Special Purpose Combined Financial Statements are prepared based on an assumption that the Project SPVs were part of the Trust for the reporting periods when the Trust was not in existence. However, the Special Purpose Combined Financial Statements may not be representative of the position which may prevail after the Project SPVs are transferred to the Trust.

The Special Purpose Combined Financial Statements are presented in Indian rupees, which is also its functional currency and all the values are rounded to nearest millions (INR 000,000), except when otherwise indicated.

Basis of Combination

The Special Purpose Combined Financial Statements have been prepared using uniform accounting policies for transactions and other events in similar circumstances. The financial statements of all the Project SPVs used for the purpose of combination are drawn up to the same reporting date.

The procedures for preparing our Special Purpose Combined Financial Statements are stated below:

- The Special Purpose Combined Financial Statements were combined by combining/adding like items of assets, liabilities, equity, income, expenses and cash flows of the Trust and the Project SPVs for the seven months period ended October 31, 2022 and fiscal years ended March 31, 2022, March 31, 2021, March 31, 2020.
- All intragroup assets and liabilities, equity, income, expenses and cash flows relating to transactions between entities of the Trust and Project SPVs are eliminated in full. Ind AS 12 Income Taxes applies to temporary differences that arise from the elimination of profits and losses resulting from intragroup transaction.

Summary of Significant Accounting Policies

Current and non-current classification

We present assets and liabilities in the special purpose combined balance sheet based on current/non-current classification. An asset is current when:

- It is expected to be realised, or is intended to be sold or consumed, in the normal operating cycle; or
- It is held primarily for the purpose of trading; or
- It is expected to realise the asset within 12 months after the reporting period; or
- The asset is a cash or equivalent unless it is restricted from being exchanged or used to settle a liability for at least twelve months after the reporting period.

All other assets are classified as non-current.

Similarly, a liability is classified as current if:

- It is expected to be settled in the normal operating cycle; or
- It is held primarily for the purpose of trading; or
- It is due to be settled within 12 months after the reporting period; or
- We do not have an unconditional right to defer the settlement of the liability for at least 12 months after the reporting period. Terms of a liability that could result in its settlement by the issue of equity instruments at the option of the counterparty does not affect this classification.

All other liabilities are classified as non-current.

Deferred tax assets and liabilities are classified as non-current assets and liabilities.

Operating Cycle

Based on the nature of our activities and the normal time between acquisitions of assets and their realisation in cash or cash equivalents, we have determined our operating cycle as twelve months for the purposes of classification of our assets and liabilities as current and non-current.

Critical accounting judgements and key sources of estimation uncertainty

The preparation of these Special Purpose Combined Financial Statements in conformity with Ind AS requires the management to make judgements, estimates and assumptions that affect the reported amounts of assets, liabilities, income and expenses, and the accompanying disclosures.

We believe that the estimates used in preparation of the Special Purpose Combined Financial Statements are prudent and reasonable. Actual results could differ due to these estimates and the differences between the actual results and the estimates are recognised in the periods in which the results are known / materialise.

Applicability of service concession arrangement accounting to toll roads concessionaire arrangements

We have determined that Appendix to Ind AS 115 "Revenue from Contracts with Customers" relating to 'Service Concession Arrangements' is applicable to the Project SPVs which provides on accounting by the operators for public to private service concession arrangements. Project SPVs (the "**Concessionaire**") have entered into concession arrangement with NHAI as per which the individual Project SPVs would participate in DBFOT or TOT basis the toll roads infrastructure. After the end of the concession arrangement, the Project SPVs have to transfer the infrastructure i.e. toll roads constructed by the Concessionaire.

Accordingly, the Project SPVs other than Andhra Pradesh Expressway Limited have recognized the intangible assets as per the accounting policy mentioned in Note on Intangible Assets (below).

Andhra Pradesh Expressway Limited has the right to receive fixed annuity payments from NHAI during the concession period and has adopted cash flow financial model. The cash flow financial model indicates the cash flow to be generated over the project lifecycle. The key inputs of the model comprise of revenue inflows (annuity), expenses to incurred to earn the revenue, estimations on cost to build and maintain the asset, interest obligations based on financing pattern and other operational efficiencies. These inputs are based on circumstances existing and management judgement / assumption on the future expectations based on current situations. Judgements include management view on changes in interest rates, cost inflation, government policy changes, etc. which are reviewed periodically by the management.

Future revenue projections for the balance concession period

The revenue projection is based on assumptions made by us regarding future traffic growth and inflation factor for assessing user toll fee as supported by the studies from the third-party independent consultant for individual Project SPV done at reasonable intervals.

We use the future revenue projections for the following purposes:

- Amortisation of Rights under Service Concession Arrangements ("**SCA**") i.e. Intangible Assets - Toll Road Carriageway: Four of the Project SPVs viz. Mahua Bharatpur Expressways Limited, Jaipur Mahua Tollway Limited, Ghaziabad Aligarh Expressways Private Limited and Western UP Tollway Limited recognizes the amortization of intangible assets relating to SCA based on proportion of actual revenue earned for the period over the projected revenue from toll road carriageway expected to be earned over the balance concession period as estimated by us. For other Project SPVs, the intangible assets relating to SCA are being amortised over the estimated useful life (being the concession period). The concession period is specified as per SCA entered by us for the respective Project SPV. However, the same is dependent on the revenue generated during the concession period as per the terms of SCA with NHAI and it may vary based on the estimation. The estimated useful life of Rights under Service Concession Arrangement – Intangible assets and the projected revenue is reviewed at the end of each reporting period, with the effect of any changes in estimate being accounted for on a prospective basis.

- We also use future revenue projections for accounting of the claim/compensation granted by NHAI by way of extension of concession period.

Provision for periodic maintenance (overlay expenses)

We estimate and provide for contractual obligations as per SCA with NHAI to restore the infrastructure to a specified level of serviceability at periodic intervals during the SCA period or before it is handed over to NHAI. These estimates are corroborated through purchase orders/ work orders placed or to be placed by us as per the road survey reports issued by an independent field expert and major maintenance strategy/ methodology approved by the Independent Consultant appointed by NHAI. As the estimated cost is based on the various assumptions such as current infrastructure (road, pavements, etc.) condition, expected timings of costs, inflation in material cost, discount rate, government policies etc. Hence, we are required to apply judgement over these factors for revalidating the provision expenses which is reviewed on annual basis.

Provision for improvement works

Certain Project SPVs estimate and provide for contract liability in respect of unavoidable obligations to improve/upgrade the infrastructure to be undertaken as per the concession agreement with NHAI. These estimates are corroborated through purchase orders/ work orders placed or to be placed by these Project SPVs as per the road survey reports issued by an independent field expert. As the estimated cost is based on the various assumptions such as current infrastructure (road, pavements, etc.) condition, inflation in material cost etc., hence we are required to apply judgement over these factors

Provision for income taxes and deferred tax

Judgements are involved in determining the provision for income taxes including judgement on whether tax positions are probable of being sustained in tax assessments. A tax assessment can involve interpretation issues, which can only be resolved over extended time periods.

Significant management judgement is also required to determine the amount of deferred tax assets that can be recognized, based upon the likely timing and the level of future taxable profits together with future tax planning strategies.

We review the carrying amount of deferred tax assets (net) at the end of each reporting period. We have recognised the deferred tax assets relating to carried forward losses and minimum alternate tax ("**MAT**") credit to the extent there are sufficient taxable temporary differences available against which the unused tax losses can be utilized. Further, deferred tax assets have been recognised to the extent of deferred tax liabilities, in the absence of reasonable certainty that future taxable amounts will be available to utilize temporary differences.

We have not recognised the deferred tax assets and liabilities on deductible temporary differences and tax losses reversing or originating and reversing during tax holiday period under section 80IA of the Income-tax Act, 1961 which has been estimated basis the future projections.

Impairment of financial assets

The impairment provision for financial assets are based on assumptions about risk of default and expected loss rates. We use our judgement in making these assumptions and selecting the inputs to the impairment calculation, based on our history, existing market conditions as well as forward looking estimates at the end of each reporting period.

Impairment of intangible assets - Rights under Service Concession Arrangements

We use the estimated future cash flows in assessing value in use for intangible assets. Future estimated cash flows are discounted to their present value using a pre-tax discount rate that reflects the current market assessments of the time value of money and the risks specific to the asset for which the estimated future cash flows have not been adjusted. The inputs to the valuation models are taken from observable markets where possible, but where this is not feasible, a degree of judgment is required in establishing fair values. Judgments include considerations of inputs such as traffic growth rates, WACC, tax rates, inflation rates, and uncertainties relating to COVID -19.

Accounting of compound financial instrument

Certain of our Project SPVs have issued Unsecured, Optionally Convertible Debentures ("**OCDs**") on private placement basis to various related parties ("**Subscribers**"). The OCD Subscribers have the right to seek premature redemption of the OCDs at face value with any accrued but unpaid interest on the OCDs, at any time prior to the final redemption date subject to the Project SPV having met all the restricted payment conditions under the senior loan agreements. In case where the redemption rights as per terms of the respective agreement are not exercised by the Subscribers, then on the final redemption date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the respective Project SPV as per the conversion terms agreed in the respective agreement.

For the purpose of accounting of interest accrued on OCDs, the respective Project SPV has estimated the future cash flows which is being used for bifurcating the outstanding interest on OCDs into liability and equity components.

During the financial year ended March 31, 2021, DA Toll Road Private Limited and Farakka - Raiganj Highways Limited had issued non-convertible debentures ("**Seller Debentures**") of ₹ 1.00 each fully paid up on private placement by conversion of its subordinate debt/ liabilities. For the purpose of valuation of Seller Debentures on the issue date and on subsequent measurement dates, these Project SPV's have used the estimated redemption dates for each redemption events based on probability of occurring of redemption events, applicable incremental borrowing rate and estimated the specific deductions to be made from tranches in case the redemption event is delayed beyond the dates envisaged in the Share Purchase Agreement for the respective Project SPV.

Useful lives of property, plant, and equipment

We review the useful lives of property, plant and equipment at each reporting date. As at each balance sheet date, we assessed that the useful lives represent the expected utility of the assets to us.

Obligations relating to employee benefits

The employee benefit obligation depends on several factors that are determined on an actuarial basis using several assumptions. The assumptions used in determining the net cost/ (income) include the discount rate, inflation and mortality assumptions. Any changes in these assumptions will impact upon the carrying amount of employee benefit obligations.

Property, plant, and equipment

Property, plant, and equipment are stated at historical cost/ deemed cost (elected in accordance with Ind AS 101, First-time Adoption of Indian Accounting Standards), as applicable, less accumulated depreciation and cumulative impairment losses, if any. Historical cost includes purchase price, borrowing costs and any cost directly attributable to bringing the assets to its working condition for its intended use.

Subsequent costs are included in the asset's carrying amount or recognised as a separate asset, as appropriate, only when it is probable that the future economic benefits associated with the item will flow to the entity and the cost of the item can be measured reliably. Cost includes expenditure that is directly attributable to qualifying assets and includes borrowing costs capitalised in accordance with our accounting policy. Such properties are classified to the appropriate categories of property, plant, and equipment when completed and ready for intended use.

Depreciation on plant and equipment is provided using straight-line method based on estimated useful life. The estimated useful life of all the property, plant and equipment is ascertained by the management using the best estimate on the basis of technical evaluation, which is depreciated based on useful life as prescribed in Schedule II of the Companies Act, 2013. Depreciation on additions/ deductions is calculated pro-rata from/ to the month of additions/ deductions.

The residual values, useful lives and methods of depreciation of property, plant and equipment are reviewed at each period end and adjusted prospectively, if appropriate.

Non-current assets classified as held for sale are measured at the lower of carrying amount and fair value less costs to sell.

Gains or losses arising from derecognition of a property, plant and equipment are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognised in the Special Purpose Combined Statement of Profit and Loss when the asset is derecognised.

Intangible assets

Intangible assets are recognised when it is probable that future economic benefits that are attributable to the asset will flow to us and the cost of the asset can be measured reliably. Intangible assets are stated at original cost net of tax/duty credits availed, if any, or deemed cost less accumulated amortisation, and cumulative impairment, if any.

Intangible Assets are stated at historical cost/deemed cost in certain Project SPVs (elected in accordance with Ind AS 101), as applicable, less accumulated amortisation and cumulative impairment losses, if any.

Rights under Service Concession Arrangements (SCA)

Rights under SCA obtained in consideration for concession fee or development of toll roads under TOT or BOT basis respectively represent the right to collect toll revenue during the concession period. The cost also include corresponding obligations of the Project SPV under the concession agreement entered with NHAI related to construction /improvements of the project highway granted to the Project SPV. Rights under SCA are capitalized as intangible assets upon obtaining the commencement of operation certificate from the authorities at cumulative development costs. The revenue from toll collection/other income during the construction period is reduced from cost of development of intangible assets. Till the completion of the construction, the development costs are recognised under intangible assets under development.

Obligation towards negative grants and the cost incurred for work beyond the original scope per SCA (normally referred as '*Change of Scope*') or upgrade services is capitalized as intangible asset under development as and when incurred. Reimbursement in respect of such amounts from NHAI are reduced from the carrying amount intangible assets under development to the extent of actual receipts. Any grant from NHAI in connection with project development is reduced from the cost of the intangible assets.

Extension of concession period by NHAI in respect of compensation for claims made by the Project SPV are capitalized as part of toll collection rights on acceptance of the claim. Where the Project SPV has a contractual right to an extension in the concession period as per the concession agreement, the same is capitalized when the right to extension in the concession period is established at the estimated amount of eligible claims.

Pre-operative expenses including administrative and other general overhead expenses that are directly attributable to the development or acquisition of intangible assets are allocated and capitalized as part of cost of the intangible assets.

Amortisation of intangible assets (Rights under SCA)

The Rights under SCA in respect of road projects of certain Project SPVs viz. Mahua Bharatpur Expressways Limited, Jaipur Mahua Tollway Limited, Western UP Tollway Limited and Ghaziabad Aligarh Expressway Private Limited are amortized over

the period of concession using the revenue-based amortization method prescribed under Schedule II to the Companies Act, 2013. Under the revenue-based method, amortization is based on proportion of actual revenue earned for the year/ period over the sum of actual revenue for the current year/ period and projected revenue from toll road carriageway expected to be earned over the balance concession period as estimated by the management. Total projected revenue is reviewed at the end of each period end and is adjusted to reflect the changes in earlier estimate vis-a-vis the actual revenue earned till the end of the period so that the whole of the cost of the intangible asset is amortized over the concession period.

For all the other Project SPVs, the rights under SCA are amortised over the shorter of the estimated period of future economic benefits which the intangible assets are expected to generate or the concession period, from the date they are available for use. The estimated useful life is reviewed at the end of each reporting period, with the effect of any changes in estimate being accounted for on a prospective basis.

An asset carried under concession arrangements is derecognised on disposal or when no future economic benefits are expected from its future use or disposal.

Other intangible assets

Historical costs of other intangible assets comprise of cost for software acquired / developed for in-house use. Intangible assets are derecognized when no future economic benefits are expected from use or disposal.

Gains or losses arising from derecognition of an intangible asset are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognized in the Special Purpose Combined Statement of Profit or Loss when the asset is derecognized.

Intangible assets that are not ready for the intended use on the date of the Balance Sheet are disclosed as "*Intangible assets under development*".

Amortization of other intangible assets

Other intangible assets with finite lives are amortised over the useful economic life and assessed for impairment whenever there is an indication that the intangible asset may be impaired. The amortisation period and the amortisation method for an intangible asset with a finite useful life are reviewed at least at the end of each reporting period. Changes in the expected useful life or the expected pattern of consumption of future economic benefits embodied in the asset are considered to modify the amortisation period or method, as appropriate, and are treated as changes in accounting estimates. The amortisation expense on intangible assets with finite lives is recognised in the Special Purpose Combined Statement of Profit and Loss unless such expenditure forms part of carrying value of another asset.

Foreign currency translations and translations

The Special Purpose Combined Financial Statements are presented in Indian Rupee (INR), which is our functional and presentational currency. Foreign currency transactions are recorded at the exchange rate prevailing on the date of the respective transactions between the functional currency and the foreign currency.

Monetary items

Monetary foreign currency assets and liabilities remaining unsettled at the Balance Sheet date are translated at the rates of exchange prevailing on that date. Gains / losses arising on account of realisation / settlement of foreign currency transactions and on translation of foreign currency assets and liabilities are recognized in the Special Purpose Combined Statement of Profit and Loss.

Exchange differences arising on the settlement of monetary items or on reporting date's monetary items at rates different from those at which they were initially recorded during the period, or reported in previous financial statements, are recognized as income or as expenses in the period in which they arise.

Non-monetary items

Non–monetary items which are carried in terms of historical cost denominated in a foreign currency are reported using the exchange rate at the date of the transaction; and non–monetary items which are carried at fair value or other similar valuation denominated in a foreign currency, are reported using the exchange rates that existed when the values were determined.

The gain or loss arising on translation of non-monetary items measured at fair value is treated in line with the recognition of the gain or loss on the change in fair value of the item (i.e., translation differences on items whose fair value gain or loss is recognised in other comprehensive income ("**OCI**") or profit or loss are also recognised in OCI or profit or loss, respectively).

Revenue recognition

Revenue is measured based on fair value of consideration received or receivable and excludes amounts collected on behalf of third parties. A performance obligation is a promise in a contract to transfer a distinct good or service (or a bundle of goods and services) to the customer and is the unit of account in Ind AS 115. A contract's transaction price is allocated to each distinct performance obligation based on their relative stand-alone selling prices.

Revenue is recognized to the extent that it is probable that the economic benefits will flow to us and the revenue can be reliably measured, regardless of when the payment is being made.

Revenue is recognized either at a point in time or over time, when (or as) we satisfy performance obligations by transferring the promised goods or services to our customers.

Service concession arrangements - recognition and measurement

We build, operate and maintain roads and other infrastructure assets under public-to-private SCA, which is an arrangement between the "grantor" (a public sector entity/authority) and the "operator" (a private sector entity/ the concessionaire) to provide services that give the public access to major economic and social facilities utilizing private-sector funds and expertise. More specifically, in applies to public to private service concession arrangement if the grantor:

- Controls or regulates what services the operators must provide with the infrastructure, to whom it must provide them, and at what price, and
- Controls through ownership /principal entitlement or otherwise -any significant residual interest in the infrastructure at the end of the term of the arrangement.

We through individual Project SPVs have entered into a concession arrangement to build, operate and maintain the roads and other infrastructure assets.

Under SCA, there are two types of models on which the SPV's operates:

1) Where the Project SPV has a right to receive toll revenue in lieu of its services agreed, it falls under '*Intangible asset model*'. Under this model, on initial recognition, an intangible asset is recognised, based on the construction/ acquisition costs incurred including related borrowing costs and expected margin earned in case of construction or upgrade services and replacement services.

2) Where the Project SPV has acquired contractual rights to receive specified determinable amounts, it falls under '*Financial assets model*'. Under this model, such rights are recognised and classified as "*Financial Assets*", even though payments are contingent on the Project SPV ensuring that the infrastructure meets the specified quality and efficiency requirements. Such financials assets are classified as "*Receivables against Service Concession Arrangements*".

With respect to SCA, revenue and costs are allocated between those relating to construction services and those relating to operation and maintenance services are accounted for separately. Consideration received or receivable is allocated by reference to the relative fair value of services delivered when the amounts are separately identifiable. For operation and maintenance services, such costs are executory in nature and are expensed off as and when incurred.

Revenue recognition for service concession arrangements

Our revenue is divided into following categories:

1. Once the infrastructure is in operation, the treatment of income is as follows:

   Under financial asset model, finance income for SCA is recognized using effective interest method. Revenues from operations and maintenance services and overlay services are recognized in each period as and when services are rendered in accordance with Ind AS 115.

   Under BOT and TOT model, toll collections from the users of the infrastructure facility constructed or operated or maintained by us under the SCAs are accounted for based on actual collection.

2. Revenue from construction contracts

   Contract revenue for fixed price contracts is recognized only to the extent of cost incurred that it is probable will be recoverable till such time the outcome of the job cannot be ascertained reliably. When the outcome of the contract is

ascertained reliably, contract revenue is recognized at cost of work performed on the contract plus proportionate margin, using the percentage of completion method.

Percentage of completion is determined based on the proportion of actual cost incurred to the total estimated cost of the project. The percentage of completion method is applied on a cumulative basis in each accounting period to the current estimates of contract revenue and contract costs. The effect of a change in the estimate of contract revenue or contract costs, or the effect of a change in the estimate of the outcome of a contract, is accounted for as a change in accounting estimate and the effect of which are recognized in the Special Purpose Combined Statement of Profit and Loss in the period in which the change is made and in subsequent periods.

For the purposes of recognising revenue, contract revenue comprises the initial amount of revenue agreed in the contract, the variations in contract work, claims and incentive payments to the extent that it is probable that they will result in revenue and they are capable of being reliably measured.

When it is probable that total contract costs will exceed total contract revenue, the expected loss is recognized as an expense in the Special Purpose Combined Statement of Profit and Loss in the period in which such probability occurs.

Interest income

Interest income from a financial asset is recognized when it is probable that the economic benefits will flow to us and the amount of income can be measured reliably. Interest is accrued on time proportion basis, by reference to the principal outstanding at the effective interest rate.

Dividends

Income from dividend on investments is accrued in the period in which it is declared, whereby our right to receive is established.

Government grants

Grants from governments are recognized at fair value where there is reasonable assurance that the we will comply with the conditions attaching to them and that the grants will be received. Government grants related to income are deferred and recognized in profit or loss over the periods in which we recognize as expenses the related costs for which the grants are intended to compensate.

Government grants whose primary condition is that we should purchase, construct, or otherwise acquire non-current assets are deducted from the carrying amount of such non-current assets.

Financial instruments

Financial assets and financial liabilities are recognized when we become a party to the contractual provisions of the instruments.

Financial assets and financial liabilities are initially measured at fair value. Transaction costs that are directly attributable to the acquisition or issue of financial assets and financial liabilities are added to or deducted from the fair value of the financial assets or financial liabilities, as appropriate, on initial recognition. However, transaction costs directly attributable to the acquisition of financial assets or financial liabilities at fair value through profit or loss ("**FVTPL**") are recognized immediately in the Special Purpose Combined Statement of Profit and Loss.

If we determine that the fair value at initial recognition differs from the transaction price, we account for that instrument at that date as follows:

- at the measurement basis mentioned above if that fair value is evidenced by a quoted price in an active market for an identical asset or liability (i.e. a Level 1 input) or based on a valuation technique that uses only data from observable markets. We recognise the difference between the fair value at initial recognition and the transaction price as a gain or loss.
- in all other cases, at the measurement basis mentioned above, adjusted to defer the difference between the fair value at initial recognition and the transaction price. After initial recognition, we recognise that deferred difference as a gain or loss only to the extent that it arises from a change in a factor (including time) that market participants would take into account when pricing the asset or liability.

Subsequent measurement of financial assets and financial liabilities is described below.

Financial assets

All regular way purchases or sales of financial assets are recognized and derecognized on a trade date basis. Regular way purchases or sales are purchases or sales of financial assets that require delivery of assets within the time frame established by regulation or convention in the marketplace. All recognized financial assets are subsequently measured in their entirety at either amortised cost or fair value, depending on the classification of the financial assets.

Classification of Financial Assets

Investments in debt instruments that meet the following conditions are subsequently measured at amortised cost (unless the same are designated as FVTPL:

- The asset is held within a business model whose objective is to hold assets in order to collect contractual cash flows; and
- The contractual terms of instrument give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.
- Debt instruments that meet the following conditions are subsequently measured at fair value through other comprehensive income (unless the same are designated as fair value through profit or loss)
- The asset is held within a business model whose objective is achieved both by collecting contractual cash flows and selling financial assets; and
- The contractual terms of instrument give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

Debt instruments at FVTPL is a residual category for debt instruments and all changes are recognized in profit or loss.

Amortized cost and effective interest method

Income is recognized on an effective interest method as per Ind AS 109 "Financial Instruments" for debt instruments other than those financial assets classified as at FVTPL. Interest income is recognized in the Special Purpose Combined Statement of Profit and Loss and is included in the "Other income" line item.

Impairment of financial assets (Expected credit loss model)

An impairment loss on financial asset is established when there is objective evidence that we will not be able to collect all amounts due according to the original terms of the receivables. Impairment loss if any are recognised in Special Purpose Combined Statement of Profit or Loss for the period.

De-recognition of financial assets

We derecognize a financial asset when the contractual rights to the cash flows from the asset expire, or when it transfers the financial asset and substantially all the risks and rewards of ownership of the asset to another party. On de-recognition of a financial asset in its entirety, the difference between the asset's carrying amount and the sum of the consideration received and receivable and the cumulative gain or loss that had been recognized in other comprehensive income and accumulated in equity is recognized in profit or loss if such gain or loss would have otherwise been recognized in the Special Purpose Combined Statement of Profit or Loss on disposal of that financial asset.

Financial Liabilities

Financial liabilities are classified at initial recognition, as financial liabilities as fair value through profit or loss, loans and borrowings, payables, or as derivatives designated as hedging instruments in an effective hedge, as appropriate. All financial liabilities are recognized initially at fair value and, in the case of loans and borrowings and payables, net of directly attributable transaction costs.

Loans and borrowings are subsequently measured at amortized costs using Effective Interest Rate method.

Financial liabilities at FVTPL are subsequently measured at fair value. Financial guarantee contracts are subsequently measured at the higher of the amount of loss allowance determined as per impairment requirements of Ind AS 109 and the amount recognized less cumulative amortization.

De-recognition of financial liabilities

Financial liability is derecognized when the obligation under the liability is discharged or cancelled or expires. When an existing financial liability is replaced by another from the same lender on substantially different terms, or the terms of an existing liability substantially modified, such an exchange or modification is treated as the de-recognition of the original liability and the recognition of the new liability. The difference in the respective carried amount is recognized in the Special Purpose Combined Statement of Profit and Loss.

Classification as debt or equity

Debt and equity instruments issued by us are classified as either financial liabilities or as equity in accordance with the substance of the contractual arrangements and the definitions of a financial liability and an equity instrument.

Derivative financial instruments

We hold foreign exchange forward contracts to mitigate the risk of changes in exchange rates on foreign currency exposures. The counterparty for these contracts is generally a bank.

Derivatives not designated as hedging instruments

This category has derivative financial assets or liabilities which are not designated as hedges. Any derivative that is not designated a hedge is categorized as a financial asset or financial liability, at fair value through profit or loss. Derivatives not designated as hedges are recognized initially at fair value and attributable transaction costs are recognized in in the Special Purpose Combined Statement of Profit and Loss when incurred. Subsequent to initial recognition, these derivatives are measured at fair value through profit or loss and the resulting exchange gains or losses are included in other income. Assets/liabilities in this category are presented as current assets/current liabilities if they are either held for trading or are expected to be realized within 12 months after the balance sheet date.

Derecognition of financial instruments

We derecognize a financial asset when the contractual rights to the cash flows from the financial asset expire or it transfers the financial asset and transfer qualifies for derecognition under Ind AS 109. A financial liability (or a part of a financial liability) is derecognized from our balance sheet when the obligation specified in the contract is discharged or cancelled or expires.

Fair value

Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date, regardless of whether that price is directly observable or estimated using another valuation technique. In estimating the fair value of an asset or a liability, we consider the characteristics of the asset or liability if market participants would take those characteristics into account when pricing the asset or liability at the measurement date. Fair value for measurement and/or disclosure purposes in these financial statements is determined on such a basis and measurements that have some similarities to fair value but are not fair value, such as net realisable value in Ind AS 2 “Inventory” or value in use in Ind AS 36 “Impairment of Assets”.

In addition, for financial reporting purposes, fair value measurements are categorized into Level 1, 2 or 3 based on the degree to which the inputs to the fair value measurements are observable and the significance of the inputs to the fair value measurement in its entirety, which are described as follows:

- Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities that entity can access at measurement date
- Level 2 inputs other than quoted prices included in Level 1, that are observable for the asset or liability, either directly (as prices) or indirectly (derived from prices); and
- Level 3 inputs for the asset or liability that are not based on observable market data (unobservable inputs).

Cash and cash equivalents

Cash and cash equivalents in the special purpose combined balance sheet comprise cash at banks and on hand and short-term deposits with an original maturity of three months or less and which are subject to an insignificant risk of changes in value. For purpose of Special Purpose Combined Statement of Cash Flows, cash and cash equivalents consist of cash and short-term deposits, as defined above, net of outstanding bank overdrafts as they are considered an integral part of our cash management.

Special Purpose Combined Statement of cash flows

Special Purpose Combined Statement of cash flows is prepared segregating the cash flows from operating, investing and financing activities. Cash flows from operating activities is reported using indirect method. Under the indirect method, the net profit/(loss) is adjusted for the effects of:

- transactions of a non-cash nature;
- any deferrals or accruals of past or future operating cash receipts or payments and,
- all other items of income or expense associated with investing or financing cash flows.

Our cash flows from operating, investing and financing activities are segregated based on the available information. Cash and cash equivalents are reflected as such in the Special Purpose Combined Statement of Cash Flow. Those cash and cash equivalents which are not available for general use as on the date of Special Purpose Combined Balance Sheet are also included under this category with a specific disclosure.

Investment property

Property that is held for long-term rental yields or for capital appreciation (including property under construction for such purposes) or both and that is not occupied by us, is classified as investment property. Investment property are measured initially at cost, including related transaction costs and where applicable borrowing costs. Subsequent expenditure is capitalized to the assets carrying amount only when it is probable that future economic benefits associated with the expenditure will flow to us and the cost of the item can be measured reliably.

An investment property is derecognized upon disposal or when the investment property is permanently withdrawn from use and no future economic benefits are expected from the disposal. Any gain or loss arising on derecognition of the property (calculated as the difference between the net disposal proceeds and the carrying amount of the asset) is included in profit or loss in the period in which the property is derecognized.

Borrowings

Borrowings are initially recognized at fair value, net of transaction costs incurred. Borrowings are subsequently measured at amortized cost. Any difference between the proceeds (net of transaction costs) and the redemption amount is recognized in profit or loss over the period of the borrowings using effective interest method. Fees paid on the establishment of loan facilities are recognized at transaction costs of the loan to the extent that it is probable that some or all the facility will be drawn down. In this case, the fee is deferred until the draw-down occurs. To the extent there is no evidence that it is probable that some or all the facility will be drawn down, the fee is capitalized as prepayment for liquidity services and amortized over the period of the facility to which it relates.

The fair value of the liability portion of the optionally convertible debentures is determined by discounting the projected future cash flows of the principal and interest component at coupon rate. The amount is recorded as a liability on an amortized cost basis until extinguished on conversion or redemption of debentures. The reminder of the proceeds is attributable to the equity portion of the compound instrument. This is recognized and included in shareholders' equity, net of income tax effects, and not subsequently remeasured.

Borrowings are removed from the balance sheet when the obligation specified in the contract is discharged, cancelled or expired. The difference between the carrying amount of a financial liability that has been extinguished or transferred to another party and the consideration paid, including any non-cash assets transferred or liabilities assumed, is recognized in profit or loss as other gains/(losses).

Where the terms of the financial liability are renegotiated and the entity issues equity instruments to a creditor to extinguish all or part of the liability (debt for equity swap), a gain or loss is recognized in profit or loss, which is measured as the difference between the carrying amount of financial liability and the fair value of equity instruments issued.

Borrowings are classified as current liabilities unless we have an unconditional right to defer settlement of the liability for at least 12 months after the reporting period. Where there is breach of a material provision of a long-term loan arrangement on or before the end of the reporting period with the effect that the liability becomes payable on demand on the reporting date, the entity does not classify the liability as current, if lender agreed, after the reporting period and before the approval of the financial statements for issue, not to demand payment as a consequence of the breach.

Borrowing costs

Borrowing costs include interest calculated using the effective interest method, amortization of ancillary costs and other costs we incur in connection with the borrowing of funds. General and specific borrowing costs that are directly attributable to the acquisition, construction or production of a qualifying assets are capitalized during the period of time that is required to complete and prepare the qualifying asset for its intended use or sale. Capitalization of borrowing costs is suspended and charged to the Special Purpose Combined Statement of Profit and Loss during extended periods when active development activity on the qualifying assets is interrupted.

Income earned on the temporary investment of specific borrowings pending their expenditure on qualifying asset is deducted from the borrowing costs eligible for capitalization. Other borrowing costs are expensed in the period in which they are incurred.

Employee Benefits

Employee benefits includes provident fund, gratuity and compensated absences.

Short-term Employee Benefit

All employee benefits falling due wholly within 12 months of rendering the service are classified as short-term employee benefits. The benefits like salaries, wages, short-term compensated absences and the expected cost of bonus, and ex-gratia are recognised in the period the related service is rendered at undiscounted amount of benefits expected to be paid in exchange for that service.

The cost of short-term compensated absences is accounted as under:

- in case of accumulated compensated absences, when employees render the services that increase their entitlement of future compensated absences; and
- in case of non-accumulating compensated absences, when the absences occur.

Post-employment benefits

Defined contribution plans

We offer our employees state governed provident fund linked with employee pension scheme as defined contribution plans. The contribution paid/ payable under the scheme is recognised during the period in which the employee renders the related service.

Defined benefit plans

The Project SPVs operates an unfunded defined benefit gratuity plan other than two of the Project SPVs viz. DA Toll Road Private Limited and Western UP Tollway Limited, that make contributions to a separately administered fund through annual contributions to Life Insurance Corporation of India under its Employee Gratuity Scheme. Our liability towards gratuity is determined at each period end.

For defined benefit gratuity plans, the cost of providing benefits is determined using the projected unit credit method, with actuarial valuations being carried out at the end of each annual reporting period. Re-measurement, comprising actuarial gains and losses, the effect of the changes to the asset ceiling (if applicable) and the return on plan assets (excluding net interest), is reflected immediately in the balance sheet with a charge or credit recognized in other comprehensive income in the period in which they occur. Re-measurement recognised in other comprehensive income is reflected immediately in retained earnings and will not be reclassified to profit or loss. Past service costs are recognised in profit or loss on the earlier of the date of the plan amendment or curtailment, and the date that we recognise related restructuring costs.

Net interest is calculated by applying the discount rate at the beginning of the period to the net defined benefit liability or asset.

Defined benefit costs are categorized as follows:

- service cost (including current service cost, past service cost, as well as gains and losses on curtailments);
- net interest expense or income; and
- re-measurement.

We present the first two components of defined benefit costs in Special Purpose Combined Statement of Profit and Loss in the line item *'Employee benefits expense'*. Curtailment gains and losses are accounted for as past service costs. The present value of the defined benefit liability is calculated using a discount rate which is determined by reference to market yields at the end of the reporting period on government bonds.

Other long-term employee benefit

The obligation for other long-term employee benefits such as long-term compensated absences, are measured at the present value of the estimated future cash outflows expected to be made by us in respect of services provided by employees up to the reporting date.

Inventories

Inventories are stated at the lower of cost and net realisable value. Cost of inventories include all costs incurred in bringing the inventories to their present location and condition. Costs are assigned to individual items of inventory based on first-in-first-out basis. Cost of purchased inventory are determined after deducting rebates and discounts. Net realisable value is the estimated selling price in the ordinary course of business less the estimated cost of completion and the estimated costs necessary to make the sales.

Insurance claims

Insurance claims are accounted for based on claims admitted / expected to be admitted and to the extent that the amount recoverable can be measured reliably and it is reasonable to expect ultimate collection.

Leases

Our lease asset classes primarily consist of leases for land and buildings. We assess whether a contract contains a lease, at inception of a contract. A contract is, or contains, a lease if the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration. To assess whether a contract conveys the right to control the use of an identified asset, we assess whether: (i) the contract involves the use of an identified asset (ii) we have substantially all of the economic benefits from use of the asset through the period of the lease and (iii) we have the right to direct the use of the asset.

At the date of commencement of the lease, we recognize a right-of-use asset ("**ROU**") and a corresponding lease liability for all lease arrangements in which it is a lessee, except for leases with a term of 12 months or less (short-term leases) and low value leases, which are accounted for as under.

Short-term leases and leases of low-value assets

Short term leases are leases with a term of twelve months or less. For short-term and low value leases, we recognise the lease payments as an operating expense on a straight-line basis over the term of the lease.

Currently, we have lease contracts which are short term leases or leases of low-value assets.

Provisions, contingent liabilities and contingent assets

Provisions are recognized when we have a present obligation (legal or constructive) as a result of a past event, it is probable that we will be required to settle the obligation, and a reliable estimate can be made of the amount of the obligation.

When some or all of the economic benefits required to settle a provision are expected to be recovered from a third party, a receivable is recognised as an asset if it is virtually certain that the reimbursement will be received and the amount of the receivable can be measured reliably.

Contingent liabilities are disclosed in notes in case of a present obligation arising from past events, when it is not probable that an outflow of resources will be required to settle the obligation or a present obligation arising from past events, when no reliable estimate is possible.

A contingent asset is a possible asset that arises from past events and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity. Contingent assets are not recognized but disclosed only when an inflow of economic benefits is probable.

Segment reporting

We identify primary segments based on the dominant source, nature of risks and returns and the internal organization and management structure. The operating segments are the segments for which separate financial information is available and for which operating profit / loss amounts are evaluated regularly by the chief operating decision maker in deciding how to allocate resources and in assessing performance. Operating segments are reported in a manner consistent with the internal reporting provided to the chief operating decision maker. Segment revenue, segment expenses, segment assets and segment liabilities have been identified to segments based on their relationship to the operating activities of the segment. The identification of operating segments and reporting of amounts is consistent with performance assessment and resource allocation by the management.

Inter-segment revenue is accounted based on transactions which are primarily determined based on market / fair value factors. Revenue, expenses, assets and liabilities which relate to us as a whole and are not allocable to segments on reasonable basis have been included under '*unallocated revenue / expenses / assets / liabilities'.*

Taxation

Income tax

The income tax expense or credit for the year/ period is the tax payable on current year's/ period's taxable income based on the applicable income tax rate adjusted by changes in deferred tax assets and liabilities attributable to temporary differences and to unused tax losses. The current income tax charge is calculated based on tax laws enacted or substantively enacted at the end of the reporting period. Management periodically evaluates, positions taken in tax returns with respect to situations in which

applicable tax regulation is subject to interpretation and provisions are established where appropriate based on amounts expected to be paid to the tax authorities.

Current tax items are recognized in correlation to the underlying transaction either in OCI or directly in equity. Our management periodically evaluates positions taken in the tax returns with respect to situations in which applicable tax regulations are subject to interpretation and establishes provisions where appropriate.

Deferred Tax

Deferred tax is recognised on temporary differences, being the differences between the tax bases of assets and liabilities and their carrying amount in the financial statements. Deferred tax is measured using the tax rates and the tax laws enacted or substantively enacted as at the reporting date. Deferred tax liabilities are recognised for all temporary differences. Deferred tax assets are recognised for temporary differences of items other than unabsorbed depreciation and carry forward losses only to the extent that reasonable certainty exists that sufficient future taxable income will be available against which these can be realized. However, if there are unabsorbed depreciation and carry forward of losses and items relating to capital losses, deferred tax assets are recognised only if there is reasonable certainty supported by convincing evidence that there will be sufficient future taxable income available to realize the deferred tax assets. Deferred tax assets and liabilities are offset if such items relate to taxes on income levied by the same governing tax laws and the entity has a legally enforceable right for such set off. Deferred tax assets are reviewed at each reporting date for their realisability.

Minimum Alternate Tax ("**MAT**") paid in accordance with the tax laws, which gives future economic benefits in the form of adjustment to future income tax liability, is considered as an asset if there is convincing evidence that the entity will pay normal income tax. Accordingly, MAT is recognised as a deferred tax asset in the Special Purpose Combined Balance Sheet when it is highly probable that future economic benefit associated with it will flow to us.

We offset deferred tax assets and deferred tax liabilities, and advance income tax and provision for tax, if it has a legally enforceable right and these relate to taxes in income levies by the same governing taxation laws.

Current and deferred tax relating to items directly recognised in other comprehensive income and reserves are recognised in other comprehensive income and reserves respectively and not in the Special Purpose Combined Statement of Profit and Loss.

Impairment of non-financial assets

The carrying values of assets / cash generating units at each reporting date are reviewed for impairment if any indication of impairment exists. The following intangible assets are tested for impairment each period end even if there is no indication that the asset is impaired:

- an intangible asset that is not yet available for use; and
- an intangible asset that is amortized over a period exceeding ten years from the date when the asset is available for use.

If the carrying amount of the assets exceed the estimated recoverable amount, an impairment is recognized for such excess amount. The impairment loss is recognized as an expense in the Special Purpose Combined Statement of Profit and Loss.

The recoverable amount is the higher of the fair value less costs of disposal and its value in use. In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects the current market assessments of the time value of money and the risks specific to the asset for which the estimated future cash flows have not been adjusted.

When there is indication that an impairment loss recognized for an asset (other than a revalued asset) in earlier accounting periods no longer exists or may have decreased, such reversal of impairment loss is recognized in the Special Purpose Combined Statement of Profit and Loss, to the extent the amount was previously charged to the Special Purpose Combined Statement of Profit and Loss.

Provision for periodic maintenance / resurfacing obligations

We estimate and provide for contractual obligations as per SCA with NHAI to restore the infrastructure to a specified level of serviceability at periodic intervals or restore the infrastructure to a specified condition before it is handed over to NHAI. Provisions are measured based on our management's estimate required to settle the obligation at the balance sheet date and are discounted using a rate that reflects the time value of money. When discounting is used, the increase in the provision due to the passage of time is recognized as a finance cost. The same is reviewed at each balance sheet date and adjustments if any to the carrying amount is provided for accordingly.

Earnings before Interest, Tax, Depreciation, Amortization, Impairment and Exceptional Items

Earnings before Interest, Tax, Depreciation and Amortization and Exceptional Items disclosed in the Special Purpose Combined Statement of Profit and Loss is computed as under:

Total income less our expenses other than finance costs, tax expenses, depreciation and amortization and exceptional items as appearing in the Special Purpose Combined Statement of Profit and Loss.

Earnings per Unit

Basic earnings per unit are calculated by dividing the net profit / (loss) for the period attributable to unit holders of the Trust by the weighted average number of units outstanding during the period.

For the purpose of calculating diluted earnings per unit, the profit or loss for the period attributable to unit holders of the Trust and the weighted average number of units outstanding during the period are adjusted for the effects of all dilutive potential units.

Dilutive potential units are deemed converted as of the beginning of the reporting date, unless they have been issued at a later date. In computing diluted earnings per unit, only potential equity units that are dilutive and which either reduces earnings per unit or increase loss per units are included.

Statement of net assets at fair value

The disclosure of Statement of Net Assets at Fair Value comprises of the fair values of the total assets and fair values of the total liabilities of individual Project SPV. The fair value of the assets are reviewed regularly by us with reference to independent assets and market conditions existing at the reporting date, using generally accepted market practices. The independent valuers are leading independent appraisers with a recognized and relevant professional qualification and with recent experience in the location. Judgment is also applied in determining the extent and frequency of independent appraisals. Such independent appraisals and the assumptions used are reviewed at each balance sheet date.

Statement of Total Returns at Fair Value

The disclosure of total returns at fair value comprises of the total Comprehensive Income as per the Special Purpose Combined Statement of Profit and Loss and other changes in fair value of investment property, investment property under construction and borrowings where the cost model is followed which were not recognized in total Comprehensive Income.

Principal Components of Combined Statement of Profit and Loss

Income

Our total income consists of revenue from operations and other income.

Revenue from operations

Revenue from operations primarily comprises revenue from toll fee collections, construction income and operations and maintenance income.

- ***Revenue from toll fee collections***: Toll fee collections consist of income arising out of toll collection and is the income derived from the tolling operations by the Project SPVs. This includes toll revenue collected by Project SPVs as per the respective concession agreements in respect of different categories of vehicles using the BOT and TOT Roads.

- ***Finance income***: Finance income consists of interest income on financial assets which is created in accordance with Ind AS by adopting financial asset model for future annuity receivables from the Concessioning Authorities.

- ***Operation and maintenance income***: Operation and maintenance income represents the income accrued on the operation and maintenance expenses incurred along with a markup under the annuity model. Revenues from operations and maintenance services are recognized in each period as and when services are rendered in accordance with Ind AS 115.

- ***Revenue from change of scope***: Revenue from change of scope represents cost incurred for additional work which is not mentioned in scope of the concession agreements. The execution for such work is outsourced by the Project SPVs to third parties.

- ***Construction Income***: This income represents cost of work performed on the contract and the proportionate margin, using the percentage of completion method.

- ***Renewals and overlay income:*** This income represents the income accrued on the overlay expenses incurred along with a markup under annuity model. Revenue from overlay services are recognized in each period as and when services are rendered in accordance with Ind AS 115.

- ***Claims for compensation/ concession extension with NHAI***: This income represents claims for compensation sought from NHAI by way of extension of concession agreement by certain number of days based on the losses incurred on account of suspension or less toll collection fee at toll plazas due to lockdowns imposed by the GoI as a remedial measure to COVID-19.

Other income

Other income primarily consists of interest on bank deposits and net gain on sale of mutual funds.

Expenses

Our expenses consist of construction cost, operation and maintenance expenses, employee benefits expense, finance costs, depreciation and amortization expense and other expenses.

- ***Cost of Construction:*** Cost of construction primarily comprises cost of construction, subcontractor charges (utility), change in scope expenses, independent engineer fees and operation and maintenance charges.

- ***Operation and maintenance expense:*** Operation and maintenance expenses primarily comprise of toll operation expenses, repair and maintenance of carriageway, insurance expenses and periodic major maintenance expenses.

- ***Employee benefits expense:*** Employee benefits expenses primarily comprise salaries, wages and bonus, contribution towards provident fund and staff welfare expense.

- ***Finance costs:*** Finance costs primarily comprise interest on borrowings, interest on other financial liability and other borrowing costs.

- ***Depreciation and amortization expenses:*** Depreciation and amortization expenses include depreciation on tangible assets and amortization of intangible assets.

- ***Other expenses:*** Other expenses primarily comprise management service charges, legal and professional charges and royalty expenses.

Results of Operations

The following table shows the results of our operations for the periods indicated:

	For the fiscal year ended March 31,			For the seven months period ended
	2020	2021	2022	October 31, 2022
		(in ₹ million)		
Income				
Revenue from operations	13,270.92	16,285.19	20,550.40	14,180.96
Other income	622.26	513.40	1,021.91	378.36
Total income	**13,893.18**	**16,798.59**	**21,572.31**	**14,559.32**
Expenses				
Cost of construction	1,073.05	2,308.40	1,387.77	799.02
Operation and maintenance expenses	3,532.06	3,799.46	8,404.82	2,477.52
Employee benefits expense	211.32	210.65	306.41	191.86
Other expenses	351.11	1,015.11	1,298.28	629.94
Total expenses	**5,167.54**	**7,333.62**	**11,397.28**	**4,098.34**
Earning before finance costs, depreciation, amortization, impairment, exceptional item and tax	**8,725.64**	**9,464.97**	**10,175.03**	**10,460.98**
Finance costs	6,837.75	10,417.46	13,940.24	7,934.11
Depreciation and amortisation expense	3,255.73	3,778.03	5,492.71	3,535.41

	For the fiscal year ended March 31,			For the seven months period ended
	2020	2021	2022	October 31, 2022
		(in ₹ million)		
Impairment charge / (reversal) of impairment of intangible assets	156.09	167.40	(268.67)	-
Loss before exceptional items and tax	**(1,523.93)**	**(4,897.92)**	**(8,989.25)**	**(1,008.54)**
Exceptional items				
Claims receivable on NHAI settlement	-	3,243.74	-	-
Loss before tax	**(1,523.93)**	**(1,654.18)**	**(8,989.25)**	**(1,008.54)**
Less: Tax expense				
Current tax	44.52	1,122.94	85.67	93.85
Deferred tax	(231.58)	(367.76)	(823.25)	(534.62)
Total tax expense	**(187.06)**	**755.18**	**(737.58)**	**(440.77)**
Net Profit/(Loss) for the period/ year	**(1,336.87)**	**(2,409.36)**	**(8,251.67)**	**(567.77)**
Other comprehensive income				
Items that will not be reclassified to profit or loss				
Re-measurement (losses) / gains on defined benefit obligations	(7.47)	18.94	(1.59)	(2.87)
Income tax relating to these items	1.95	(4.65)	0.32	0.75
Total other comprehensive (loss)/income for the period/ year	**(5.52)**	**14.29**	**(1.27)**	**(2.12)**
Total comprehensive Profit/(Loss) for the period/ year	**(1,342.39)**	**(2,395.07)**	**(8,252.94)**	**(569.89)**

Results of Operations for the seven months period ended October 31, 2022

Income

Total income for the seven months period ended October 31, 2022 was ₹ 14,559.32 million, which primarily consists of revenue from operations amounting to ₹ 14,180.96 million.

Revenue from operations

Revenue from operations for the seven months period ended October 31, 2022 was ₹ 14,180.96 million, which was primarily attributable to revenue from toll fee collections of ₹ 13,103.69 million. Of the ₹ 13,103.69 million, ₹ 2,942.65 million was from DA Toll Road Private Limited, ₹ 1,443.23 million was from Ghaziabad Aligarh Expressways Private Limited and ₹ 1,284.34 million was from Farakka - Raiganj Highways Limited.

Other Income

Other income for the seven months period ended October 31, 2022 was ₹ 378.36 million. Oher income was 2.60% of our total income for the seven months ended October 31, 2022.

Expenses

Total expenses for the seven months period ended October 31, 2022 was ₹ 15,567.86 million, the break up of which is provided below.

Construction Cost

Construction cost for the seven months period ended October 31, 2022 was ₹ 799.02 million. This was primarily due to completion of construction work for DA Toll Road Private Limited and construction of six-laning of Ghaziabad-Aligarh section of NH-91 for Ghaziabad Aligarh Expressway Private Limited.

Operation and maintenance expense

Operation and maintenance expenses for the seven months period ended October 31, 2022 was ₹ 2,477.52 million which primarily consists of repair and maintenance of carriageway of ₹ 1,018.57 million and toll operation expenses of ₹ 522.07 million and periodic major maintenance of ₹ 471.93 million.

Employee benefits expense

Employee benefits expense for the seven months period ended October 31, 2022 was ₹ 191.86 million, which primarily consists of salaries and wages of ₹ 168.09 million.

Other expenses

Other expenses for the seven months period ended October 31, 2022 was ₹ 629.94 million, which primarily consists of management service charges of ₹ 281.31 million, insurance expense of ₹ 144.12 million and legal and professional fees of ₹ 61.43 million.

Finance costs

Finance costs for the seven months period ended October 31, 2022 was ₹ 7,934.11 million, which primarily consists of interest on optionally convertible debentures of ₹ 3,574.87 million, interest on term loan of ₹ 2,898.28 million and interest on non-convertible debentures of ₹ 1,060.14 million.

Depreciation and amortisation expense

Depreciation and amortisation expense for the seven months period ended October 31, 2022 was ₹ 3,535.41 million, which was attributable to amortisation of intangible assets of ₹ 3,514.70 million and depreciation of property, plant and equipment of ₹ 20.71 million.

Loss before tax

As a result of the factors outlined above, our loss before tax was ₹ 1,008.54 million for the seven months period ended October 31, 2022.

Tax expenses

Tax expenses for the seven months period ended October 31, 2022 comprised of current tax of ₹ 93.85 million and deferred tax credit of ₹ 534.62 million.

Total comprehensive loss for the period

As a result of the factors outlined above, total comprehensive loss for the seven months period ended October 31, 2022 was ₹ 569.89 million.

Comparison of fiscal years ended March 31, 2021 and 2022

Income

Total income increased by 28.42% from ₹ 16,798.59 million in the fiscal year ended March 31, 2021 to ₹ 21,572.31 million in the fiscal year ended March 31, 2022. This was primarily due to an increase in toll revenue of TOT assets and Nelamangala Devihalli Expressway Private Limited which were acquired and were operational for only a partial period during fiscal year ended March 31, 2021 but were fully operational during fiscal year ended March 31, 2022.

Revenue from operations

Revenue from operations increased by 26.19% from ₹ 16,285.19 million in the fiscal year ended March 31, 2021 to ₹ 20,550.40 million in the fiscal year ended March 31, 2022. This was primarily due to an increase in revenue from toll fee collections from ₹ 12,884.98 million in the fiscal year ended March 31, 2021 to ₹ 18,685.58 million in the fiscal year ended March 31, 2022, which was partially offset by a decrease in construction income from ₹ 2,337.09 million in the fiscal year ended March 31, 2021 to ₹ 1,415.52 million in the fiscal year ended March 31, 2022 and decrease in claims for compensation/ concession extension pursuant to COVID-19 lockdown from ₹ 576.30 million in the fiscal year ended March 31, 2021 to no such compensation/ concession extension in fiscal year ended March 31, 2022.

Other Income

Other income increased by 99.05% from ₹ 513.40 million in the fiscal year ended March 31, 2021 to ₹ 1,021.91 million in the fiscal year ended March 31, 2022. This was due to interest on fixed deposit / gain on mutual fund investment on surplus/restricted cash invested by TOT assets, Nelamangala Devihalli Expressway Private Limited, DA Toll Road Private Limited and Farakka - Raiganj Highways Limited since these assets were acquired and were operational for only a partial period during fiscal year ended March 31, 2021 but were fully operational during fiscal year ended March 31, 2022. Mainly on account of:

(i) an increase in interest on financial assets carried at amortized cost – bank deposits from ₹ 240.68 million in the fiscal year ended March 31, 2021 to ₹ 399.32 million in the fiscal year ended March 31, 2022.

(ii) an increase in liabilities no longer required written off/ remission in loan facility from ₹ 55.80 million in the fiscal year ended March 31, 2021 to ₹ 220.68 million in the fiscal year ended March 31, 2022.

(iii) an increase in net gain on sale of mutual funds from ₹ 11.12 million in the fiscal year ended March 31, 2021 to ₹ 95.49 million in the fiscal year ended March 31, 2022.

(iv) an increase in claims receivable on account of a one-time settlement from NHAI amounting to ₹ 132.40 million in the fiscal year ended March 31, 2022.

Expenses

Total expenses increased by 55.41% from ₹ 7,333.62 million in the fiscal year ended March 31, 2021 to ₹ 11,397.28 million in the fiscal year ended March 31, 2022. This was primarily due to a significant increase in operation and maintenance expenses.

Construction Cost

Construction costs decreased by 39.88% from ₹ 2,308.40 million in the fiscal year ended March 31, 2021 to ₹ 1,387.77 million in the fiscal year ended March 31, 2022. This was primarily due to completion of construction work for Farakka - Raiganj Highways Limited in fiscal year ended March 31, 2021.

Operation and maintenance expense

Operation and maintenance expenses increased by 121.21% or ₹ 4,605.36 million from ₹ 3,799.46 million in the fiscal year ended March 31, 2021 to ₹ 8,404.82 million in the fiscal year ended March 31, 2022. This was primarily due to following reasons:

(i) an increase in periodic major maintenance expense from ₹ 1,919.57 million in the fiscal year ended March 31, 2021 to ₹ 5,123.47 million in the fiscal year ended March 31, 2022 primarily as a result of an increase in periodic major maintenance expense in Ghaziabad Aligarh Expressways Private Limited by ₹ 2,580.48 million due to an increase in bitumen prices and significant repairs to pavement of carriageways brought about by an independent third party in a recent survey.

(ii) an increase in repair and maintenance of carriageway expenses from ₹ 820.94 million in the fiscal year ended March 31, 2021 to ₹ 1,691.42 million in the fiscal year ended March 31, 2022 primarily due to increase in portfolio of assets under the Cube Group (i.e., on account of the acquisition of TOT assets, Nelamangala Devihalli Expressway Private Limited, DA Toll Road Private Limited and Farakka - Raiganj Highways Limited which were acquired and were operational for only a partial period during fiscal year ended March 31, 2021 but were fully operational during fiscal year ended March 31, 2022) and bad condition of roads acquired during fiscal year ended March 31, 2022.

(iii) an increase in vehicle hire charges from ₹ 58.55 million in the fiscal year ended March 31, 2021 to ₹ 206.80 million in the fiscal year ended March 31, 2022.

As a percentage of total income, operations and maintenance expenses make up 22.62% and 38.96% for the fiscal year ended March 31, 2021 and 2022, respectively

Employee benefits expense

Employee benefits expense increased by 45.46% from ₹ 210.65 million in the fiscal year ended March 31, 2021 to ₹ 306.41 million in the fiscal year ended March 31, 2022. This was primarily due an increase in salary and wages from ₹ 179.48 million in the fiscal year ended March 31, 2021 to ₹ 266.40 million in the fiscal year ended March 31, 2022 mainly on account of increase in fully operational portfolio of assets (i.e., on account of the acquisition of TOT assets, Nelamangala Devihalli Expressway Private Limited and Farakka - Raiganj Highways Limited which were acquired and were operational for only a partial period during fiscal year ended March 31, 2021 but were fully operational during fiscal year ended March 31, 2022).

Other expenses

Other expenses increased by 27.90% from ₹ 1,015.11 million in the fiscal year ended March 31, 2021 to ₹ 1,298.28 million in the fiscal year ended March 31, 2022. This was primarily due to an increase in management service charges from ₹ 215.03 million in the fiscal year ended March 31, 2021 to ₹ 446.28 million in the fiscal year ended March 31, 2022 and an increase in insurance expenses from ₹ 167.81 million in the fiscal year ended March 31, 2021 to ₹ 246.47 million in the fiscal year ended

March 31, 2022, which was partially offset by a decrease in royalty expense payable by Farakka - Raiganj Highways Limited from ₹ 282.83 million in the fiscal year ended March 31, 2021 to ₹ 150.28 million in the fiscal year ended March 31, 2022.

Finance costs

Finance costs increased by 33.82% from ₹ 10,417.46 million in the fiscal year ended March 31, 2021 to ₹ 13,940.24 million in the fiscal year ended March 31, 2022. This was due to the following reasons:

(i) an increase in interest on optionally convertible debentures from ₹ 1,225.81 million in the fiscal year ended March 31, 2021 to ₹ 4,029.71 million in the fiscal year ended March 31, 2022 primarily due to full year interest on debentures issued by TOT assets, Nelamangala Devihalli Expressway Private Limited, DA Toll Road Private Limited, Farakka - Raiganj Highways Limited and Walayar Vadakkencherry Expressways Private Limited to fund balance construction or repayment of erstwhile promoter loan.

(ii) an increase in interest on term loans from ₹ 6,138.88 million in the fiscal year March 31, 2021 to ₹ 6,487.79 million in the fiscal year March 31, 2022.

(iii) an increase in unwinding of interest on major maintenance/ infrastructure upgrade from ₹ 342.36 million in the fiscal year ended March 31, 2021 to ₹ 589.23 million in the fiscal year ended March 31, 2022.

(iv) an increase in unwinding of interest on interest accrued for non-convertible debentures from ₹ 16.54 million in the fiscal year ended March 31, 2021 to ₹ 112.73 million in the fiscal year ended March 31, 2022.

Depreciation and amortisation expense

Depreciation and amortisation expense increased by 45.39% from ₹ 3,778.03 million in the fiscal year ended March 31, 2021 to ₹ 5,492.71 million in the fiscal year ended March 31, 2022. This was primarily due to an increase in the amortisation of intangible assets from ₹ 3,763.08 million in the fiscal year ended March 31, 2021 to ₹ 5,463.40 million in the fiscal year ended March 31, 2022. This was primarily due to an increase in assets on account of the acquisition of TOT assets and Nelamangala Devihalli Expressway Private Limited which was operational for partial period during fiscal year ended March 31, 2021 but was fully operational during fiscal year ended March 31, 2022 and as a result full year amortization was charged in fiscal year ended March 31, 2022 compared to partial period charged during fiscal year ended March 31, 2021.

Impairment of Intangible Assets

One of the Project SPVs, namely Western UP Tollway Limited had accounted for an impairment charge of ₹ 167.40 million during the fiscal year ended March 31, 2021 resulting in cumulative impairment loss booked on intangible asset amounting to ₹ 323.49 million. However, during the fiscal year ended March 31, 2022, Western UP Tollway Limited had accounted for reversal of impairment charge on intangible assets of ₹ 268.67 million primarily on account of an increase in traffic due to start of the Delhi-Meerut expressway.

Loss before exceptional items and tax

As a result of the above outlined factors, our loss before exceptional items and tax increased by 83.53% from ₹ 4,897.92 million in the fiscal year ended March 31, 2021 to ₹ 8,989.25 million in the fiscal year ended March 31, 2022.

Exceptional items

For the fiscal year ended March 31, 2021 we had an exceptional item in respect of claims receivable from NHAI pursuant to settlement agreement between Farakka - Raiganj Highways Limited and NHAI amounting to ₹ 3,243.74 million.

Tax expenses

Tax expenses for the year decreased from ₹ 755.18 million in the fiscal year ended March 31, 2021 to a tax credit of ₹ 737.58 million in the fiscal year ended March 31, 2022, which was primarily due to a decrease in current tax expense from ₹ 1,122.94 million in the fiscal year ended March 31, 2021 to ₹ 85.67 million in the fiscal year ended March 31, 2022 on account of tax paid on revenue claim received from NHAI by Farakka - Raiganj Highways Limited in fiscal year March 31, 2021 and an increase in deferred tax credit from ₹ 367.76 million in the fiscal year ended March 31, 2021 to ₹ 823.25 million in the fiscal year ended March 31, 2022.

Total comprehensive loss for the year

As a result of the factors outlined above, total comprehensive loss for the year increased from ₹ 2,395.07 million in the fiscal year ended March 31, 2021 to ₹ 8,252.94 million in the fiscal year ended March 31, 2022.

Comparison of fiscal years ended March 31, 2020 and 2021

Income

Total income increased by 20.91% from ₹ 13,893.18 million in the fiscal year ended March 31, 2020 to ₹ 16,798.59 million in the fiscal year ended March 31, 2021. This was primarily due to an increase in toll revenue of TOT assets and Nelamangala Devihalli Expressway Private Limited which was acquired and was operational for partial period during fiscal year ended March 31, 2021.

Revenue from operations

Revenue from operations increased by 22.71% from ₹ 13,270.92 million in the fiscal year ended March 31, 2020 to ₹ 16,285.19 million in the fiscal year ended March 31, 2021. This was primarily due to an increase in revenue from toll fee collections from ₹ 10,474.47 million in the fiscal year ended March 31, 2020 to ₹ 12,884.98 million in the fiscal year ended March 31, 2021, an increase in construction income from ₹ 1,083.29 million in the fiscal year ended March 31, 2020 to ₹ 2,337.09 million in the fiscal year ended March 31, 2021, an increase in claim for compensation on account of suspension or lower toll collection at toll plaza due to lockdowns imposed by Government of India as a remedial measure to combat COVID-19 from ₹ 41.19 million in the fiscal year ended March 31, 2020 to ₹ 576.30 million in the fiscal year ended March 31, 2021, which was partially offset by a decrease in renewals and overlay income from ₹ 1,185.86 million in the fiscal year ended March 31, 2020 to no such income in the fiscal year ended March 31, 2021.

Other Income

Other income decreased by 17.49% from ₹ 622.26 million in the fiscal year ended March 31, 2020 to ₹ 513.40 million in the fiscal year ended March 31, 2021. This was primarily due to remission in loan liability pursuant to a contract of ₹ 120.00 million and deferred share warrant income of ₹ 287.62 million in the fiscal year ended March 31, 2020 which was nil in fiscal year ended March 31, 2021, which were partially offset by increase in net foreign exchange gain from nil in the fiscal year ended March 31, 2020 to ₹ 101.50 million in the fiscal year ended March 31, 2021.

Expenses

Total expenses increased by 41.92% from ₹ 5,167.54 million in the fiscal year ended March 31, 2020 to ₹ 7,333.62 million in the fiscal year ended March 31, 2021. This was primarily due to a significant increase in construction costs as well as an increase in other expenses.

Construction costs

Construction costs increased by 115.13% or ₹ 1,235.35 million from ₹ 1,073.05 million in the fiscal year ended March 31, 2020 to ₹ 2,308.40 million in the fiscal year ended March 31, 2021. This was primarily due to the construction of balance EPC works in DA Toll Road Private Limited and Farakka - Raiganj Highways Limited in fiscal year ended March 31, 2021 post acquisition of these entities by Cube Highways and Infrastructure III Pte. Ltd. and Cube Highways and Infrastructure II Pte. Ltd, respectively.

Operation and maintenance expense

Operation and maintenance expenses increased by 7.57% from ₹ 3,532.06 million in the fiscal year ended March 31, 2020 to ₹ 3,799.46 million in the fiscal year ended March 31, 2021. This was primarily due an increase in repair and maintenance of carriageway expenses from ₹ 397.88 million in the fiscal year ended March 31, 2020 to ₹ 820.94 million in the fiscal year ended March 31, 2021, which was partially offset by a decrease in periodic major maintenance expense from ₹ 2,192.74 million in the fiscal year ended March 31, 2020 to ₹ 1,919.57 million in the fiscal year ended March 31, 2021. As a percentage of our total income, operations and maintenance expenses made up 25.42% and 22.62% for the fiscal year ended March 31, 2020 and 2021, respectively.

Employee benefits expenses

Employee benefits expenses decreased by 0.32% from ₹ 211.32 million in the fiscal year ended March 31, 2020 to ₹ 210.65 million in the fiscal year ended March 31, 2021.

Other expenses

Other expenses increased by 189.11% or ₹ 664.00 million from ₹ 351.11 million in the fiscal year ended March 31, 2020 to ₹ 1,015.11 million in the fiscal year ended March 31, 2021. This was primarily due to royalty expenses of ₹ 282.83 million in the fiscal year ended March 31, 2021, an increase in management service charges from ₹ 92.47 million in the fiscal year ended

March 31, 2020 to ₹ 215.03 million in the fiscal year ended March 31, 2021 and an increase in insurance expense from ₹ 89.98 million in the fiscal year ended March 31, 2020 to ₹ 167.81 million in the fiscal year ended March 31, 2021.

Finance costs

Finance costs increased by 52.35% from ₹ 6,837.75 million in the fiscal year ended March 31, 2020 to ₹ 10,417.46 million in the fiscal year ended March 31, 2021. This was primarily due to an increase in interest on term loans from ₹ 4,265.27 million in the fiscal year ended March 31, 2020 to ₹ 6,138.88 million in the fiscal year ended March 31, 2021 and an increase in interest on optionally convertible debentures from ₹ 1.14 million in the fiscal year ended March 31, 2020 to ₹ 1,225.81 million in the fiscal year ended March 31, 2021.

Depreciation and amortisation expense

Depreciation and amortisation expense increased by 16.04% from ₹ 3,255.73 million in the fiscal year ended March 31, 2020 to ₹ 3,778.03 million in the fiscal year ended March 31, 2021. This was primarily due to an increase in the amortisation of intangible assets from ₹ 3,243.49 million in the fiscal year ended March 31, 2020 to ₹ 3,763.08 million in the fiscal year ended March 31, 2021.

Impairment of Intangible Assets

One of the Project SPVs, namely Western UP Tollway Limited had accounted for an impairment charge of ₹ 156.09 million and ₹ 167.40 million during the fiscal year ended March 31, 2020 and 2021, respectively due to significant decrease in traffic on the asset on account of traffic diversions to Ganga canal road and the mining ban imposed by the state government.

Loss before exceptional item and tax

As a result of the above outlined factors, our loss before exceptional items and tax increased by 221.40% or ₹ 3,373.99 million from ₹ 1,523.93 million in the fiscal year ended March 31, 2020 to ₹ 4,897.92 million in the fiscal year ended March 31, 2021.

Exceptional item

For the fiscal year ended March 31, 2021 we had an exceptional item in respect of claims receivable from NHAI pursuant to settlement agreement between Farakka Raiganj Highways Limited and NHAI amounting to ₹ 3,243.74 million.

Tax expenses

Tax expenses for the year increased from a tax credit of ₹ 187.06 million in the fiscal year ended March 31, 2020 to a tax expense of ₹ 755.18 million in the fiscal year ended March 31, 2021 which was primarily due to an increase in current tax from ₹ 44.52 million in the fiscal year ended March 31, 2020 to ₹ 1,122.94 million in the fiscal year ended March 31, 2021 primarily due to claims receivable from NHAI pursuant to settlement agreement between Farakka - Raiganj Highways Limited and NHAI recognized as an exceptional item in fiscal year ended March 31, 2021, which was partially offset by an increase in deferred tax credit from ₹ 231.58 million in the fiscal year ended March 31, 2020 to ₹ 367.76 million in the fiscal year ended March 31, 2021.

Total comprehensive loss for the year

As a result of the factors outlined above, total comprehensive loss for the year increased from ₹ 1,342.39 million in the fiscal year ended March 31, 2020 to ₹ 2,395.07 million in the fiscal year ended March 31, 2021.

Liquidity and Capital Resources

Our main sources of liquidity are cash flow from our operations**,** short and long-term debt financing from financial institutions and equity capitalization from our shareholders.

Our main liquidity requirements are primarily for routine operation and maintenance expenses, capital expenditure and servicing of debt. We also require working capital to meet our obligations with our suppliers and employees on an ongoing basis as part of the ordinary course of our business.

As of October 31, 2022, our cash and cash equivalents totaled ₹ 10,718.79 million and bank balances other than cash and cash equivalents totaled ₹ 3,435.88 million. As of October 31, 2022, our total current liabilities were ₹ 19,219.49 million.

Cash Flows

Particulars	For the fiscal year ended March 31			For the seven months period ended
	2020	2021	2022	October 31, 2022
	(in ₹ million)			
Net cash generated from operating activities	8,951.20	13,561.38	8,627.80	6,101.43
Net cash used in investing activities	(3,349.89)	(61,925.53)	(2,761.70)	(3,684.98)
Net cash generated from / (used in) in financing activities	(6,605.22)	53,662.25	1,834.00	(8,914.53)
Cash and cash equivalents at the end of the period/ year (net of earmarked balances)	**1,782.42**	**7,080.52**	**14,780.62**	**8,282.54**

Operating Activities

Net cash flows generated from operating activities for the seven months period ended October 31, 2022 was ₹ 6,101.43 million. Our loss before tax for the seven months period ended October 31, 2022 amounted to ₹ 1,008.54 million, which was adjusted primarily for the following to reconcile to net cash flows: finance cost (excluding derivative hedging cost) amounting to ₹ 7,921.94 million and depreciation and amortization expense amounting to ₹ 3,535.41 million. Our operating profit before working capital changes was ₹ 10,096.32 million. This was adjusted for working capital changes and other adjustments, primarily provisions amounting to ₹ 4,356.86 million and financial liabilities and non-financial liabilities amounting to ₹ 889.18 million. Our cash flow from operations for the seven months period ended October 31, 2022 amounted to ₹ 6,221.45 million, which was adjusted for income tax paid amounting to ₹ 120.02 million.

Net cash flows generated from operating activities for the fiscal year ended March 31, 2022 was ₹ 8,627.80 million. Our loss before tax for the fiscal year ended March 31, 2022 amounted to ₹ 8,989.25 million, which was adjusted primarily for the following to reconcile to net cash flows: finance cost (excluding derivative hedging cost) amounting to ₹ 13,910.60 million and depreciation and amortization expense amounting to ₹ 5,492.71 million. Our operating profit before working capital changes was ₹ 9,480.97 million. This was adjusted for working capital changes and other adjustments, primarily financial liabilities and non-financial liabilities amounting to ₹ 7,314.79 million, provisions amounting to ₹ 4,904.79 million and financial assets and non-financial assets amounting to ₹ 3,353.13 million. Our cash flow from operations for the fiscal year ended March 31, 2022 amounted to ₹ 10,013.68 million, which was adjusted for income tax paid amounting to ₹ 1,385.88 million.

Net cash flows generated from operating activities for the fiscal year ended March 31, 2021 was ₹ 13,561.38 million. Our loss before tax for the fiscal year ended March 31, 2021 amounted to ₹ 1,654.18 million, which was adjusted primarily for the following to reconcile to net cash flows: finance cost (excluding derivative hedging cost) amounting to ₹ 10,316.38 million and depreciation and amortization expense amounting to ₹ 3,778.03 million. Our operating profit before working capital changes was ₹ 11,744.85 million. This was adjusted for working capital changes and other adjustments, primarily financial assets and non-financial assets amounting to ₹ 2,883.80 million, financial liabilities and non-financial liabilities amounting to ₹ 2,100.31 million, provisions amounting to ₹ 1,587.66 million and trade payables amounting to ₹ 1,120.34 million. Our cash flow from operations for the fiscal year ended March 31, 2021 amounted to ₹ 13,529.19 million, which was adjusted for income tax refunded amounting to ₹ 32.19 million.

Net cash flows generated from operating activities for the fiscal year ended March 31, 2020 was ₹ 8,951.20 million. Our loss before tax for the fiscal year ended March 31, 2020 amounted to ₹ 1,523.93 million, which was adjusted primarily for the following to reconcile to net cash flows: finance cost (excluding derivative hedging cost) amounting to ₹ 6,797.55 million and depreciation and amortization expense amounting to ₹ 3,255.73 million. Our operating profit before working capital changes was ₹ 8,696.99 million. This was adjusted for working capital changes and other adjustments, primarily financial assets and non-financial assets amounting to ₹ 675.35 million, trade payables amounting to ₹ 379.76 million and provisions amounting to ₹ 253.79 million. Our cash flow from operations for the fiscal year ended March 31, 2020 amounted to ₹ 8,929.75 million, which was adjusted for income tax refunded amounting to ₹ 21.45 million.

Investing Activities

Net cash flows used in investing activities for the seven months period ended October 31, 2022 was ₹ 3,684.98 million, primarily attributable to redemption from mutual funds of ₹ 2,784.55 million and payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under development (net) and advances for capital expenditure) of ₹ 1,645.90 million which was partially offset by movement in bank balances (including deposits) not considered as cash and cash equivalents (net) of ₹ 449.13 million.

Net cash flows used in investing activities for the fiscal year ended March 31, 2022 was ₹ 2,761.70 million, attributable to payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under development (net) and advances for capital expenditure) of ₹ 9,375.92 million which was partially offset by proceeds on from NHAI on settlement of ₹ 5,253.91 million and net redemption from mutual funds of ₹ 1,254.97 million.

Net cash flows used in investing activities for the fiscal year ended March 31, 2021 was ₹ 61,925.53 million, primarily attributable to payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under development (net) and advances for capital expenditure) of ₹ 59,726.08 million and movement in bank balances (including deposits) not considered as cash and cash equivalents (net) of ₹ 1,506.65 million.

Net cash flows used in investing activities for the fiscal year ended March 31, 2020 was ₹ 3,349.89 million, primarily attributable to movement in bank balances (including deposits) not considered as cash and cash equivalents (net) of ₹ 2,163.60 million and payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under development (net) and advances for capital expenditure) of ₹ 1,116.11 million.

Financing Activities

Net cash flows used in financing activities for the seven months period ended October 31, 2022 was ₹ 8,914.53 million, primarily attributable to repayment of long term borrowings of ₹ 14,695.79 million and interest paid (including interest capitalized) of ₹ 5,391.29 million which was partially offset by proceeds from long term borrowings of ₹ 14,306.79 million.

Net cash generated from financing activities for the fiscal year ended March 31, 2022 was ₹ 1,834.00 million, primarily attributable to proceeds from long term borrowings of ₹ 42,184.30 million which was partially offset by repayment of long term borrowings of ₹ 32,221.95 million and interest paid (including interest capitalized) of ₹ 9,204.41 million.

Net cash flows generated in financing activities for the fiscal year ended March 31, 2021 was ₹ 53,662.25 million, primarily attributable to proceeds from long term borrowings of ₹ 69,458.25 million and proceeds from issue of capital (including security premium) of ₹ 6,653.02 million, which was partially offset by repayment of long term borrowings of ₹ 11,402.46 million and interest paid (including interest capitalized) of ₹ 10,458.04 million.

Net cash flows used in financing activities for the fiscal year ended March 31, 2020 was ₹ 6,605.22 million, primarily attributable to interest paid (including interest capitalized) of ₹ 5,578.64 million and repayment of long term borrowings of ₹ 3,162.52 million, which was partially offset by proceeds from short-term borrowings (net) of ₹ 1,219.84 million.

Indebtedness

Our borrowings consist of term loans taken from banks, secured non-convertible debentures and unsecured optionally convertible debentures and non-convertible debentures. The table below sets forth further details on our current and non-current financing obligations that were outstanding as of October 31, 2022:

Financing Instrument	**Ind AS outstanding Amount** ***(in ₹ million)***
Term loan from banks (secured)	57,010.49
Term loan from financial institutions and NBFCs	5,664.96
Listed non-convertible debenture (secured)	11,684.89
Optionally convertible debenture (unsecured)	42,727.89
Non-convertible debenture from related party (unsecured)	4,410.11
Non-convertible debenture from others (unsecured)	3,474.18
Term loan from others (Unsecured)	280.33
Total current and non-current indebtedness ...	**1,25,252.85**

Interest and commissions: For loans availed by the Project SPVs, the interest rate is a base rate specified by the lender plus applicable spread, if any, per annum. The applicable spread varies among different loans. The rate of interest upon non-convertible debentures is at a fixed rate per annum.

Maturity and Repayment: The final maturity period of the loans availed by the Project SPVs ranges from the loan disbursement or refinance date to March 2050. These loans are repayable in accordance with the repayment schedule specified in the relevant financing agreements, which typically prescribe monthly instalments for rupee loans, semi-annual instalments for the foreign currency loan and monthly instalments with respect to the non-convertible debentures. For details, please see *"Audited Special Purpose Combined Financial Statements – Note 22 - Borrowings"* on page 391.

Contractual Obligations

The table below analyses the Trust Group's financial liabilities into relevant maturity categories based on their contractual maturities for all non-derivative financial liabilities, as on October 31, 2022:

The amounts disclosed in the table are the contractual undiscounted cash flows net of processing fees:

Less than One Year	**One to Two Years**	**Two to Five Years**	**More than Five Years**	**Total**

	Less than One Year	One to Two Years	Two to Five Years	More than Five Years	Total
Borrowings	6,556.57	8,071.98	27,838.63	90,467.07	**132,934.25**
Trade payable	2,633.35	33.14	-	-	**2,666.49**
Other financial liabilities	6,403.49	374.96	-	2,880.15	**9,658.60**
Total	**15,593.41**	**8,480.08**	**27,838.63**	**93,347.22**	**145,259.34**

Capital Expenditure

Historically, our capital expenditure requirements have principally consisted of concession fees which is paid at the inception of the project and periodic major maintenance expenses. Our payment towards capital expenditures in fiscal years 2020, 2021 and 2022 and the seven months period ended October 31, 2022 totalled ₹ 1,116.11 million, ₹ 59,726.08 million, ₹ 9,375.92 million and ₹ 1,645.90 million, respectively. Historically, our capital expenditure needs have been financed through a combination of the cash flow generated by our operations, debentures from related parties and debt financing from banks and financial institutions.

Sufficiency of Working Capital

The Investment Manager has confirmed that the Trust has the ability to meets its working capital requirements for at least 12 months from the date of the Placement Memorandum.

Related Party Transactions

We have in the past engaged, and in the future may engage, in related party transactions. For a description of our related party transactions, see the section entitled "*Related Party Transactions*" on page 275.

Seasonality

Traffic volume tends to decrease during the monsoon season and conversely tends to increase during holiday seasons. While the northern parts of India experience monsoon rains during the period from June or July until September or October every year, the southern parts of India, especially coastal parts of Andhra Pradesh, experience monsoon rains even during the months of October to December. The monsoon season may also restrict our ability to carry on activities related to its operation and maintenance of toll roads.

Unusual or Infrequent Events or Transactions

Except as described in this Final Placement Memorandum, there have been no events or transactions to our knowledge which may be described as "unusual" or "infrequent".

Off-Balance Sheet Arrangements

We did not have any material off-balance sheet arrangements during the fiscal periods presented.

Quantitative and Qualitative Information on Market Risks

We are exposed to various financial risks. These risks are primarily categorised into credit risk, liquidity risk and market risk.

Credit Risk

Credit risk is the risk of financial loss to us if a customer or counterparty to a financial instrument fails to meet its contractual obligations, and arises principally from our receivables from customers. The maximum exposure to credit risk is limited to the carrying amount of following types of financial assets: cash and cash equivalents, trade receivables, other financial assets, and deposits with banks. We have credit risk on trade receivables from NHAI and ETC receivable. We continuously review these claims and provide for expected credit losses based on each claim.

Liquidity Risk

Liquidity risk is the risk that we may encounter difficulty in meeting our present and future obligations associated with financial liabilities that are required to be settled by delivering cash or another financial asset. We are exposed to liquidity risk due to borrowings and trade and other payables. We measures risk by forecasting cash flows. Our approach to managing liquidity is to ensure, as far as possible, that we will always have sufficient liquidity to meet our liabilities when due without incurring unacceptable losses or risking damage to our reputation. We ensure that we has sufficient fund to meet expected operational expenses, servicing of financial obligations.

Market Risk

Interest Rate Risk

Liabilities
Our policy is to minimise interest rate cash flow risk exposures on long-term financing. At the reporting periods end, we are exposed to changes in market interest rates through bank borrowings at variable interest rates.

Assets
Our fixed deposits are carried at amortised cost and are fixed rate deposits. They are therefore not subject to interest rate risk as defined in Ind AS 107 'Financial Instruments Disclosures', since neither the carrying amount nor the future cash flows will fluctuate because of a change in market interest rates.

Price Risk

We require for implementation (construction, operation and maintenance) of the projects various commodities such as cement, bitumen, steel and other construction materials which are exposed to price risk. We are able to manage our exposure to price increases through bulk purchases and negotiations. Hence, the sensitivity analysis is not required to be provided. Our exposure to price risk arises from investments held and classified at fair value through profit or loss. To manage the price risk arising from investments, we diversify our portfolio of assets through fixed rate investment like deposit with bank and investment in mutual funds (Growth Scheme).

Foreign Currency Risk

Foreign currency risk is the risk that the fair value or future cash flows of an exposure will fluctuate because of changes in foreign exchange rates. We have no significant exposure to the risk of changes in foreign exchange rates. For further information, see "*Special Purpose Combined Financial Statements – Note 46: Financial Risk Management*" on page 426.

Significant developments since October 31, 2022

Except as disclosed above and elsewhere in this Final Placement Memorandum, to our knowledge no circumstances have arisen since October 31, 2022, that could materially and adversely affect or are likely to affect, our operations, trading or profitability, or the value of our assets or our ability to pay our material liabilities within the next 12 months.

Capitalisation Statement

Capitalisation Statement of the Trust on a consolidated basis

(in ₹ million)

Particulars	Pre issue as at October 31, 2022	Post issue [(1)(2)]
Debt:		
Non-current borrowings	1,19,130.54	1,19,130.54
Current borrowings	6,122.31	6,122.31
Interest accrued on borrowings	8,478.71	8,478.71
Less: Cash and cash equivalent, Bank balances other than cash and cash equivalents net of restricted deposits and deposits with banks[(3)]	(12,834.98)	(12,834.98)
Total adjusted debt (A)	**1,20,896.58**	**1,20,896.58**
Equity:		
Capital	8,522.87	-
Unit Capital – Fresh Issue[(2)]	-	38,010.92
Unit Capital – Offer for Sale[(4)]	-	14,232.36
Unit Capital – Existing unitholders (Formation Transaction) [(4)]	-	92,526.33
Other equity	(7,636.53)	-
Total equity (B)	**886.34**	**1,44,769.61**
Debt equity ratio [A/B]	**136.40**	**0.84**

[(1)] Other than Unit Capital, all other numbers provided in the table above are as of October 31, 2022.
[(2)] The figures for the respective financial statements line items under post Issue column are derived after considering the impact due to proposed issue of unit capital (net of offer expenses on page 231 of the Final Placement Memorandum) and does not include any other transactions or movements for such financial statements line items after October 31, 2022. The actual capitalisation post the Issue would depend on the actual position of debt and equity on the deemed date of Allotment.
[(3)] Cash and cash equivalents has been considered after excluding deposits maintained in Major Maintenance Reserve account amounting ₹1,430.69 million and restricted deposits of ₹ Nil million.
[(4)] Represents issue of Units to Sponsors and their associates under the Formation Transaction against transfer of Equity shares of the InvIT Assets to the InvIT and the Ordinary Units tendered by Selling Unitholders under Offer for Sale to the Eligible Investors

Capitalisation Statements in relation to the Project SPVs

Pursuant to the Offer, there is no change in the capitalization statements of the Project SPVs as at October 31, 2022. For details of capital structure of the Project SPVs, please see the sections entitled "*Business*" and "*Financial Indebtedness and Deferred Payments*" on pages 172 and 232, respectively.

RELATED PARTY TRANSACTIONS

In terms of Regulation 2(1)(zv) of the InvIT Regulations, related party shall be as defined as under the Companies Act, 2013 or under the applicable accounting standards and shall also include: (i) Parties to the Trust; and (ii) promoters, directors, significant stakeholders and partners of the Parties to the Trust. Further, related parties also include such persons and entities as defined in terms of the applicable accounting standards, being Ind AS 24 on "*Related Party Disclosures*" ("**Related Parties**") in relation to related party transactions. For further details in relation to related party transactions, please see the section entitled "*Audited Special Purpose Combined Financial Statements*" on page 345. The Parties to the Trust, may, from time to time, enter into related party transactions, in accordance with applicable law.

Procedure for dealing with Related Party Transactions

To ensure proper approval, supervision and reporting of the transactions between the Trust and its Related Parties, the board of directors of the Investment Manager has adopted the policy in relation to related party transactions and conflict of interests ("**RPT Policy**"), pursuant to its resolution dated July 11, 2022, to regulate the transactions between the Trust and its Related Parties. The key terms of the RPT Policy are provided below:

(i). In accordance with the InvIT Regulations, the Investment Manager will ensure that all related party transactions shall be:

(a). on an arm's length basis in accordance with the Income Tax Act, 1961 and Companies Act, 2013;

(b). in accordance with the relevant accounting standards;

(c). in the best interest of the Unitholders;

(d). consistent with the strategy and investment objectives of the Trust; and

(e). compliant with applicable law.

(ii). The Investment Manager will ensure that all related party transactions, other than the transactions set out below, are on an arm's length basis, pursuant to a benchmarking report obtained from a Big 4 Accounting Firm:

(a). acquisition of assets by the Trust;

(b). related party transactions undertaken between the Trust and the Project SPVs, including any borrowings availed by the Project SPVs from the Trust; and

(c). any fees paid by the Trust or the Project SPVs to the Investment Manager or Project Manager pursuant to the Investment Management Agreement, Project Implementation and Management Agreement and any shared services agreement executed by the Trust.

(iii). Review and approval of related party transactions:

(a). In the first instance, the Audit Committee shall be responsible for the approval or any subsequent modification of all transactions of the Trust with Related Parties and shall recommend the same to the IM Board.

(b). Each transaction which is identified as a related party transaction shall be pre-approved by the IM Board prior to entering into such transaction.

(c). The IM Board may grant omnibus approval for related party transactions subject to limits on quantum and nature as determined by the IM Board; however, no omnibus approval may be granted for related party transactions that are not on an arm's length basis as determined above. Each such omnibus approval shall be valid for a period not exceeding one year from the date of such approval, and related party transactions undertaken after the expiry of such period shall require fresh approval of the IM Board. The IM Board shall review, on a quarterly basis, the details of related party transactions entered into by the Trust pursuant to the omnibus approval.

(iv). The Investment Manager will establish an internal control system so as to ensure that all future related party transactions are compliant with the InvIT Regulations and applicable accounting standards. Further, the Investment Manager shall convene meetings of the Unitholders in accordance with Regulation 22 of the InvIT Regulations, and maintain records

pertaining to such meetings in the manner prescribed. The Investment Manager shall also ensure compliance with any additional guidelines issued in this regard by SEBI and other relevant regulatory, statutory or governmental authorities from time to time.

(v). In addition to any other requirement that may be prescribed in terms of the InvIT Regulations or other applicable laws, all related party transactions to be entered into in the future will be decided by the IM Board after the examination of the nature of the transaction and its supporting documents or such other data as may be deemed necessary by the IM Board. Subject to point (ii) above, all related party transactions, (i) shall be on arm's length terms, and (ii) shall be notified to the IM Board prior to entering into the transaction, as soon as practicable, with relevant documents showing how the Investment Manager determined such related party transaction to be on an arm's length basis, and in the case of any related party transaction with an aggregate value over US$500,000 or outside the ordinary course of business, at least 10 business days prior to entry into such related party transaction, following which the IM Board may require information to satisfy itself of the arm's length nature of the transaction.

(vi). Subject to the provisions of applicable law, any director, being a Related Party to a transaction and/or if he or the person who nominated him as a director has any interest in a transaction, shall not be involved in the decision making in respect of the relevant related party transaction and will recuse himself/herself and abstain from discussion and review / voting of the related party transaction.

(vii). The Investment Manager will ensure that if the total value of all the related party transactions in a financial year pertaining to acquisition or sale of assets, whether directly or through a holding company or SPV, or investments into securities, exceeds 5% of the value of the assets of the Trust or any other applicable threshold prescribed by the InvIT Regulations, approval from the Unitholders shall be obtained prior to entering into any such subsequent transaction with any Related Party, in accordance with the Regulation 22 of the InvIT Regulations.

(viii). The Investment Manager will ensure that if the value of the funds borrowed from Related Parties in a financial year exceeds 5% of the total consolidated borrowings of the Trust, any holding company and the SPVs, or any other applicable threshold prescribed by the InvIT Regulations, approval from the Unitholders shall be obtained prior to entering into any such subsequent transaction with any Related Party, in accordance the InvIT Regulations.

(ix). As a general rule, the Audit Committee must demonstrate to the IM Board that future related party transactions satisfy the criteria set out in (i) above at the time of recommending the same for the approval of the IM Board.

(x). The Investment Manager will maintain a register to record all related party transactions entered into by the Trust and the basis on which they are entered into.

(xi). The Investment Manager will also incorporate into its internal audit plan a review of all related party transactions entered into by the Trust during each financial year, including a review of the implementation of the agreements relating to related party transactions, including any right of first offer or right of first refusal arrangements, to acquire assets from the Sponsor(s).

(xii). The IM Board shall review at least quarterly in each financial year the related party transactions entered into during such quarter to ascertain that the guidelines and procedures established to monitor the related party transactions have been complied with. Provided that any person who is a Related Party interested in the related party transaction, as well as an Associate of such Related Party, who forms a part of the IM Board, shall not review such related party transactions in which he or his Associate is interested.

(xiii). While considering voting on a related party transaction which requires approval of the Unitholders, voting by any person who is a Related Party in such transaction as well as Associate of such person(s) shall not be considered on the specific issue.

Potential Conflict of Interest

(i). Subject to the applicable law and RPT Policy, all resolutions in writing of the IM Board in relation to matters concerning related party transactions of the Trust must be approved by more than 50% of the Directors on the IM Board eligible to vote on such related party transactions.

(ii). Where matters concerning the Trust relate to transactions entered into or to be entered into by the Investment Manager for and on behalf of Trust with a Related Party, the IM Board is required to consider the terms of the transactions to

satisfy itself that the transactions are conducted in accordance with the parameters set out in the policy, including by way of obtaining a benchmarking report, if required, as set out above.

(iii). As part of its review of the internal audit reports at least quarterly in each financial year, the IM Board will review the internal audit reports of the implementation of the share purchase agreements to acquire assets from the Sponsor(s), to ensure compliance. The review will include an examination of supporting documents and such other data deemed necessary to the IM Board.

Disclosure and Reporting

(i). The Investment Manager shall submit to the Trustee, quarterly reports on the activities of the Trust, including the status of compliance with the requirements specified under the InvIT Regulations in relation to related party transactions, within such time as may be prescribed in the InvIT Regulations and applicable law.

(ii). Related party transactions shall be disclosed: (a) in the offer document with respect to any such transactions entered into prior to the offer of units and any such proposed transactions subsequent to the offer; and (b) to the Stock Exchanges and the Unitholders periodically, in accordance with the InvIT Regulations and the agreements to be entered into with the Stock Exchanges in relation to the listing of the Ordinary Units. In respect of any related party transaction, the Investment Manager shall adequately disclose the details of any fees or commissions received or to be received by such Related Party(ies) to the Stock Exchanges.

(iii). Where any of the Related Parties have an interest in a business which competes or is likely to compete, either directly or indirectly, with the activities of the Trust, the details required to be disclosed as per the InvIT Regulations shall be disclosed in any offer document or placement memorandum, as applicable and in accordance with the InvIT Regulations.

(iv). In accordance with the InvIT Regulations, the annual report to be submitted by the Investment Manager to all Unitholders, electronically or by physical copies, and to the Stock Exchanges within three months from the end of the financial year, shall contain, inter alia, details of all related party transactions, including acquisitions or disposal of any projects, directly or through SPVs during the year, the value of which exceeded one percent of value of the assets of the Trust.

Related Party Transactions

Present and On-going Related Party Transactions

Related Party Transactions of the Trust in relation to the setting up of the Trust and this Offer

A number of present and on-going transactions with certain Related Parties have been, or will be, entered into in relation to the setting up of the Trust. The Trustee and the Investment Manager confirm that the following related party transactions have been, or shall be, entered into, on an arm's length basis in accordance with the relevant accounting standards, in the best interest of the Unitholders, consistent with the strategy and investment objectives of the Trust:

(A) Trust Deed

Please see the section entitled "*Parties to the Trust – Key Terms of the Trust Deed*" on page 109 for a description of the terms of the Trust Deed. The Trustee has received a sum ₹ 10,000 towards the initial settlement of the Trust from the Settlor.

(B) Investment Management Agreement

Please see the section entitled "*Parties to the Trust – Key Terms of the Investment Management Agreement*" on page 122 for a description of the terms of the Investment Management Agreement.

(C) Project Implementation and Management Agreement

Please see the section entitled "*Parties to the Trust – Key Terms of the Project Implementation and Management Agreement*" on page 133 for a description of the terms of the Project Implementation and Management Agreement.

(D) Trust Loan Agreements

Please see the section entitled "*Financial Indebtedness and Deferred Payments – Principal terms of borrowings proposed to be availed by each of the Initial Portfolio Assets from the Trust*" on page 239 for a description of the terms of the Trust Loan Agreements.

(E) Share Purchase Agreements

Please see the section entitled "*Related Party Transactions – Acquisition of the Initial Portfolio Assets by the Trust*" on page 278 for a description of the terms of the Share Purchase Agreements.

(F) Claims Management Agreement

Please see the section entitled "*Related Party Transactions – Acquisition of the Initial Portfolio Assets by the Trust*" on page 278 for a description of the terms of the Claims Management Agreement.

(G) Right of First Offer ("ROFO") Agreement

Please see the section entitled "*Related Party Transactions – Acquisition of future assets by the Trust*" on page 282 for a description of the terms of the ROFO Agreement.

(H) Reimbursement Agreement

Please see the section entitled "*Related Party Transactions – Reimbursement Agreement*" on page 284 for a description of the terms of the Reimbursement Agreement.

Acquisition of the Initial Portfolio Assets by the Trust

Share Purchase Agreements ("SPAs")

The relevant members of the Cube Group (i.e. CH-I, CH-ID, CH-II, CH-III and Cube Mobility Investments Pte Ltd.) (each referred to as the "**Seller**"), the Trustee (acting on behalf of the Trust), the Investment Manager and the Initial Portfolio Assets have entered into SPAs in order for the Trust to purchase, and the relevant Seller to sell, the entire issued, subscribed and paid-up share capital of the of the relevant Initial Portfolio Asset ("**Sale Shares**") (other than MBEL, where the third-party shareholder will continue to hold approximately 0.03% of the equity share capital, subject to compliance with the InvIT Regulations) prior to the filing of the Placement Memorandum. Key terms of the SPAs are as follows:

Sale and purchase: The Trust (acting through the Trustee) agrees and undertakes to purchase from the relevant Seller, and the relevant Seller agrees and undertakes to sell to the Trust, the Sale Shares, in consideration of issue of Consideration Units, as defined in the relevant SPA, to the relevant Seller on a spot delivery basis, free and clear of any encumbrances, other than as disclosed in the relevant disclosure letter, and together with all rights attaching thereto, such that the Trust shall, upon transfer of the Sale Shares, receive full legal and beneficial ownership of the Sale Shares and all rights thereto.

Seller conditions precedent: The completion of the sale and purchase of the Sale Shares is conditional on the fulfilment (or waiver by the Trust, where such waiver is permitted under applicable law) of the following conditions precedent (as applicable to each of the Initial Portfolio Assets):

(i) the following conditions precedent, to the reasonable satisfaction of the Investment Manager (acting on behalf of the Trust) –

  (a) the relevant Initial Portfolio Asset and the relevant Seller shall have obtained prior approval for the transaction contemplated under the SPA, from the concessioning authority.
  (b) the relevant Initial Portfolio Asset and the relevant Seller shall have ensured that the budgeted capex cost as set out in the SPA is fully funded by the relevant Seller.

(ii) the following conditions precedent, amongst others –

  (a) except as set out in the relevant disclosure letter, each of the relevant Seller warranties being true, correct and not misleading, a certificate for which will be provided by the relevant Seller;
  (b) the relevant Seller having provided copies of the resolutions of the board of directors and shareholders of the relevant Seller for the transfer of Sale Shares to the Trust in the agreed form;
  (c) the relevant Initial Portfolio Asset shall have delivered to the Trust a certificate from an independent chartered accountant or a SEBI registered merchant banker certifying the fair market value of the Sale Shares computed

in accordance with any internationally accepted pricing methodology for valuation on an arm's length basis pursuant to the Foreign Exchange Management Act, 1999;

(d) the relevant Initial Portfolio Asset shall deliver to the Trust a certificate and valuation report prepared by an independent accountant in compliance with Section 56(2)(x) of the Income Tax Act, 1961 and computed in accordance with Rule 11UA of the Income tax Rules. For preparing such valuation report, reliance would be placed on the audited financial statements for the year ending March 31, 2022 and management projected financials for the interim period for which audited financial statements cannot be made available;

(e) finalisation of 'basis of allotment' under the InvIT Regulations ;

(f) the relevant Initial Portfolio Asset shall have delivered to the Trust a no-objection certificate from its lenders, and consent of debenture trustees, permitting the relevant Initial Portfolio Asset to enter into the SPA and perform the transactions contemplated under the SPA; and

(g) the relevant Initial Portfolio Asset shall have complied with all the conditions required for early redemption under the debt documents executed by the Initial Portfolio Asset.

The conditions precedent in (i) and (ii) above shall collectively be referred to as "**Seller Conditions Precedent**"

(iii) The completion of the sale and purchase of the Sale Shares is conditional on the fulfilment (or waiver by the relevant Seller, where such waiver is permitted under applicable law) of the following conditions precedent, to the reasonable satisfaction of the relevant Seller (collectively, "**Trust Conditions Precedent**") –

(a) the Trust shall have executed the Trust Loan Agreement with the relevant Initial Portfolio Asset;

(b) The Trust shall have delivered to the relevant Seller a certificate from an independent chartered accountant or a Securities and Exchange Board of India registered merchant banker certifying the fair market value of the Consideration Units (as defined in the SPA) computed in accordance with any internationally accepted pricing methodology for valuation on an arm's length basis pursuant to the Foreign Exchange Management Act, 1999; and

(c) The Trust shall have delivered to the relevant Seller a valuation report prepared by a Securities and Exchange Board of India registered Category I Merchant Banker or a chartered accountant, in relation to the valuation of the Consideration Units, prepared in accordance with Section 56(2)(x) of the Income Tax Act, 1961.

The Seller Conditions Precedent and the Trust Conditions Precedent shall collectively be referred to as the "**Conditions Precedents**".

Closing: The closing shall occur within 15 working days (or such other later date as may be mutually agreed by the parties in writing) of acceptance of the satisfaction or waiver as the case may be, of the Conditions Precedents set out above, at the principal place of business of the Trust. The date on which the closing occurs shall be referred to as the "Closing Date". All transactions contemplated by the SPA to be completed on the Closing Date shall be deemed to occur simultaneously and no transaction shall be consummated unless all such transactions are consummated.

Relevant Seller representations and warranties: The relevant Seller represents and warrants to the Trust and the Investment Manager that each of the Seller Warranties (as defined in the SPA) shall remain true and correct as at the Closing Date, except as otherwise provided for in the SPA. Further, each Seller Warranty shall be construed separately and independently and shall not be expanded by reference to any other matter, warranty or undertaking. The Sellers have represented and warranted that, amongst other things:

(i) each of the Seller and the Initial Portfolio Asset is duly incorporated and validly existing under the laws of relevant jurisdiction of their incorporation or organization, and has the right, power and authority to enter into, execute, deliver and perform its obligations under the SPA;

(ii) execution and delivery by each of the Seller and the Initial Portfolio Asset and the performance of each of their obligations under the SPA have been duly and validly authorized by all necessary corporate action on the part of the Seller and the Initial Portfolio Asset respectively, and does not require any further approvals of any third party. Upon execution and delivery by each party, the SPA will constitute legal, valid and binding obligations of the Seller and the Initial Portfolio Asset and is enforceable against each of them in accordance with their terms, except as limited by applicable bankruptcy, insolvency, reorganization or moratorium;

(iii) neither the Seller nor the Initial Portfolio Asset has authorised any agents, consultants, joint venture partners or other persons acting on its behalf, to take, any action or to refrain from taking any action that would cause the Initial Portfolio Asset to be in violation of any applicable anti-corruption laws and/or the anti-corruption internal policies of the Seller;

(iv) the accounts of the Initial Portfolio Asset have been prepared in accordance with the relevant accounting standards, and give a true and fair view of the assets, liabilities and state of financial affairs of the Initial Portfolio Asset at the Accounts Date, as defined in the SPA; and

(v) the Initial Portfolio Asset has conducted, and is conducting its business in material compliance with Applicable Law, as defined in the SPA.

Trust representation and warranties: The representations and warranties provided by the Trustee (on behalf of the Trust), include, amongst others:

(i) due incorporation and valid existence;
(ii) due authorisation for the consummation of the SPA;
(iii) execution of the SPA and transactions contemplated in the SPA does not violate its charter documents, or material breach or constitute a material default of material contract or contravene applicable law; and
(iv) representations in relation to solvency.

Indemnity: Upon Closing (as defined in the SPA), the Sellers will indemnify, defend and hold harmless the Trust (acting through its Trustee) and the Investment Manager (in its capacity as the investment manager of the Trust) and the Initial Portfolio Assets and respective directors of the Initial Portfolio Assets and Investment Manager ("**Indemnified Parties**") from and against Losses (as defined in the SPA) of the relevant Indemnified Party which (i) relate to, or arise from, breach of any Seller Warranty (as defined in the SPA); and (ii) pertain to any Specific Indemnity Matter (as defined in the SPA). The indemnification obligations of the Seller will be the exclusive monetary remedy available to the indemnified parties for the breach of Seller Warranties and Specific Indemnity Matters under applicable law or in equity or otherwise against the relevant Seller. Further, any obligation of the Seller to indemnify or make any other payment to the Indemnified Party under the SPA shall be subject to the limitations on liability set out in SPA, including amongst other things:

(i) the Seller not being liable for any Claim (as defined in the SPA) if and to the extent it is attributable to, or the amount of such Claim is increased as a result of, any (a) prospective or retrospective change of applicable law or regulation or directive of a governmental authority, or any interpretation thereof or (b) change (including retrospective changes) in the rates of tax in force after the date of the SPA;

(ii) aggregate liability of the Sellers shall not exceed certain thresholds set out in the SPA;

(iii) the Indemnified Party not being entitled to recover damages or obtain payment, reimbursement, restitution or indemnity more than once in respect of any one loss, breach or other set of circumstances which gives rise to more than one Claim; and

(iv) the Sellers only being liable for a Claim if (a) the aggregate amount of the liability of the Seller for the sum of all Claims made which relate to a series of connected matters or have a common cause of action exceeds 1% of the amount equivalent to the Gross Consideration Units as defined in the SPA multiplied by the Offer Price plus one percent of the Gross Sponsor Debt as defined in the SPA, at each time a Claim is made; and (b) the amount of the liability of the Seller for each Claim, forming part of such Claim Basket (as defined in the SPA), is not less than 0.1% of the amount equivalent to the Consideration Units multiplied by the Offer Price plus zero point one percent of the Sponsor Debt, provided that the Sellers shall in no event be liable for a Claim where the liability of the Sellers for such Claim is less than the De Minimis Loss.

Termination: The SPA shall be effective from the date of execution of the SPA, and shall continue to be valid and in full force and effect unless terminated in accordance with the below provisions:

(i) by mutual consent of the parties in writing; and

(ii) by either of the parties by notice in writing to the other parties, if the closing does not occur by 30 days from the date of opening of the Offer in accordance with the InvIT Regulations, or such other later date as may be mutually agreed by the parties in writing.

Claims Management Agreement

WUPTL has entered into a claims management agreement ("**CMA**") on January 2, 2023, as amended and restated on April 1, 2023 with Cube Infrastructure Investment Company Pte. Ltd. ("**Cube**"), Cube Highways and Infrastructure Pte. Ltd., the Trustee (acting on behalf of the Trust) and the Investment Manager in relation to certain pending claims which WUPTL has ("**Claims**"), and recovery of the consequent claim amounts. Some of the key terms of the CMA are as follows:

Treatment of Receivables: An amount of ₹165.00 million (collectively, "**Receivables**"), net of withheld amounts (as defined in the CMA) and costs, shall solely and exclusively be utilised for the purposes of redemption of the Outstanding Sponsor Debt, as defined in the CMA.

In the event that the concession period of WUPTL is extended by way of an order or settlement agreement with NHAI, in order to fulfil any Claim set out in the CMA, an amount of ₹ 1.95 million per day shall be deemed to be the monetary value for each day of such extension ("**Extension Receivables**") and shall form a part of the Receivables as of the date of grant of such Extension Receivables, and the Outstanding Sponsor Debt shall be redeemed to such extent.

Utilisation of Receivables: WUPTL shall, and the Trust shall procure that WUPTL shall, utilise the Receivables (or any part thereof) less the withheld amounts and less any reasonable costs incurred by WUPTL in relation to the Claims (including costs of providing a bank guarantee in connection with release of award pursuant to relevant NHAI circular), for the redemption of the Outstanding Sponsor Debt (or part thereof) in the manner contemplated in the Debenture Agreement, as defined in the CMA, within the timelines set out in the CMA.

Further, in the event that WUPTL fails to utilise the Extension Receivables to pay Cube in the manner set out above, the Trust shall infuse such amounts in WUPTL to ensure that WUPTL is able to redeem the Outstanding Sponsor Debt for an amount equal to the Extension Receivables (less withheld amounts and any reasonable costs incurred by WUPTL in relation to the Claims), and shall procure that WUPTL shall utilize such amount for the redemption of the Outstanding Sponsor Debt for an amount equal to the Extension Receivables, in the manner contemplated in the Debenture Agreement, within the timelines set out in the CMA.

Tax treatment of Receivables: WUPTL shall, and the Trust shall procure that WUPTL shall, utilize the outstanding business losses, unabsorbed depreciation, minimum alternate tax credit and/ or any tax holiday benefits to the extent it can be utilised under applicable law, to offset any tax liabilities that may arise on WUPTL on account of the receipt of the Receivables.

Further, WUPTL shall, unless WUPTL has obtained a written opinion by a specified accounting firm opining that no tax should be payable by WUPTL in respect of all of the Receivables ("**Accounting Opinion**"), which Accounting Opinion shall be obtained by WUPTL five days prior to the Payout Date (as defined in the CMA), withhold a specified amount of the Receivables on account of it being payable as tax on Receivables ("**Tax Withheld Amounts**"). It being clarified that in the event WUPTL obtains an Accounting Opinion, WUPTL shall not withhold any amounts from the Receivables on account of tax and the Tax Withheld Amounts in such case shall be nil.

Failure to comply with utilisation of Receivables: In the event of failure of WUPTL to utilise Receivables for redemption of the Outstanding Sponsor Debt by the Payout Date in the manner set out above for any reason whatsoever, other than on account of a prohibition under applicable law, or a Final Order (as defined in the CMA) received by WUPTL restricting utilisation of the Receivables in the manner contemplated under the CMA (in which case the parties will mutually explore and agree upon alternatives to give effect to the treatment of Receivables to achieve the same commercial outcome), the Receivables shall accrete at an interest of 10% per annum from the Payout Date until the date of redemption of Outstanding Sponsor Debt (or part thereof).

Claim management process: Some of the key steps of the Claims management process, as contemplated in the CMA, are as follows –

(i) On and from the date of execution of the CMA, Cube shall be authorised to represent WUPTL in accordance with the CMA, in all Claim Proceedings (as defined in the CMA) and shall be entitled to control, pursue, and/or deal with the Claim Proceedings on behalf of WUPTL. All costs and expenses in relation to the Claim Proceedings shall be to Cube's account and shall be borne by Cube.

(ii) On the date of execution of the CMA, (i) WUPTL shall issue an irrevocable power of attorney in favour of the nominees of Cube;* and (ii) the board of directors of WUPTL shall pass a resolution, specifically and exclusively authorising Cube or its nominees, to institute, defend, handle, control, pursue and/or deal with (including settle or compromise) the Claim Proceedings on behalf of WUPTL, through such nominees, at the sole cost of Cube.

**WUPTL has executed a power of attorney dated April 1, 2023 to authorize Mukul Shastry, a representative of Cube to do all acts, deeds, matters and things, for and on behalf of and in the name of the WUPTL as may be required in connection with or incidental to, the recovery of the Receivables by WUPTL.*

(iii) WUPTL shall not conduct or control any Claim proceedings for any Receivables, without the prior written consent of Cube.

(iv) WUPTL shall provide to Cube copies of all information and documents in relation to Receivables as are reasonably requested by Cube, and Cube shall provide WUPTL copies of all information and documents in relation to Receivables as are received by Cube. Any correspondence or communication received by WUPTL in relation to Receivables shall be forwarded to Cube within five working days of receipt of the same, and any correspondence or communication received by Cube or its agents in relation to Receivables shall be forwarded to WUPTL within five working days of receipt of the same.

Term and Termination:

Amongst others,

(i) The CMA shall be effective from the date of the CMA and shall continue to be valid and in full force and effect unless terminated in accordance with the terms of the CMA.

(ii) The CMA may be terminated by mutual consent of the parties in writing.

(iii) The CMA shall automatically stand terminated, without any further action from any part, on the date that is ten Working Days prior to March 31, 2028, being date on which the tax deduction benefits available to the SPV (as defined in the CMA) under Section 80-IA of the Income Tax Act, 1961 ceases to be available to the SPV.

(iv) The CMA shall stand automatically terminated, without any further action from any party, if (i) all Receivables are utilized in accordance with the terms of the CMA, and there are no Claims that are pending determination; or (ii) Cube has not pursued the Claims for a period of more than three continuous years.

(v) If Cube has not pursued the Claims within the applicable limitation period under the applicable law and such period has elapsed, WUPTL may issue a written notice to Cube under the CMA upon lapse of such limitation period, and where Cube has not pursued the Claim within 45 days from the date of such notice, the CMA shall stand terminated.

Acquisition of future assets by the Trust

ROFO Agreement

CH-I, CH-III, the Trustee (acting on behalf of the Trust) and the Investment Manager have entered into the ROFO Agreement, to enable the Trust to have the right to purchase assets held by CH-I and CH-III, after the Offer. Some the key terms of the ROFO Agreement are as follows:

Right of first offer: The Trust shall have a right of first offer ("**ROFO**") over fully paid up equity shares, debt securities and other similar securities ("**ROFO Securities**") of the special purpose vehicles identified in the ROFO Agreement ("**ROFO SPVs**"), held by CH-I or CH-III, as applicable (the "**Seller**"). Such ROFO will be available to the Trust from the date on which the Ordinary Units are listed and commence trading on the Stock Exchanges ("**Trust Listing Date**") and will be available until such date which is nine months from the Trust Listing Date ("**ROFO Period**").

Offer: During the ROFO Period, the Sponsors shall, from time to time, make an irrevocable invitation to offer to the Trust, through the Trustee or the Investment Manager, for the acquisition and refinancing of the ROFO Securities, regardless of whether the Sponsors have, at that point, completed the acquisition of all ROFO Securities (the "**Invitation to Offer**"). The Invitation to Offer shall specify the number of ROFO Securities held by any of the Sponsors (such entity, being the "**Seller**"), along with brief details in relation to the relevant ROFO SPVs and the road assets acquired and developed by the ROFO SPVs ("**ROFO Assets**"), such as the audited financial statements of the ROFO SPVs and the material litigations and claims involving the ROFO Assets and any other information reasonably deemed material by the Seller.

In the event the Trust is interested in the acquisition and refinancing of all (and not less than all) of the ROFO Securities set out in the Invitation to Offer, the Trust shall communicate such interest in writing within a period of seven days from the date of receipt by the Trust of the Invitation to Offer, which may be accompanied with a due diligence questionnaire that is customary for transactions of such nature (the "**Notice of Interest**"). The Seller shall provide information as requested by the Trust through the due diligence questionnaire ("**Information**") within 15 days of receipt of the Notice of Interest in such manner as set out in the ROFO Agreement, to enable the Trust to perform a due diligence exercise.

Within a period of 60 days from the date of receipt of the Information, or such other time as may be mutually agreed between the parties, provided the Seller has complied with its obligation to provide Information in accordance with the terms of the

ROFO Agreement, the Trust shall have the right but not the obligation to make an irrevocable offer to acquire all (and not less than all) of the ROFO Securities at a value as may be attributed by the Trust to such ROFO SPV (the "**ROFO SPV Offer Price**") by delivering an irrevocable offer letter (the "**ROFO SPV Offer Letter**") to the Seller. The ROFO SPV Offer Letter will be binding on the Trust.

Acceptance: The Seller may accept the ROFO SPV Offer Price, by delivering a notice of acceptance to the Trust within a period of 30 days (the "**ROFO Acceptance Period**") from the date of receipt of the ROFO SPV Offer Letter by the Seller (the "**ROFO Acceptance Notice**"). If the ROFO Acceptance Notice is received by the Trust during the ROFO Acceptance Period, the sale of the ROFO Securities shall be completed in accordance with the ROFO SPV Offer Price within a period mutually decided by the parties, subject to receipt of all consents.

Non-acceptance: In the event that (i) no ROFO Acceptance Notice from the Seller is received by the Trust during the ROFO Acceptance Period, or (ii) the Seller declines to accept the offer set out in the ROFO SPV Offer Letter made by the Trust, the Seller and the Trust shall enter into good faith negotiations for a period of up to 30 days or any other time period as may be agreed upon between the Seller and the Trust in relation to the ROFO SPV Offer Price. If the Seller and the Trust agree upon the value of the ROFO Securities, the sale of the ROFO Securities shall be completed within a period mutually decided by the parties, subject to receipt of all consents. In the event no agreement is reached, the Seller shall be entitled to sell all the ROFO Securities to any person prior to the expiry of the ROFO Period at an amount higher than the ROFO SPV Offer Price. In the event the ROFO Period has expired, the Seller shall be under no obligation to follow the procedure for tendering the offer, as set out above, if it subsequently desires to sell the ROFO Securities.

Absence of offer: In the event that the Trust (a) does not make an offer to purchase the ROFO Securities within 82 days from the receipt of the Invitation to Offer, or (b) notifies the Seller of its decision to not purchase the ROFO Securities (the "**ROFO Non-Acceptance Notice**"), then without prejudice to the other rights of the Seller, the Seller shall have the right (but not the obligation) to sell all of the ROFO Securities to any person on any terms specified by the Seller.

Conditions where ROFO shall not be applicable: The ROFO shall not apply to any disposal or acquisition or refinancing of ROFO Securities, where the Seller, after its best efforts, fails to obtain the requisite consents required, for the acquisition of such ROFO Securities by the Trust. The ROFO shall also not be applicable in the event any Governmental Authority (*as defined in the ROFO Agreement)* or the lenders of the ROFO SPV substitute or replace the ROFO SPV as the holder of the ROFO Asset pursuant to and in accordance with the terms of the Project Agreements (as defined in the ROFO Agreement), as the case may be.

Representations and warranties: Each party shall represent and warrant to the other party to the ROFO Agreement, as follows:

(i) Each party is duly organized and validly existing under applicable law, and has the right, power and authority to execute, deliver and perform the ROFO Agreement;

(ii) The ROFO Agreement has been duly executed and delivered by such party and, assuming the due authorization, execution and delivery by all other parties hereto, constitutes valid and binding obligations of such party enforceable against such party in accordance with its terms, subject to any insolvency proceedings;

(iii) The execution and delivery of the ROFO Agreement by such party and the performance by such party of its obligations under the ROFO Agreement has been duly and validly authorized by all necessary corporate action and does not require any further authorization or consent of any third party;

(iv) The execution, delivery and performance by such party of the ROFO Agreement, and the compliance by it with the provisions of the ROFO Agreement will not result in:
   (a) a breach of, or constitute a default under, any agreement or instrument to which such party is a party or by which such party is bound; or
   (b) result in a violation of its constitutional documents; or
   (c) contravene any applicable law to which it is subject, or any order, writ, injunction or decree of any court or Governmental Authority to which it is subject; and

(v) No liquidation, dissolution, winding up, commencement of bankruptcy, insolvency, liquidation or similar proceedings, whether voluntary or involuntary, with respect to it is pending or has been pending, or to the knowledge of such party, threatened.

Term and Termination: The ROFO Agreement shall become effective and binding on the parties on and from the Trust Listing Date, and shall continue to be valid and in full force and effect for the ROFO Period provided that none of the ROFO procedures set out in the ROFO Agreement are subsisting upon the expiry of the ROFO Period. In the event ROFO procedures set out in the ROFO Agreement are subsisting upon the expiry of the ROFO Period, the ROFO Agreement shall terminate immediately upon the completion of all ROFO procedures, as set out in the ROFO Agreement, apart from the procedures in relation to the signing and closing of the relevant share purchase agreements, which were initiated during the ROFO Period.

The ROFO Agreement may only be terminated in respect of a particular ROFO SPV at a time earlier than the term of the ROFO Agreement mentioned above, in the event that the Trust does not make an offer to purchase the ROFO Securities within 82 days from the receipt of the Invitation to Offer or notifies the Seller of its decision to not purchase the ROFO Securities of such ROFO SPV.

Reimbursement Agreement

The Investment Manager has entered into a reimbursement agreement dated September 7, 2022 with the Sponsors, CH-II, CH-ID and Cube Mobility ("**Reimbursing Parties**") in relation to reimbursement of certain costs (the "**Reimbursement Agreement**"). The parties to the Reimbursement Agreement have agreed that, amongst other things:

(i) *From November 23, 2021 to July 20 2022*: The Reimbursing Parties shall reimburse the expenses incurred by the Investment Manager on behalf of the Reimbursing Parties, as set out in the Reimbursement Agreement, in an agreed proportion as set out in the Reimbursement Agreement ("**Agreed Proportion**").

(ii) *September 7, 2022 onwards*: If an Incurring Party (as defined in the Reimbursement Agreement) incurs additional expenses on behalf of the Reimbursing Parties, the Incurring Party shall be required to send a reimbursement request to the Reimbursing Parties along with all necessary documentation on a monthly basis and the Reimbursing Parties may, at their sole discretion, reimburse any Incurring Party in the Agreed Proportion.

(iii) *Term:* The Reimbursement Agreement shall remain valid and in full force and effect until mutually terminated in writing.

Borrowings from Related Parties

Borrowings in the form of inter-corporate deposits, and other short term and subordinated loans were provided by the Sponsors and certain of their associates to the Initial Portfolio Assets. For details, please see the section entitled "*Financial Indebtedness and Deferred Payments*" on page 232.

Related Party Transactions of the Initial Portfolio Assets in relation to their registered office

Each of the Initial Portfolio Assets (apart from DATRL, FRHL and WVEPL) have entered into license agreements effective from September 1, 2022 with the Project Manager for the purposes of licensing certain premises owned by the Project Manager and using such premises as their registered offices.

Potential Conflicts of Interest

The Investment Manager has established certain procedures to deal with conflict of interest issues. For further details on management of potential conflicts of interest, please see the section entitled "*Related Party Transactions – Procedure for dealing with Related Party Transactions*" on page 275.

REGULATIONS AND POLICIES

The following description is a summary of certain sector specific laws currently in force in India, which are applicable to the business of the Initial Portfolio Assets, and the Trust, in the road infrastructure sector. The information summarized in this section has been obtained from statutes, regulations, publications, and sector-specific policies available in the public domain. The description set out below is not exhaustive, and is only intended to provide general information to Bidders, and is neither designed as, nor intended to substitute, professional legal advice and regulatory approvals. The interpretations, as provided hereinbelow, are subject to modification or clarification by subsequent legislative, judicial or administrative decisions. For information regarding regulatory approvals obtained by the Initial Portfolio Assets and the Trust, please see the section entitled "Regulatory Approvals" on page 294.

Regulatory Framework on Road Infrastructure

The regulatory framework in India in the highways sector, implemented on a public-private partnership ("**PPP**") basis, mainly derives its source from the primary legislations of National Highways Authority of India Act, 1988 (the "**NHAI Act**") and the National Highways Act, 1956 (the "**NH Act**") enacted by the Indian parliament, each as amended or supplemented.

The National Highways Act, 1956

The policy of the MoRTH, in implementing the NH Act, is to vest the MoRTH with the power to declare a national highway and for acquisition of land for this purpose. The GoI, by notification, can declare the intention to acquire any land for a 'public purpose' as envisaged by the law and such land can be used for building, maintenance, management and operation of the declared national highways throughout the country. The NH Act prescribes the procedure for such land acquisition. The procedure includes, *inter alia*, a declaration of an intention to acquire, entering and surveying such land, hearing of objections, a declaration of the acquisition and the power to take possession. The NH Act also provides for payment of compensation to owners and any other person whose right of enjoyment or ownership in the land has been affected. The NH Act vests MoRTH with the power to appoint a competent authority for the effective implementation of the NH Act and its policies. The said appointed authority retains the right and power to (a) survey, make any inspection, valuation or enquiry; (b) take levels; (c) dig or bore into sub-soil; (d) set out boundaries and intended lines of work; (e) mark such levels, boundaries and lines placing marks and cutting trenches; or (f) do such other acts or things as may be laid down by rules made in this behalf by that government.

All the notified national highways shall vest in the name of the Union and for the purposes, shall include all lands appurtenant thereto and all the bridges, culverts, tunnels and other enlisted constructions under the said NH Act. The Central Government shall assume the responsibility of maintaining and construction of national highways in proper condition in accordance to the law. The Central Government also retains the right to levy fee over the services and benefits rendered in relation to the use of such national highways.

The GoI is responsible for the development and maintenance of national highways. However, it may direct that such functions may also be exercised by the government of a state in which the highway is located or by any officer or authority subordinate to the GoI or to the state government. Further, the GoI has the power to enter into an agreement with any person for the development and maintenance of a part or whole of the highway. Such person would have the right to collect and retain fees at such rates as may be notified by the GoI and will also have the powers to regulate and control the traffic, for proper management of the highway, in accordance with the provisions of the Motor Vehicles Act, 1988, as amended. The GoI also has the power to make rules for carrying out the purposes of the NH Act.

The National Highways Authority of India Act, 1988

The NHAI Act was enacted in pursuance of the powers of the Central Government for appointing a competent authority under the NH Act and provides for the constitution of an authority for the development, maintenance and management of national highways and for matters connected therewith or incidental thereto. In accordance with the NHAI Act, the GoI carries out development and maintenance of the national highways through NHAI. Subject to the provisions of the NHAI Act, the NHAI has the power to enter into and perform any contract necessary for the discharge of its functions. The NHAI has the power to acquire any land to discharge its functions, and such acquired land will be deemed to be land needed for a 'public purpose'. The NHAI Act prescribes a limit in relation to the value of the contracts that may be entered into by NHAI. However, the NHAI may enter into contracts exceeding the specified value, on obtaining prior approval of the GoI. The NHAI Act provides that the contracts for acquisition, sale, or lease of immovable property on behalf of the NHAI cannot exceed a term of 30 years unless previously approved by the GoI.

NHAI's objective is to ensure that all contract awards and procurements conform to the best industry practices with regard to transparency of process, adoption of bid criteria to ensure healthy competition in award of contracts. In accordance with the NHAI Act, the NHAI shall consist of a full time chairman, not more than 6 full time members and not more than 6 part time members who are being appointed by the Central Government. Additionally, various project implementation units headed by project director have been set at various sites to oversee timely completion of the projects.

In view of the challenging task of construction, development, and management of national highways being undertaken by NHAI, the Committee on Public Undertakings selected the subject "National Highways Authority of India (NHAI)" for comprehensive examination and report. The National Highways Authority of India (Amendment) Act, 2013, received the assent of the President of India on September 10, 2013, and aimed at increasing the institutional capacity of NHAI to help execute the powers delegated to it. National Highways Development Project ("**NHDP**") was launched in 1998 with the objective of developing roads of international standards which facilitate smooth flow of traffic. The NHDP envisages creation of roads with enhanced safety features, better riding surface, grade separator and other salient features.

As per the NHAI Works Manual, 2006, NHAI's mandate is the time and cost bound implementation of the NHDP. The sources of finance available to the NHAI include fund assistance from external funding agencies like the International Bank of Reconstruction and Development and the Asian Development Bank. NHAI's role encompasses involving the private sector in provision, maintenance, and operation of the national highways.

Financing of the NHDP

The GoI, under the Central Road and Infrastructure Fund Act, 2000 created a fund which is required to be utilized for the development and maintenance of national highways (the "**Central Road Fund**"). Section 18 of the NHAI Act also provides for the creation of a separate NHAI Fund. Any capital grant or aid received, loan taken, borrowing made, or any other sum received by the NHAI is credited to the NHAI Fund. Certain sources for financing of the NHDP are through dedicated accruals under the Central Road Fund by levy of cess on fuel as well as involving the private sector and encouraging public private partnerships. The NHDP is also financed through long-term external loans from the International Bank of Reconstruction and Development, the Asian Development Bank and the Japan Bank for International Cooperation as well as through tolling of roads for different projects undertaken by the NHAI.

Private Participation in NHDP

In an effort to attract private sector participation in the NHDP, the NHAI has issued model concession agreements ("**MCAs**") which have been formulated by Planning Commission of India or NITI Aayog and other departments of Central Government where a private entity, being the concessionaire, is, through an international competitive bidding ("**ICB**") process, awarded a concession (in form of a bundle of licenses) to build, own, operate and collect toll on a road for a specified period of time. The concession to develop highway projects is given by the NHAI or other governmental authorities under various models of PPP like:

(i) Build, Operate, Transfer (BOT)/ Design, Build, Finance, Operate and Transfer (DBFOT) – In this model, the entire designing, financing and construction is undertaken by the concessionaire at its own cost. The concessionaire is entitled to collect toll or receive annuity payments from the NHAI, as the case may be, during the concession period after the construction of the highway project. The bid for the project may either be selected basis the lowest grant wanted by the private developer from the NHAI or the highest premium the private developer is willing to pay to NHAI, in the form of additional concession fee. The concessionaire at the end of the concession period transfers the highway project to the NHAI (free of charge and clear of all encumbrances). The concessionaire's investment in the highway project is recovered directly through user fees collected by way of tolls. Under the BOT model, the projects which are generally not viable based on toll revenue alone, the NHAI or the relevant governmental authority provides concessionaire with a capital grant upto certain percentage of the project cost to increase the viability of projects and the quantum of such grant is determined on a case to case basis. For certain projects with high traffic volumes, concessionaire also offers a negative grant (i.e., premium) to the NHAI.

(ii) Hybrid Annuity Model (HAM) – In this model, the NHAI or the relevant governmental authority invests 40% (forty percent) of the construction cost of the project in (five) equal instalments and the balance amount is infused by the private developer. The private developer recovers his investment in the form of annuity payments received by it over a period of 15 (fifteen) years. Additionally, there is no revenue risk for the private developer under HAM model because the toll is collected by the NHAI or relevant governmental authorities unlike the BOT model where the private developer collects it.

(iii) Toll, Operate and Transfer (TOT) – In this model, the road projects which are in operational phase are awarded by the NHAI or relevant governmental authorities to the concessionaire. The NHAI passes on the toll collection rights and operation and maintenance obligations to the concessionaire against payment of upfront concession fees quoted by the concessionaire as a part of the bidding process.

The bidding for the projects takes place in two stages as per the process provided below:

1. in the pre-qualification (RFQ) stage, the NHAI selects certain applicants on the basis of technical and financial expertise, prior experience in implementing similar projects and previous track record; and

2. in the bidding (RFP) stage, the NHAI invites financial bids from the pre-qualified applicants at the RFQ-stage on the basis of which the concession is awarded to the successful bidder by the NHAI for implementation of the project.

The GoI, under the Central Road and Infrastructure Fund Act, 2000 created a fund which is required to be utilized for the development and maintenance of national highways (the "**Central Road Fund**"). Section 18 of the NHAI Act also provides for the creation of a separate NHAI Fund. Any capital grant or aid received, loan taken, borrowing made, or any other sum received by the NHAI is credited to the NHAI Fund. Certain sources for financing of the NHDP are through dedicated accruals under the Central Road Fund by levy of cess on fuel as well as involving the private sector and encouraging public private partnerships. The sources of finance available to the NHAI also include fund assistance from external funding agencies like the International Bank of Reconstruction and Development and the Asian Development Bank. NHAI's role encompasses involving the private sector in provision, maintenance, and operation of the national highways.

In accordance with the MCAs for projects above ₹1,000 million, the concessionaire meets the upfront cost and expenditure on annual maintenance and recovers the entire cost along with the interest from toll collections during the concession period. As per the 'Guidelines for Investment in Road Sector' issued by MoRTH in 2009, in order to increase the viability of projects, a capital grant of up to 40% of the project cost is provided by the NHAI or the GoI. The quantum of grant is determined on a case to case basis and typically constitutes the bid parameter in Build, Operate, Transfer ("**BOT**") projects which are generally not viable based on toll revenue alone. For certain projects with high traffic volumes, concessionaire also offers a negative grant (i.e., premium) to the NHAI. The concessionaire at the end of the concession period transfers the road back to the Government (free of charge and clear of all encumbrances). The concessionaire's investment in the road is recovered directly through user fees collected by way of tolls. As per the MCAs for annuity based projects, the concessionaire is required to meet the entire upfront cost (no grant is paid by the NHAI or the GoI) and the expenditure on annual maintenance for annuity based projects. The concessionaire recovers the entire investment through pre- determined annuity payments to be made by the NHAI or the GoI. Furthermore, MoRTH approved certain amendments to the model concession agreement, inter-alia, in relation to deferment of premium payments.

Exit Policy

The CCEA in May 2015 approved a comprehensive exit policy framework with the objective to mobilize funds in the market. In pursuance thereto, NHAI, vide Circular No. NHAI/1103/CGM(FA)/4/2015 dated June 9, 2015 permitted divestment of 100% equity by concessionaires/developers after two years of completion of construction to facilitate unlocking of funds for new infrastructure projects. The equity divested is required to be invested by promoters in new projects. This comprehensive exit policy framework is expected to harmonize certain conditions across all concessions signed prior to 2009 with the policy framework for post 2009 contracts which permit divestment of equity up to 100%, two years after completion of construction. In line with the spirit of quoted circular, the NHAI issued another circular dated September 9, 2015 followed by the circular dated November 19, 2015, on the same subject, allowing the promoter to use the proceeds from the sale of divested equity of the concessionaire in one or more of the following:

(i). to reinvest in incomplete NHAI projects;
(ii). to reinvest any other highway projects;
(iii). any other power sector projects; or
(iv). to retire their debt to financial institutions in any other infrastructure projects.

Relaxation in the 'change in ownership' clause in Hybrid Annuity Model (HAM) projects

The MoRTH, *vide* circular dated November 10, 2020 and November 27, 2020, read along with the NHAI circular dated December 31, 2020, amended the MCAs in respect of project implemented under the HAM model, and permitted the selected bidder/consortium members, for the new as well as subsisting national highways project under the HAM-model, to transfer their equity six months after COD is achieved for the respective project.

Rationalized Compensation

The CCEA in November 2015 approved a policy for rationalized compensation to concessionaires for languishing national highway projects in BOT mode for delays that are not attributable to the concessionaires. Under the policy, the NHAI is authorized to allow an extension of the concession period for BOT (Toll) projects while keeping the original operation period unchanged. The NHAI has also been authorised to pay compensatory annuities to the concessionaire corresponding to the actual period of delay that is not attributable to the concessionaire upon successful completion of the project. In these cases, the construction period will be enhanced but the tenure of the concession will remain unchanged.

One Time Fund Infusion Scheme

The CCEA in October 2015 gave its approval to the NHAI for a one-time infusion of funds with the purpose of reviving and physically completing stalled projects in the advanced stages of completion. As per the policy, the amount of funds required in each case shall be approved by NHAI on a case to case basis.

Bidder Information

MoRTH has developed the Bidder Information Management System ("**BIMS**") to streamline the process of pre- qualification of bidders for EPC mode of contracts for all national highway works, with enhanced transparency and objectivity. BIMS works as a data base of bidder information that covers basic details, civil works experience, cash accruals and network, and annual turnover so that bidders' pre-qualification can be assessed based on evaluation parameters like threshold capacity and bid capacity from already stored data and the technical evaluation can be carried out in a faster manner.

Land Acquisition

While land is acquired for national highway projects under the NH Act, the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (the "**Land Acquisition Act**") must also be complied with. MoRTH has issued comprehensive guidelines on land acquisition for national highways taking into account the applicability of the Land Acquisition Act.

Arbitral Awards

CCEA on August 31, 2016 approved various measures to revive the construction sector. An office memorandum dated September 5, 2016 was issued by the National Institute for Transforming India with certain proposals. On November 20, 2019, the CCEA approved certain proposals in relation to the arbitrations by or against government entities, for the effective implementation of the CCEA's decision on August 31, 2016 on its initiatives to revive the construction sector. Initially, the CCEA had approved the proposal that government agencies will be required to pay 75% of the arbitral award to the concessionaire against a bank guarantee, in cases where the award already announced is challenged. However, pursuant to a press release dated November 20, 2019, the CCEA approved, inter-alia, that where a government entity has challenged an arbitral award, resultant of which the amount of the arbitral award has not been paid, 75% of such award will be paid by the government entity to the contractor or the concessionaire against a bank guarantee only for the said 75% and not for its interest component. In relation to interest payable to the government entity, if a subsequent court order required the refund of 75% of the amount, the payment of such amounts will be required to be made as per the court orders.

Applicable Rules

As per the NH Act and the NHAI Act, the Central Government is empowered to make rules in order to further the objects of NH Act and NHAI Act. In exercise of such power, the Central Government has framed certain rules which are, amongst others, as follows:

- The National Highways Rules, 1957, as amended;
- National Highways Authority of India (Budget, Accounts Audit, Investment of Funds and Powers to enter Premises) Rules, 1990, as amended;
- The National Highways (Manner of Depositing the Amount by the Central Government with Competent Authority for Acquisition of Land) Rules, 1998;
- The National Highways Tribunal (Procedure for Appointment as Presiding Officer of the Tribunal) Rules, 2003, as amended;
- The National Highways Tribunal (Procedure) Rules 2003;
- National Highways Authority of India (The Term of Office and Other Conditions of Service of Members) Rules, 2003, as amended;
- The Central Road Fund (State Roads) Rules, 2007;
- The National Highways Tribunal (Financial and Administrative Powers) Rules, 2004;
- The National Highways Tribunal (Procedure for Investigation of Misbehaviour or Incapacity of Presiding Officer) Rules, 2003;
- The National Highways Fee (Determination of Rates and Collection) Rules, 2008, as amended;
- The Highway Administration Rules, 2004;
- The National Highways (Collection of Fees by any person for the use of Section of National Highways/Permanent Bridges/Temporary bridge on National Highways) Rules, 1997
- The National Highways (Fee for the use of National Highways and Permanent Bridge public Funded Project) Rules, 1997;
- The National Highways (Rate of Fee) Rules, 1997;
- Construction Workers (Regulation of Employment and Conditions of Services) Act, 1996 and Central Rule, 1998;
- C.E.A. (Measures Relating to Safety and Electric Supply) Regulations, 2010;
- Central Electronical Authority (Measures Relating to Safety and Electric Supply) Regulations, 2020; and

- Indian Electricity Rules, 1956

Environmental Compliances and Regulations

Infrastructure projects must also ensure compliance with environmental legislations such as the Water (Prevention and Control of Pollution) Act, 1974 ("**Water Pollution Act**"), the Air (Prevention and Control of Pollution) Act, 1981 ("**Air Pollution Act**") and the Environment Protection Act, 1986, as amended ("**Environment Act**", together with the Water Pollution Act and the Air Pollution Act, the "**Environment Protection Acts**"). The Water Pollution Act aims to prevent and control water pollution. This legislation provides for the constitution of a central pollution control board ("**Central Pollution Control Board**" or "**CPCB**") at the Central level and state pollution control boards ("**State Pollution Control Boards**" or "**SPCBs**", together with the Central Pollution Control Board, the "**PCBs**") at the State levels. The functions of the CPCB includes, among other things, coordination of activities of the SPCBs, collecting data relating to water pollution and the measures devised for the prevention and control of water pollution and prescription of standards for streams or wells. The SPCBs are responsible for, among other things, the planning for programmes for prevention and control of pollution of streams and wells, collecting and disseminating information relating to water pollution and its prevention and control, inspection of sewage or trade effluents, works and plants for their treatment and to review the specifications and data relating to plants set up for treatment and purification of water, laying down or annulling the effluent standards for trade effluents and for the quality of the receiving waters, and laying down standards for treatment of trade effluents to be discharged. These authorities issue consent to establish and consent to operate which are to be required to be renewed periodically. These authorities also have the power of search, seizure and investigation if the authorities are aware of or suspect violation of such regulations. This legislation prohibits any person from establishing any industry, operation or process or any treatment and disposal system, which is likely to discharge trade effluent into a stream, well or sewer, or bring into use any new or altered outlet for discharge of sewage, or begin to make any new discharge of sewage without taking prior consent of the SPCBs.

In context of the environmental compliances and regulations, the National Green Tribunal Act, 2010 (the "**NGT Act**") is an important legislation which provides for the establishment of a National Green Tribunal ("**NGT**") for the effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto.

In accordance with the Forest (Conservation) Act, 1980, state governments are not permitted to make any order de-reserving any reserved forest or directing the use of forest land for a non-forest purpose, or assignment of any forest land through lease or otherwise to any private person or corporation without the approval of the GoI. The Ministry of Environment, Forest and Climate Change ("**MoEF**") mandates the Environment Impact Assessment ("**EIA**") must be conducted for specified projects. In the process, the MoEF receives proposals or the setting up of projects and assesses their impact on the environment before granting clearances to the projects.

The EIA Notification S.O. 1533, issued on September 14, 2006 (the "**EIA Notification**") as amended and amended from time to time, under the provisions of the Environment Protection Act, prescribes that new construction of specified projects require prior environmental clearance from the MoEF. The environment clearance must be obtained from MoEF according to the procedure specified in the EIA Notification. No construction work or preparation of land by the project management except for securing the land, relating to the setting up of a specified project can be undertaken until such clearance is obtained. Under the EIA Notification, the environmental clearance process for new projects consists of four stages – screening, scoping, public consultation and appraisal. After completion of public consultation, the applicant is required to make appropriate changes in the draft 'EIA Report' and the 'Environment Management Plan.' The final EIA Report has to be submitted to the concerned regulatory authority for appraisal. The regulatory authority is required to give its decision within 105 days of the receipt of the final EIA Report. The EIA Guidance Manual for Highways, 2010 explains the four stages of the environmental clearance process and the contents of the EIA Report required to be submitted by highway projects.

Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

The Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, as amended, impose an obligation and duty on the owners and operators of any facility or industry with a capability to create hazardous materials to safely dispose of such material in transport and other means of collecting and storing. Each occupier and operator of any facility generating hazardous waste is required to obtain an approval from the relevant state pollution control board for collecting, storing and treating the hazardous waste.

Green Highways (Plantation, Transplantation, Beautification and Maintenance) Policy, 2015

In September 2015, MoRTH has launched Green Highways (Plantation, Transplantation, Beautification and Maintenance) Policy, 2015, which will require road developers to earmark 1% of a project's total cost for planting of trees and shrubs along the national highways. Under this policy, the maintenance of such plantations will be outsourced through a bidding process to plantation agencies. MoRTH/NHAI will appoint the authorized agency for empanelment of such plantation agencies.

Public Liability Insurance Act, 1991

The Public Liability Insurance Act, 1991 (the "**Public Liability Act**"), imposes liability on the owner or controller of hazardous substances for any damage arising out of an accident involving such hazardous substances. A list of 'hazardous substances' covered by the legislation has been enumerated by the GoI by way of a notification. The owner or handler is also required to take out an insurance policy insuring against liability under the legislation. The rules made under the Public Liability Act mandate that the employer has to contribute towards the Environment Relief Fund, a sum equal to the premium paid on the insurance policies. This amount is payable to the insurer.

Labour Laws and Other Regulations

The laws and regulations to employment that may be applicable to the Trust, the Investment Manager, the Sponsors, and the Initial Portfolio Assets include the following:

- Factories Act, 1948;
- Contract Labour (Regulation and Abolition) Act, 1970;
- Payment of Bonus Act, 1965;
- Employees' State Insurance Act, 1948;
- Employees' Provident Funds and Miscellaneous Provisions Act, 1952;
- Payment of Gratuity Act, 1972;
- Shops and Commercial Establishments Acts, where applicable;
- Minimum Wages Act, 1948;
- Industrial Disputes Act, 1947;
- Employees' Compensation Act, 1923;
- Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013;
- Child Labour (Prohibition and Regulation) Act, 1986; and
- Maternity Benefit Act, 1961.

The Occupational Safety, Health and Working Conditions Code, 2020 (enacted by the Parliament of India and assented to by the President of India on September 28, 2020) will come into force on such date as may be notified in the official gazette by the Central Government and different dates may be appointed for different provisions of the Occupational Safety, Health and Working Conditions Code, 2020. Once effective, it will subsume, amongst others, the Factories Act, 1948 and the Contract Labour (Regulation and Abolition) Act, 1970.

The Code on Social Security, 2020 (enacted by the Parliament of India and assented to by the President of India on September 28, 2020) has been notified to the extent of Section 142 of the Code on Social Security, 2020 and will come into force in its entirety on such date as may be notified in the official gazette by the Central Government. Different dates may be appointed for different provisions of the Code on Social Security, 2020. Once effective, it will subsume, amongst others, the Employees' Compensation Act, 1923, the Employees' State Insurance Act, 1948, the Employee's Provident Fund and Miscellaneous Provisions Act, 1952, the Maternity Benefit Act, 1961 and the Payment of Gratuity Act, 1972.

The Code on Wages, 2019 (enacted by the parliament of India and assented to by the President of India on August 8, 2019) was notified in the official gazette by the Central Government on December 18, 2020 to the extent of certain provisions governing the constitution and functions of the central advisory board under the Code on Wages. Once notified and effective in its entirety, it will subsume the Equal Remuneration Act, 1976, the Minimum Wages Act, 1948, the Payment of Bonus Act, 1965 and the Payment of Wages Act, 1936. Further, multiple states have been issuing draft rules in relation to the same.

In addition to the above, various state shops and commercial establishments acts are also applicable to the Initial Portfolio Assets.

Other applicable law

The Motor Vehicles Act, 1988

The development, maintenance and management as well as control of the National Highways are regulated by the NH Act and the NHAI Act. Under the Motor Vehicles Act, 1988, some powers have been delegated to the Transport Department of the State Governments.

Section 138 of the Motor Vehicles Act, 1988 further empowers the State Governments to make rules for the control of traffic, including for the purpose of the removal and the safe custody of vehicles including their loads which have broken down or which have been left standing or have been abandoned on roads; the installation and use of weighing devices; the maintenance and management of wayside amenities complexes; the exemption from all or any of the provisions of relating to fire brigade vehicles, ambulances and other special classes or descriptions of vehicle, subject to such conditions as may be prescribed; the maintenance and management of parking places and stands and the fee, if any, which may be charged for their use; prohibiting

the taking hold of or mounting of a motor vehicle in motion; prohibiting the use of foot-paths or pavements by motor vehicles, generally, the prevention of danger, injury or annoyance to the public or any person, or of danger or injury to property or of obstruction to traffic.

Motor Vehicles (Amendment) Act, 2019

The Motor Vehicles (Amendment) Act, 2019, is targeted towards bringing changes in the transport sector to encourage safer driving practices among Indian motor vehicle drivers. It proposes to create a National Road Safety Board, which has been notified by the MoRTH in September 2021. The National Road Safety Board shall be responsible for promoting road safety, innovation and adoption of new technology and for regulating traffic and motor vehicles.

Indian Trusts Act, 1882

The Indian Trusts Act, 1882 ("**Trusts Act**") governs all private trusts in India.

The Trusts Act sets out the purpose for which private trusts can be established, the manner in which they may be created, executed and extinguished. The person creating a trust under the Trusts Act is the author of such trust, the person to whom the author grants the power and authority to regulate the trust is the trustee and the persons for whose benefit such trust has been created are the beneficiaries of such trust. The Trust Act sets out the rights, duties, liabilities and powers of the trustees and the beneficiaries vis-a-vis the trust. The Trust has been settled in accordance with the provisions of the Trusts Act.

Control of National Highways (Land and Traffic) Act, 2002

The Control of National Highways (Land and Traffic) Act, 2002 (the "**Control of NH Act**") provides for control of land within national highways, right of way and traffic moving on national highways and also for removal of unauthorised occupation thereon.

In accordance with the provisions of the Control of NH Act, the Central Government has established Highway Administrations. Under the Control of NH Act, all land that forms part of a highway which vests in the Central Government, or that which does not already vest in the Central Government but has been acquired for the purpose of highways shall be deemed to be the property of the Central Government. The Control of NH Act prohibits any person from occupying any highway land or discharging any material through on such land without the permission of the Highway Administration or any officer authorised by such administration. The Control of NH Act permits the grant of lease and license for use of highway land for temporary use.

Indian Tolls Act, 1851

In accordance with the Indian Tolls Act, 1851 (the "**Tolls Act**"), the state governments have been vested with the power to levy tolls at such rates as they deem fit, to be levied upon any road or bridge, made or repaired at the expense of the Central or any state government. The tolls levied under the Tolls Act, are deemed to be 'public revenue' and the collection of tolls can be placed under any person the State governments' deem fit. Such persons are enjoined with the same responsibilities as if they were employed in the collection of land revenue. Further, all police officers are bound to assist the toll collectors when required in the implementation of the Tolls Act. The Tolls Act further gives power for recovery of toll and exempts certain category of people from payment of toll.

National Highways Fee (Determination of Rates and Collection) Rules, 2008

The National Highways Fee (Determination of Rates and Collection) Rules, 2008 (the "**NH Fee Rules**"), regulates the collection of fee for the use of national highways. In accordance with the NH Fee Rules, the GoI may, by a notification, levy fee for use of any section of a national highway, permanent bridge, bypass or tunnel forming part of a national highway, as the case may be. However, the GoI may, by notification, exempt any section of a national highway, permanent bridge, bypass or tunnel constructed through a public funded project from levy of such fee.

The NH Fee Rules supersede the National Highways (Temporary Bridges) Rules, 1964, the National Highways (Collection of Fees by any Person for the Use of Section of National Highways/ Permanent Bridge/ Temporary Bridge on National Highways) Rules, 1997, the National Highways (Fees for the use of National Highways Section and Permanent Bridges Public Funded Project) Rules, 1997 and the National Highways (Rate of Fees) Rules, 1997 other than in respect of things done or omitted to be done under such rules prior to supersession. The NH Fee Rules do not apply to agreements and contracts executed or bids invited prior to the publication of such rules i.e. prior to December 5, 2008.

The collection of fee in case of a public funded project shall commence within 45 days from the date of completion of the project. The NH Fee Rules further provide for the base rate of fee applicable for the use of a section of the national highway for different categories of vehicles and the fees collected by the executing authority shall be remitted to the GoI. However, the GoI may, by notification, allow any or all of the executing authorities to appropriate the whole, or part of such fees for purposes as may be specified.

FASTag lanes on fee plazas is a policy initiative of the GoI in which there is an exclusive lane in the fee plaza for movement of vehicles fitted with FASTag. The FASTag is a device which is fitted on the front windscreen of vehicles to indicate online toll payment. The amended NH Fee Rules impose a penalty equivalent to two times the fee applicable if a vehicle not fitted with FASTag enters the exclusive FASTag lane. However, in case a user is unable to pay, due to malfunctioning electronic toll collection infrastructure, the user will be permitted to pass the fee plaza without payment.

The NH Fee rules were also amended to provide that the driver or owner of a mechanical vehicle which is loaded in excess of permissible load specified for its category, (i) shall not be permitted to use the national highway or cross the fee plaza until the excess load has been removed, and (ii) shall be liable to pay a fee to the toll collection agency equal to ten times of the fee applicable to such category of mechanical vehicle. However, in case no weighbridge has been installed at the toll plaza, no fee for overloading shall be levied. The Central Government, in exercise of its powers under the amended NH Fees Rules, 2008 has issued National Highways Fee (Determination of Rates and Collection) Amendment Rules, 2022, whereby the "closed user fee collection system" has been introduced. For this purpose, the executing authority may establish fee plazas on national highways.

The National Highways Rules, 1957 (the "NH Rules")

The NH Rules provide that in situations where the estimate cost of the execution of any original work on a national highway exceeds ₹ 1,000,000, a detailed estimated of the cost is to be forwarded to the GoI. An application for allotment of funds for meeting expenditure on an original work on a national highway must also be made to the GoI. The executing agency of the highway is required to furnish monthly progress reports and a completion report on the conclusion of the work. The NH Rules also give the consulting engineer of the GoI the right to inspect the work while it is in progress or after completion.

National Monetisation Pipeline (NMP)

NITI Aayog has developed the pipeline, in consultation with infrastructure line ministries, based on the mandate for 'Asset Monetisation' for roads and highways, amongst others, under Union Budget 2021-22. The framework for monetisation of core asset monetisation has three key imperatives: (i) monetization of 'rights' not 'ownership' i.e. assets will be handed back to the government at the end of transaction life; (ii) brownfield de-risked assets and stable revenue streams; and (iii) structured partnerships under defined contractual frameworks with strict performance standards. This shall include selection of de-risked and brownfield assets with stable revenue generation profile with the overall transaction structured around revenue rights. The primary ownership of the assets under these structures shall be with the government.

Provisions under the Constitution of India and other legislations in relation to collection of toll

Entry 59, List II of Schedule VII read with Article 246 of the Constitution of India vests state governments with the power to levy tolls. Further, in accordance with the Tolls Act, state governments have been vested with the power to levy tolls at such rates as they deem fit.

Foreign Investment Regulations

Foreign investment in Indian securities is governed by the provisions of the FEMA, as amended, read with the applicable FEMA Rules, the FEMA (Mode of payment and Reporting of Non-Debt Instruments) Regulations, 2019 and the consolidated FDI Policy issued by the Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, Government. Foreign investment is permitted (except in the prohibited sectors) either through the automatic route or the approval route, depending upon the sector in which foreign investment is sought to be made. Under the FEMA Rules and the current consolidated FDI Policy, effective from October 15, 2020, an infrastructure investment trust registered and regulated by the SEBI under the InvIT Regulations, being an 'investment vehicle', is permitted to receive foreign investment from a person resident outside India (subject to Press Note 3 (2020 series)), including an FPI or an NRI subject to the terms and conditions specified in the FEMA Rules.

Downstream investment by an infrastructure investment trust shall be regarded as indirect foreign investment if neither the sponsor nor the investment manager of such an infrastructure investment trust is Indian 'owned and controlled' as defined in FEMA Rules.

Downstream investment by an 'investment vehicle' shall have to conform to the sectoral caps and conditions/restrictions, if any, as applicable to the company in which the downstream investment is made as per the FDI Policy. Foreign investment of up to 100% through the automatic route is permitted in the infrastructure sector in India. An infrastructure investment trust that receives foreign investment shall be required to make such report and in such format to the RBI or to the SEBI as may be prescribed by them from time to time.

The payment for the units of an infrastructure investment trust acquired by a person resident or registered/ incorporated outside India shall be made by an inward remittance from abroad through banking channels or by way of swap of shares of an SPV, or

out of funds held in a Non-resident External ("**NRE**") or Foreign Currency Non-resident Bank ("**FCNR(B)**") account maintained in accordance with the Foreign Exchange Management (Deposit) Regulations, 2016.

Further, any person who is a non-resident and holds units of an infrastructure investment trust in accordance with the FEMA Rules may pledge such units (i) in favour of a bank in India to secure the credit facilities being extended to the Indian company for bona fide purposes; (ii) in favour of an overseas bank to secure the credit facilities being extended to the person, or a person resident outside India who is the promoter of the Indian company or the overseas group company of the Indian company; (iii) in favour of a Non-Banking Financial Company registered with the RBI to secure credit facilities being extended to the Indian company for bona fide purposes; and (iv) subject to the authorized dealer bank satisfying itself of the compliance of the conditions stipulated by the RBI in this regard.

In addition to the above, compliance with the provisions of various tax-related legislations, intellectual-property related legislations and other applicable law for our day-to-day operations is also required.

REGULATORY APPROVALS

Provided below are the material consents, licenses, permissions, registrations and approvals from the Government, various governmental agencies and other statutory and/or regulatory authorities with which (i) the Trust and the Initial Portfolio Assets can undertake the Offer and the transactions contemplated in relation to the Offer; and (ii) the Trust and the Initial Portfolio Assets can undertake their respective current business activities, as applicable. Unless otherwise stated, these approvals are valid as of the date of this Final Placement Memorandum. In the event that any of the approvals and licenses that are required for the Initial Portfolio Asset's business operations expire in the ordinary course of business, the Initial Portfolio Assets will apply for such renewal from time to time. For details in connection with the regulatory and legal framework within which the Trust and the Initial Portfolio Assets operate, please see the section entitled "Regulations and Policies" on page 285.

A. Approvals in relation to the Offer

1. Resolutions dated July 11, 2022 and March 22, 2023, passed by the board of directors of the Investment Manager in relation to the Offer and other incidental matters.

2. In-principle listing approval from BSE dated August 3, 2022, extended by way of letters dated December 1, 2022 and March 10, 2023.

3. In-principle listing approval from NSE dated September 2, 2022, extended by way of letters dated November 3, 2022 and February 2, 2023.

4. Final approvals dated (i) September 29, 2022 to FRHL and NDEPL; (ii) October 19, 2022, to JMTL and MBEL; (iii) October 28, 2022 to GAEPL; (iv) November 11, 2022 to HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL; (v) December 6, 2022 to WVEPL; (vi) January 11, 2023 to APEL; (vii) January 20, 2023 to WUPTL; and (viii) March 22, 2023 to DATRPL issued by the NHAI in relation to the transfer of aforesaid Project SPVs to the Trust and other related matters.

B. Approvals in relation to the Trust

1. Certificate of registration dated April 5, 2022, bearing registration number IN/InvIT/22-23/0022, issued by SEBI to the Trust pursuant to Regulation 3 of the InvIT Regulations, for registration of the Trust as an infrastructure investment trust.

C. Material Business Approvals in relation to Initial Portfolio Assets

I. APEL

a. Environment clearance dated May 19, 2006 issued by Ministry of Environment and Forest for upgrading existing 2 lane to 4 lane divided carriageway configuration of Kothakota to Kurnool section of NH-7 from existing km 135.469 to km 211.000 by NHAI.

b. Certificate of registration of establishment dated June 4, 2019 issued by Department of Labour, Government of National Capital Territory of Delhi.

c. Certificate of registration dated June 12, 2017 issued by Labour Department, Government of Telangana under Section 7(3) of Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.

d. Certificate of registration dated November 24, 2021 issued by Labour Department, Government of Telangana under Telangana Shops and Establishments Act, 1988.

e. Completion Certificate dated September 26, 2022 issued by Aarvee Associates Architects, Engineers and Consultants Private Limited, Independent Consultant for 4-laning of Kottakota-Kurnool section of NH-7 (km 135.469 to km 211.000) in the state of Andhra Pradesh on BOT (Annuity) basis.

f. No-objection granted by the Government of Telangana for extraction of groundwater from an existing operational borewell in Pullur District.

II. *DATRPL*

a. Environment clearance dated July 23, 2012 issued by Ministry of Environment & Forests for widening and improvement of six-laning of Delhi-Agra section of NH-2 from km 20.500 to km 199.000 in the state of Haryana and Uttar Pradesh.

b. Forest clearance stage-I approval dated May 8, 2012 issued by Ministry of Environment & Forests for diversion of 189.48 ha of forest land in favour of Project Director, CMU, NHAI, Faridabad for both side widening of NH-2 from km 2.0 to km 44.200 falling under Faridabad district and km 44.200 to 93.800 falling under Palwal district, Haryana.

c. Forest clearance stage-I approval dated June 21, 2012 issued by Ministry of Environment & Forests for diversion of 252.81 ha of forest land and cutting of 61813 trees for upgradation and widening of NH-2 from km 93.800 to km 176.760 (Mathura) and km 176.760 to km 199.600 (Agra) in Mathura and Agra district of Uttar Pradesh.

d. Forest clearance stage-II approval April 16, 2013 dated issued by Ministry of Environment & Forests for diversion of 189.48 ha of forest land in favour of Project Director, CMU, NHAI, Faridabad for both side widening of NH-2 from km 2.0 to km 44.200 falling under Faridabad district and km 44.200 to 93.800 falling under Palwal district, Haryana.

e. Forest clearance stage-II approval dated August 23, 2013 issued by Ministry of Environment & Forests for diversion of 252.81 ha of forest land and cutting of 61813 trees for upgradation and widening of NH-2 from km 93.800 to km 176.760 (Mathura) and km 176.760 to km 199.600 (Agra) in Mathura and Agra district of Uttar Pradesh.

f. In-principle approval dated January 7, 2020 issued by NHAI for harmonious substitution of existing shareholders of DATRPL with CH-III and final approval dated November 17, 2020 issued by NHAI for harmonious substitution of existing shareholders of DATRPL with CH-III.

g. Provisional certificate of completion dated May 20, 2022 issued by the independent engineer.

h. No-objection certificate granted by Ground Water Department, Ministry of Jal Shakti, Government of Uttar Pradesh to DATRL, for ground water extraction from existing borewell at Mahuvan toll plaza, Mathura, Uttar Pradesh, valid until January 31, 2028.

III. ***FRHL***

a. Environment clearance dated September 16, 2008 issued by Ministry of Environment & Forests for widening and strengthening of existing 2 lane to 4/6 lane from Farakka to Raiganj section from km 295 to km 398 of NH-3 in the State of West Bengal.

b. No Objection Certificates No. PG/DOES/342 and PG/DOES/343 dated March 16, 2018 issued by Chief Electrical Inspector, Directorate of Electricity, Government of West Bengal for installation of 2*180 KVA, 415V, 3-phase, 50HZ, A.C. Stand by Outdoor Canopy D.G. Set of make M/s Stanford Alternator in FRHL, Lakshmipur (Farakka) Toll Plaza on NH-34, P.O. Pubaran, Baisnabnagar, District Malda.

c. Renewed Labour License No. 46/L(S0)/2017-E,3 dated March 6, 2017 issued by Ministry of Labour and Employment under Section 12(1) of the Contract Labour (Regulation and Abolition) Act, 1970, valid until March 5, 2024.

d. Certificate of registration dated March 6, 2017 issued by Ministry of Labour and Employment under The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.

e. Certificate of completion dated March 25, 2022 issued by the independent engineer.

f. Re-financing approval dated November 17, 2022 issued by NHAI for re-financing of existing debt of ₹6,636.10 million and additional debt of ₹ 2,238.50 million, as outstanding on September 30, 2022.

IV. GAEPL

a. Environmental clearance dated March 3, 2009 issued by Ministry of Environment and Forest.

b. Forest clearance dated March 30, 2012 issued by Ministry of Environment and Forest.

c. Registration certificate of shop or commercial establishment dated April 1, 2019 issued by Labour Department, Uttar Pradesh under the Uttar Pradesh Shops and Commercial Establishment Act, 1962, valid until March 31, 2024.

d. Completion certificate dated April 23, 2022 issued by the independent engineer.

V. ***HTL***

a. Environment clearance dated February 19, 2007 issued by Ministry of Environment & Forests.

b. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to HTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105461.

c. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

VI. *JLTL*

a. Environment clearance dated January 17, 2007 issued by Ministry of Environment & Forests.

b. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to JLTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105473.

c. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

VII. *JMTL*

a. Certificate of completion dated March 9, 2015 issued by LEA Associates South Asia Pvt. Ltd., Consulting Engineers & Planners for improvement, operation, maintenance, rehabilitation and strengthening of existing 2-lane road and widening to 4-lane of divided highway of Mahua-Jaipur section of NH-11 from km 120.000 to 228.000 in the state of Rajasthan on build, operate and transfer basis under NHDP Phase-IIIA.

b. Environmental clearance vide letter dated August 1, 2006 under the provisions of Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and the notification issued by MOEF on environmental impact assessment dated January 27, 1994.

c. No-objection certificate dated May 6, 2006 issued by RSPCB addressed to the Secretary, MoEF, stating that RSPCB had communicated its' no objection to an application being made by the JMTL to MoEF for obtaining an environmental clearance in relation to the project.

d. Consent to establish issued by RSPCB *vide* letters dated August 16, 2018 and August 20, 2018 under Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 and Section 25 of the Water (Prevention & Control of Pollution) Act, 1974.

e. Certificate of Importer Exporter Code issued by the office of the Ministry of Commerce and Industry, GOI, allotting IEC number 0905013212.

f. Renewed license issued by Regional Labour Commissioner (Central), GOI *vide* its letter dated September 1, 2022 under the Contract Labour (R&A) Act, 1970, valid up to August 10, 2023.

g. Re-financing approval dated November 17, 2022 issued by NHAI for re-financing of existing debt of ₹ 2,081.20 million, as outstanding on September 30, 2022.

h. No-objection certificates granted by the Central Ground Water Authority, Government of India for ground water abstraction.

VIII. *JVTL*

a. Environment clearance dated January 17, 2007 issued by Ministry of Environment & Forests.

b. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to JVTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105496.

c. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

IX. *KETL*

a. Registration certificate dated October 15, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to KETL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020158480.

b. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

X. *KMTL*

a. No-objection certificate granted by Central Ground Water Authority under Department of Water Resources, River Development and Ganga Rejuvenation, Government of India to KMTL, for ground water abstraction with NOC number CGWA/NOC/INF/ORIG/2021/13127 valid from September 29, 2021 to September 27, 2026 for an existing well.

b. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to KMTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105504.

c. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XI. *LRTL*

d. Environment clearance dated July 10, 2012 issued by Ministry of Environment & Forests.

e. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to LRTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105510.

f. No-objection certificate granted by Ground Water Department, Ministry of Jal Shakti, Government of Uttar Pradesh to LRTL, for ground water extraction from existing borewell.

g. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XII. *MBEL*

a. Certificate of completion dated September 13, 2009 issued by Aarvee Associates Architects Engineers and Consultants Private Limited for improvement, operation and maintenance rehabilitation and strengthening of the existing 2-lane road and widening to 4-lane divided highway of Bharatpur-Mahua section of National Highway 11 from km 63.00 to km 120.00 in the state of Rajasthan on BOT basis.

b. Consent issued by RSPCB under the Section 25 and Section 26 of the Water (Prevention and Control of Pollution) Act, 1974 and Section 21(4) of the Air (Prevention and Control of Pollution) Act, 1981 for the Ludhwai and Amoli Toll Plazas established on the project highway.

c. Renewed certificate of registration issued by the Licensing Officer and Assistant Labour Commissioner, GOI *vide* its letter dated September 13, 2022 under the Contract Labour (Regulation and Abolition) Act, 1970 valid up to October 4, 2023.

d. Registration certificate dated July 12, 2016 under Section 7(3) of the Buildings and Other Construction Workers (Regulation of Employment and Condition of Service) Act, 1996 bearing registration number BOCW/2016/14/396524.

e. No-objection certificates granted by Central Ground Water Authority, Government of India to MBEL for groundwater abstraction from borewells.

XIII. *MKTL*

a. Registration certificate dated July 31, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to MKTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020105516.

b. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XIV. ***NDEPL***

a. Environment Clearance dated March 13, 2007 issued by Ministry of Environment & Forests for upgradation of existing 2 lane road from Nelamangala to Bommanhalli (28.200 km to 107.900 km) to 4/6 laning of NH-48 in the state of Karnataka under NHDP phase III by NHAI.

b. No objection certificate granted by Karnataka Ground Water Authority bearing number KGWAN1267136360 for extraction of groundwater at the toll plaza located at Nagamangala taluk, valid for a period of five years from December 13, 2022.

c. Final approval bearing reference no. NHAI/CGM(F)/SBI/2020 dated September 18, 2020 issued by NHAI for substitution of Concessionaire i.e. Lanco Devihalli Highways Limited by Cube Highways and Infrastructure Pte Ltd.

d. Provisional certificate of completion dated June 23, 2012 issued by the independent engineer.

e. Approval dated May 24, 2022 issued by District Groundwater Directorate, Bengaluru Rural District to permit the utilization of borewell for drinking purposes.

f. Re-financing approval dated November 17, 2022 issued by NHAI for re-financing of existing debt of ₹ 2,174.80 million and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XV. ***NKTL***

a. Registration certificate dated October 28, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to NKTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020170413.

b. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XVI. ***SMTL***

a. Registration certificate dated October 28, 2020 issued by Department of Labour, Government of National Capital Territory of Delhi to SMTL evidencing certification as an establishment under the Delhi Shops & Establishment Act, 1954 with registration number 2020170420.

b. No objection certificate granted by Water Resource Department, Public Works Department, Government of Tamil Nadu for withdrawal of groundwater bearing certificate number 181/2021 valid for a period of three years from November 23, 2021.

c. Re-financing approval dated January 6, 2023 issued by NHAI for availing refinancing facility from the Trust amounting to ₹ 34,382.50 million to repay the outstanding debt of State Bank of India. and additional debt of ₹ 473.30 million, as outstanding on September 30, 2022.

XVII. ***WVEPL***

a. Environment Clearance dated September 15, 2008 issued by Ministry of Environment and Forests for widening and strengthening of 4/6 laning of WVEPL from 182.250 km to 240.000 km in the State of Kerala by NHAI.

b. Certificate of completion certificate dated October 31, 2015 issued by the independent engineer.

c. Re-financing approval dated December 30, 2022 issued by NHAI for re-financing of existing debt of ₹ 1,190.00 million

and additional loan - I of ₹719.80 million and additional loan – II of ₹24.70 million, as outstanding on June 30, 2022.

XVIII. *WUPTL*

a. Authorisation dated March 12, 2019 issued by UPPCB under the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for generation, collection, utilisation, storage and disposal or any other use of hazardous or other wastes or both on the premises or at the premises of the Project, valid up to March 12, 2024.

b. Consent dated February 3, 2019 issued by UPPCB under Sections 25 and 26 of the Water (Prevention and Control of Pollution) Act, 1974 for the disposal of its industrial effluents through the effluence treatment plant for irrigation/ or to the river through drains, and discharge of domestic effluents through septic tanks, valid up to March 31, 2023.*

c. Consent dated February 3, 2019 issued by UPPCB under Sections 21 and Section 22 of the Air (Prevention and Control of Pollution) Act, 1981, for the emission of air pollutants from the diesel generator installed at the Toll Plazas by the Company, valid up to March 31, 2023.*

d. Renewed certificate of Registration issued by the office of the Regional Labour Commissioner, GOI *vide* its letter dated June 13, 2022 under the Contract Labour (Regulation and Abolition) Act, 1970, valid up to June 5, 2023.

e. Certificate of completion dated June 2, 2016 issued by the independent engineer.

f. Re-financing approval dated February 10, 2023 issued by NHAI for re-financing of existing debt of ₹ 726.40 million, as outstanding on December 31, 2022.

**An application dated March 16, 2023 has been submitted by WUPTL to UPPCB seeking exemption from renewal of consent under Air Act and Water Act.*

D. Approvals applied for, but not yet received

As on the date of this Final Placement Memorandum, there are no approvals required to be obtained by the Trust and the Initial Portfolio Assets, for which applications have been made, but approvals have not been received, other than as described below:

(i) Application dated February 6, 2023 has been submitted by WVEPL to the District Office, Ground Water Department, Palakkad for obtaining NOC to extract ground water from an operational borewell.

(ii) Application dated March 16, 2023 has been submitted by DATRPL to the Ground Water Department, Ministry of Jal Shakti, Government of Uttar Pradesh for obtaining NOC for sinking of proposed well in a non-notified area.

(iii) Application dated August 13, 2021 has been submitted by DATRPL under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998 for registration of establishment employing building workers

(iv) Applications dated April 25, 2022 and March 24, 2022 have been submitted by KETL and NKTL, respectively for obtaining NOC to extract ground water from operational borewells at their respective plazas under Tamil Nadu Groundwater (Development and Management) Act, 2003.

(v) Applications dated December 21, 2020 have been submitted by APEL to the Mandal Revenue Officer, Jogulamba, Gadwal District and the Mandal Revenue Officer, Vanaparthi District for extraction of ground water;

(vi) Application dated July 30, 2018 and January 22, 2021 have been submitted by APEL to the Mandal Revenue Officer, Kurnool District for extraction of ground water;

(vii) Application dated April 15, 2018 have been submitted by APEL to the Mandal Revenue Officer, Vanaparthi District for extraction of ground water;

(viii) Application dated December 8, 2022 has been submitted by JLTL to the Ground Water Department, Ministry of Jal Shakti, Government of Uttar Pradesh for obtaining NOC for sinking of a proposed well in a non-notified area.

(ix) Application dated November 16, 2022 has been submitted by GAEPL to the Ministry of Labour and Employment, Office of the Assistant Labour Commissioner (Central), Jhansi, for issuance of license under the Contract Labour (Regulation and Abolition) Act, 1970.

(x) Application dated February 16, 2023 has been submitted by NKTL to Chief Engineer, Public Works Department, Nanguneri for obtaining no-objection certificate for extraction of groundwater from an operation borewell.

(xi) Applications dated March 24, 2023 has been submitted by WVEPL to State Groundwater Authority, Kerala for permission to abstract groundwater for certain toll plazas.

E. Approvals for which applications are yet to be made

As on the date of this Final Placement Memorandum, and other than as set out below, there are no approvals required to be obtained by the Trust and the Initial Portfolio Assets, for which applications are yet to be made.

(i) Ground water extraction permission from Uttar Pradesh Ground Water Department for extraction of ground water from operational borewells at toll plazas in relation to GAEPL.

(ii) No objection certificate from Ground Water Department, Ministry of Jal Shakti, Government of Uttar Pradesh for sinking of a proposed well in a non-notified area for JVTL.

LEGAL AND OTHER INFORMATION

Except as stated in this section, there is no material civil litigation, criminal litigation or actions by regulatory authorities, in each case involving the Initial Portfolio Assets, the Trust, the Sponsors, the Investment Manager, the Project Manager, or any of their respective Associates and the Trustee, that are currently pending as on the date of this Final Placement Memorandum.

For the purpose of this section, details of all criminal and regulatory actions involving the Trust (including the Initial Portfolio Assets), the Sponsors, the Investment Manager, the Project Manager, or any of their respective Associates, and the Trustee, that are currently pending have been disclosed. All criminal matters involving the Trust, (including the Initial Portfolio Assets), the Sponsors, the Investment Manager, the Project Manager, or any of their respective Associates, and the Trustee, that are currently pending, if any, have been disclosed. All claims involving the Initial Portfolio Assets that are currently pending have been disclosed. Further, any civil matter involving an amount equivalent to, or more than, the amounts as disclosed below, in respect of the Trust (including the Initial Portfolio Assets), the Sponsors, the Project Manager, the Investment Manager and each of their respective Associates and the Trustee has also been disclosed. Details of proceedings related to direct and indirect taxes have been disclosed in a consolidated manner, indicating the number of cases and the total amount.

For the Trust (including the Initial Portfolio Assets), the total combined income for the period ended March 31, 2022 was ₹ 21,572.31 million. Accordingly, in respect of the Trust, its Associates (apart from entities which are Associates of the Sponsors, Investment Manager or Project Manager) and each of the Initial Portfolio Assets, all outstanding civil matters which involve an amount equal to or exceeding ₹ 1,078.62 million (being 5% of the total combined income for Fiscal 2022) have been considered material. Additionally, all cases where an adverse outcome would materially and adversely affect the business, operations or financial position or reputation of each of the Trust or the Initial Portfolio Assets, irrespective of the amount involved, may also be identified as material litigation and disclosed.

For CH-I, the total net worth for the financial year ended December 31, 2021 was ₹ 37,299 million. Accordingly, in respect of CH-I and its Associates, all outstanding civil matters which involve an amount equal to or exceeding ₹ 373 million (being approximately 1% of the total net worth for the financial year ended December 31, 2021) have been considered material. Similarly, for CH-III, the total net worth for the financial year ended December 31, 2021 was ₹ 43,653 million. Accordingly, in respect of CH-III and its Associates, all outstanding civil matters which involve an amount equal to or exceeding ₹ 436.53 million (being 1% of the total net worth for the financial year ended December 31, 2021) have been considered material.

For the Investment Manager, the total net worth for Fiscal 2022 was ₹ 140.45 million. Accordingly, in respect of the Investment Manager and its Associates, all outstanding civil matters which involve an amount equal to or exceeding ₹ 7.02 million (being 5% of the total net worth for Fiscal 2022) have been considered material.*

For the Project Manager, the total consolidated income for Fiscal 2022 was ₹ 722.59 million. Accordingly, in respect of the Project Manager and its Associates, all outstanding civil matters which involve an amount equal to or exceeding ₹ 36.12 million (being 5% of the total consolidated income for Fiscal 2022) have been considered material.

For the Trustee, the total consolidated income for Fiscal 2022 was ₹ 232.00 million. Accordingly, in respect of the Trustee, all outstanding civil matters which involve an amount equal to or exceeding ₹ 11.60 million (being 5% of the total consolidated income for Fiscal 2022) have been considered material.

Additionally, all outstanding cases involving the Sponsors, Investment Manager, the Project Manager or any of their Associates, where an adverse outcome would materially and adversely affect the business, operations or financial position or reputation of the Sponsors, the Investment Manager or the Project Manager, irrespective of the amount involved, have been considered as material and disclosed.

For entities which are common Associates of the Sponsors, the Investment Manager and the Project Manager, where the above-mentioned materiality thresholds in relation to the Sponsors, the Investment Manager and the Project Manager apply, all outstanding civil matters which involve an amount equal to or exceeding ₹ 436.53 million (being the higher of the thresholds (in terms of amount) applicable to the Sponsors, the Investment Manager and the Project Manager) have been considered material.

Further, all pending cases, where the amount is not ascertainable but considered material by the Trust, the Sponsors, the Investment Manager, the Project Manager or any of their Associates and the Trustee as on the date of this Final Placement Memorandum have been disclosed. Also, in cases where outcome of one litigation impacts one or more other litigations, which individually are below materiality threshold, but collectively above, such cases have also been disclosed.

**Net worth means the aggregate value of the paid-up share capital and all reserves created out of the profits (securities premium account and debit or credit balance of profit and loss account) after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off as per the audited balance sheet but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation*

I. Litigation and Regulatory Actions against the Trust and its Associates

As on the date of this Final Placement Memorandum, there are no outstanding criminal litigation, non-ordinary course regulatory actions or material civil litigation against the Trust and its Associates.

II. Litigation involving the Initial Portfolio Assets

Material civil proceedings filed against the Initial Portfolio Assets

DATRPL

(i). Reliance Infrastructure Limited ("**Petitioner**") has filed a writ petition against DATRPL and NHAI ("**Respondents**") before the High Court of Delhi ("**Delhi High Court**") challenging certain onerous conditions stipulated in the circular issued by NHAI on February 24, 2020 for 'Harmonious substitution of existing Concessionaire or selected bidder/consortiums by Fund Houses' ("**Circular**") and the letter dated December 12, 2019 addressed by NHAI to DATRPL on 'Modification in Qualification Criteria Of Harmonious Substitution Guidelines' ("**Direction**"). The Petitioner has claimed that, NHAI, by way of the Circular and Direction has excluded the right of the Petitioner to approach a legal forum for the adjudication of certain disputes which has forced the Petitioner to settle all pending claims with NHAI. The Petitioner has prayed for (i) the quashing of the conditions imposed by NHAI in the aforesaid Circular and Direction and (ii) permission to exercise its right of dispute resolution under the relevant concession agreement. The High Court dismissed the petition by way of its order dated September 7, 2022 ("**Order**") and held that the Petitioner does not have locus standi in the matter as it has divested its shareholding in DATRPL. The Petitioner has filed a letters patent appeal before the appellate jurisdiction of the Delhi High Court challenging the Order. The appeal is currently pending.

(ii). Karan Dalal and Rajvir ("**Petitioners**") have filed a writ petition against DATRPL and NHAI ("**Respondents**") before the High Court of Punjab and Haryana ("**High Court**") challenging the allegedly illegal and wrongful grant of provisional certificate of completion to DATRPL and resultant establishment of toll plaza at Gadpuri. The Petitioners sought fulfilment of certain obligations under DATRPL Concession Agreement pertaining to six-laning of DATRPL Project Highway. By way of an order dated November 30, 2022 ("**Order**"), the High Court directed that a local commission shall be appointed to inspect the stretch of road so as to determine deficiencies in the mandatory works and services required to be completed under DATRPL Concession Agreement. DATRPL has filed an application under section 151 of the Code of Civil Procedure, 1908 praying for modification or recall of the Order. The matter is currently pending.

(iii). Tej Pal and others ("**Plaintiffs**") has filed a plaint against DATRPL and State of Haryana ("**Defendants**") before the Court of Civil Judge (Senior Division), Palwal ("**Civil Court**") seeking permanent injunction against the Respondents in order to restrain them from carrying out construction on certain lands which is alleged to be owned by the gram panchayat. The Civil Court, by way of its order dated May 21, 2022 ("**Order**"), has rejected the plaint stating that the Plaintiffs do not have any cause of action. An appeal has been preferred by the Plaintiffs against the Order before District and Sessions Court, Palwal and is currently pending.

MKTL

(iv). Jaykrishna Flour Mills ("**Petitioner**") has filed a writ petition before the Madurai Bench of the High Court of Madras ("**High Court**") against MKTL. The Petitioner had sought exemption from payment of toll fees by its vehicles in pursuance of injunction orders issued by the High Court in writ petition bearing number WP (MD) No: 5617/2014 and had prayed for the High Court to, amongst other things, (i) quash the prevalent fee notification and (ii) direct NHAI to exempt vehicles owned by the Petitioner from paying toll fees at Kappalur Toll Plaza. The High Court, on April 2, 2014, noted that an order against NHAI restraining it from collecting toll fees from vehicles proceeding to NH 208 was already in place ("**Initial Order**") and granted a stay in favour of the Petitioner by way of its interim order dated April 2, 2014 ("**Interim Order**"). The stay was extended until May 31, 2014. MKTL has requested the Petitioner to make appropriate arrangements to pay the toll or obtain an approval from NHAI in relation to the passing of vehicles in Kappalur Toll plaza without payment of toll. The High Court has dismissed the petition and has held that exemption from payment of toll fee cannot be granted. The Petitioner has filed an appeal before the appellate jurisdiction of High Court on the grounds that (i) the toll plaza is not located in accordance with Rule 8 of National Highways Fee (Determination of Rates and Collection) Rules, 2008; and (ii) the Petitioner is arbitrarily being forced to pay the toll fee. The appeal is currently pending.

Others

(i). Certain persons ("**Petitioners**") have filed separate cases against some of the Initial Portfolio Assets before various civil courts, consumer courts and other authorities, amongst other things, (i) alleging excess collection of toll; (ii)

challenging acquisition of land used for the Initial Portfolio Assets; and (iii) challenging certain encroachment notices served upon the Petitioners. These matters are currently pending.

(ii). Certain persons have filed separate labour cases against some of the Initial Portfolio Assets before various civil and labour courts in relation to, amongst other things, wrongful termination of employment, increase in salaries and demands of bonus. These matters are currently pending.

Material civil proceedings filed by the Initial Portfolio Assets

As on the date of this Final Placement Memorandum, there are no material civil proceedings filed by the Initial Portfolio Assets.

Criminal Proceedings involving the Initial Portfolio Assets

DATRPL

(i). The State of Haryana has initiated criminal proceedings against the project manager of DATRPL before the Chief Judicial Magistrate, Faridabad ("**CJM Court**"). A first information report was filed against DATRPL under sections 279, 337, 338 and 304A of the Indian Penal Code, 1860, as amended, in relation to the death of the son of Manoj Kumar Wadhwa in a road accident allegedly due to potholes on the road forming part of DATRPL's project. The matter is currently pending before the CJM Court.

(ii). Giriraj Kishore ("**Complainant**") has initiated criminal proceedings against Rajesh Madan and the Team Leader of U.R.S. Scale Wilson Pvt. Ltd. ("**Respondents**") before the Court of Judicial Magistrate, Chhata, Mathura ("**CJM Court**"). A First Information Report ("**FIR**") was filed by the Complainant under Section 430 of the Indian Penal Code, 1860 ("**IPC**"), as amended, against the Respondents in relation to the project assets of DATRPL for intentionally not constructing a drain near Complainant's land despite multiple reminders which has led to the collapse of Complainant's boundary wall and has also destroyed the crops planted in Complainant's land. The CJM took cognizance of the complaint on April 6, 2022 under Section 432 of the IPC. The matter is currently pending.

MBEL

(i). The Labour Enforcement Officer ("**Plaintiff**") has filed two separate cases against MBEL (erstwhile Madhucon Agra Jaipur Expressway Limited) before the Civil Court, Bair District, Bharatpur ("**Civil Court**") alleging non-compliance under Sections 23 and 24 of the Contract Labour (Regulation and Abolition) Act, 1970. The Plaintiff has also filed another case before Civil Court under Section 22 of the Minimum Wages Act, 1948 for non-payment of minimum wage to a worker as stipulated under the aforesaid Act. The matters are currently pending.

(ii). Uttam Sharma has filed a criminal complaint against the erstwhile directors and certain employees of MBEL ("**Accused Persons**") before the court of Additional Chief Judicial Magistrate, Bharatpur ("**ACJM Court**"). The complaint was filed under section 418 and 420 of the Indian Penal Code, 1860 for charging excess toll fees from the commuters using the project highway. The ACJM Court took cognizance of the complaint on October 29, 2014, and issued a bailable warrant of arrest against the Accused Persons ("**Warrant**"). Aggrieved by the Warrant, the erstwhile directors of MBEL have filed a revision petition before the sessions court. The matter is currently pending.

GAEPL

(i). GAEPL has filed various FIRs in relation to damage to structures and assets on the project highway. These matters are currently pending.

Regulatory Proceedings involving Initial Portfolio Assets

(i). The office of the Registration and Stamps Department, Government of Telangana has issued notices to APEL and KMC Constructions Limited ("**KMC**") in relation to the inadequate stamping of the EPC contract entered into between APEL and KMC. APEL is contesting the aforesaid notices.

(ii). Certain Initial Portfolio Assets have received notices from regulatory authorities, in relation to the stamping of the concession agreements entered into by such Initial Portfolio Assets. The relevant Initial Portfolio Assets are contesting the aforesaid notices and the order before various authorities and while these matters are currently pending, in accordance with the share purchase agreement through which the Cube Group acquired these Initial Portfolio Assets, the erstwhile sellers are obligated to indemnify, defend and hold harmless the Initial Portfolio Assets in relation to any payment of deficient stamp duty on the concession agreements.

(iii). Certain Initial Portfolio Assets have received notices, requests for information and summons from regulatory authorities, including the Economic Offenses Wing, Palwal (in relation to deposit of amounts in a bank account during demonetization) and the Directorate General of GST Intelligence (in relation to allegations of non-payment of goods and services tax), which have been responded to. No further communication has been received in these matters.

Claims against Initial Portfolio Assets

TOT SPVs

(i). There have been delays by the TOT SPVs in completion of work as per Schedule B of the respective Concession Agreement. The delays are, amongst other things, for construction of admin building, construction of service roads, installation and operation of static weight bridge and land demarcation for toll plaza building. The construction work is underway and The TOT SPVs have stated to NHAI, by way of multiple correspondences, that they cannot be held liable for non-completion of works within the prescribed timelines. There is no further update on these matters.

FRHL

(i). NHAI, *vide* its letter dated December 23, 2020, has raised a claim of an amount equivalent to ₹18.55 million ("**Demand Amount**") for short realization of royalty and cess on extraction of earth and sand in construction and widening of the project highway. FRHL, by way of its letter dated January 11, 2021 and August 11, 2021, has alleged that the Demand Amount was computed based on erroneous assumptions such as the length of the project highway and FRHL had already deposited an amount of ₹9.55 million and no further dues against royalty for extraction of earth are pending. NHAI by way of its letter dated September 9, 2021 and an independent engineer by way of its letter dated September 22, 2021 has requested FRHL to submit responses with respect to the pending amount. The claim is currently pending with regards to the balance amount.

LRTL

(i). NHAI, through a letter dated August 19, 2021, has issued notice to LRTL for submission of negative change of scope for de-scoping of a proposed vehicle underpass. The independent engineer, *vide* letter dated August 24, 2021, issued notice to LRTL for submission of the relevant proposal. LRTL, in its response dated December 7, 2021 has submitted detailed proposal of estimate for negative change of scope. The independent engineer has provided certain observations in relation to the responses submitted by LRTL which has been complied with by LRTL as stated in the letter dated February 9, 2022. The independent engineer *vide* letter dated August 18, 2022 has submitted, for perusal and approval by the NHAI, a negative change of scope proposal, as submitted by LRTL, of a proposed vehicle underpass of approximately ₹ 536.17 million. In this regard, LRTL is required to pay 80% of the descoped amount, amounting to ₹ 428.93 million to NHAI. The claim is currently pending.

DATRPL

(i). NHAI *vide* letter dated September 1, 2022 has imposed a sum of ₹ 16.78 million on DATRPL on account of non-illumination of street lights on Project Highway on the recommendation of the independent engineer. NHAI has recovered ₹ 7.72 million and has claimed balance penalty amount of ₹ 9.16 million, by way of its letter dated November 22, 2022. DATRPL vide its letter dated November 30, 2022, has claimed that the balance amount to be recovered by NHAI is ₹ 4.67 million. The claim is currently pending.

(ii). NHAI, by way of its letter dated February 25, 2021, directed DATRPL to pay an amount equivalent to ₹ 15.91 million as pending electricity bill dues, due since October 2017. NHAI also noted that due to negligence on part of DATRPL, the streetlights installed are not illuminated. NHAI directed DATRPL to immediately settle the dues with the concerned electricity department. DATRPL, by way of its letter dated June 8, 2021, submitted that it would take up highway lighting in the Agra section and replace the existing poles with new ones. There has been no further update on this matter.

GAEPL

(i). NHAI *vide* letter dated September 1, 2022 has notified GAEPL to deposit an amount of approximately ₹17.44 million as damages for breach of maintenance obligation under the Concession Agreement. GAEPL has submitted its response to NHAI, *vide*, letter dated September 10, 2022, delineating the remedial measures undertaken by GAEPL to fulfil its operation and maintenance obligations. GAEPL has submitted that there was no breach of maintenance obligation and accordingly there is no default as alleged by the independent engineer. NHAI *vide* letter dated November 3, 2022 instructed GAEPL to deposit the penalty. The independent engineer in its letter dated November 14, 2022 reiterated GAEPL's ongoing maintenance obligations and requested it for rectification of the deficiencies found in its monthly inspection. GAEPL *vide* its letters dated December 15, 16 & 17, 2022, stated that major maintenance was underway, and provided reassurance that immediate action was being taken to rectify issues and GAEPL was in compliance with

all its operation and maintenance obligations. GAEPL also reiterated its request to the independent engineer to recall its notice, and not initiate any adverse action against it as no breach of maintenance obligations had occurred. In its letter dated December 19, 2022 the independent engineer highlighted newly developed potholes and requested repair of the same, along with compliance of all other previous issues. The claim is currently pending.

(ii). The independent engineer has imposed a penalty of ₹ 41.19 million vide letter dated July 5, 2022 for not carrying out periodical maintenance work (for instance, repair of shoulder, studs, road marking and BC overlay) for the period of January 2021 to May 2022. NDEPL has objected to the claim by way of its letter dated July 13, 2022 and has requested NHAI to direct the independent engineer to recalculate the penalty amount. The claim is currently pending with NHAI.

For additional details please see the section entitled "*Risk Factors – The Project SPVs may be liable to pay damages to the concessioning authority for non-compliance or delayed compliance with the terms of the Concession Agreements"* on page 75.

III. Litigation involving the Sponsors and their associates (including common associates of the Sponsors, the Project Manager and the Investment Manager)

(i) ICICI Bank Limited ("**Plaintiff**") filed a commercial suit before High Court of Bombay ("**High Court**") against State Bank of India and Dena Bank ("**Original Defendants**") seeking an injunction against them from exercising the right of substitution of Lanco Devihalli Highways Limited ("**LDHL**") with any selectee. Since CH-I ("**Defendant**") was shortlisted as the selectee for substituting LDHL with an SPV held by it or its associate, it was impleaded as a defendant in the said commercial suit by an order dated February 11, 2019. The High Court by way of its order dated February 18, 2019 stated that CH-I was required to pay transaction consideration after the Original Defendants have granted no objection. Pursuant to the aforesaid order, the transaction was closed and supplementary concession agreement was executed by NDEPL. While CH-I continues to be a party to the said suit, the outstanding issue is with reference to the distribution of consideration. Thus, CH-I has filed an application for removal of its name as a defendant to the suit. The matter is currently pending.

(ii) CH-II ("**Plaintiff**") has filed a commercial suit before the High Court of Bombay ("**High Court**") against IL&FS Transportation Networks Limited ("**ITNL**"), Infrastructure Leasing and financial Services Limited ("**IL&FS**") and Chenani Nashri Tunnelway Limited ("**CNTL**") (collectively, referred to as "**Defendants**") seeking, *inter alia*, (a) specific performance of the share purchase agreement ("**SPA**") executed between the Plaintiff and the Defendants in relation to transfer of 100% shareholding of ITNL in CNTL to the Plaintiff; (b) mandatory injunction against the Defendants to extend the long stop date (*as defined in the SPA*) up to ninety days after receipt of all approvals and fulfilment of all conditions. The Hon'ble Bombay High Court passed an interim order dated September 14, 2021 directing the Plaintiff to file an application before the National Company Law Tribunal, Mumbai ("**NCLT**"). Subsequently, the Plaintiff filed an application before the NCLT. The Plaintiff also approached the Bombay High Court seeking injunction to restrain the Defendants from divesting, disposing of, transferring, alienating, or creating any other interests in the shares of CNTL otherwise than under the SPA. The High Court in its order dated November 25, 2021 recorded that any decision at the behest of IL&FS and ITNL cannot prejudice any rights and contentions of Plaintiff. The matter is currently pending before the NCLT.

(iii) N. Vijaya Kumar ("**Petitioner**") has filed a writ petition against KNR Tirumala Infra Private Limited ("**Respondent**") before the High Court of Andhra Pradesh at Amaravathi ("**High Court**") seeking a writ of mandamus. The Petitioner prays for declaration of the act of permanently covering up Mungilipattu Kaluva water channel a natural spring stream channel by the Respondent as illegal, improper and unconstitutional. The Petitioner also seeks relief to direct the Respondent to restore Mungilipattu Kaluva water channel by constructing proper drainage systems to ensure the free flow of the water channel. The High Court has passed an interim direction to the Respondent to restore the water channel. The petition is currently pending.

IV. Litigation involving the Investment Manager and its associates

Please see section entitled "*Legal and Other Information - Litigation involving the Sponsors and their associates (including common associates of the Sponsors, the Project Manager and the Investment Manager)*" on page 305 above.

V. Litigation involving the Project Manager and its associates

Please see section entitled "*Legal and Other Information - Litigation involving the Sponsors and their associates (including common associates of the Sponsors, the Project Manager and the Investment Manager)*" on page 305 above.

VI. Litigation involving the Trustee

Nil

Taxation Proceedings

The details of all outstanding tax disputes involving the Initial Portfolio Assets and against the Trust, Sponsor, the Project Manager, the Investment Manager, their respective Associates and the Trustee, are set forth below:

Name of the entity	Number of Proceedings	Amount Involved (in ₹ million)
Direct tax		
i. Trust	Nil	N.A.
ii. Sponsor	Nil	N.A.
iii. Investment Manager	Nil	N.A.
iv. Project Manager	Nil	N.A.
v. Associates of Sponsor / Project Manager / Investment Manager	3	534.39
vi. Initial Portfolio Assets	22	383.61
vii. Trustee	Nil	N.A.
Indirect Tax		
i. Trust	Nil	N.A.
ii. Sponsor	Nil	N.A.
iii. Investment Manager	Nil	N.A.
iv. Project Manager	Nil	N.A.
v. Associates of Sponsor / Project Manager / Investment Manager	15	4,305.53
vi. Initial Portfolio Assets	12	319.72
vii. Trustee	Nil	N.A.

SECURITIES MARKET OF INDIA

The information in this section has been extracted from documents available on the website of SEBI and the Stock Exchanges and has not been prepared or independently verified by the Parties to the Trust or the Placement Agents or any of their respective affiliates or advisors. The information below is given for the benefit of investors in the Offer. Investors are advised to make their independent investigations and ensure that they are eligible to subscribe to, purchase or otherwise acquire the Ordinary Units they Bid for under Indian laws or regulations.

The Indian Securities Market

India has a long history of organized securities trading. In 1875, the first stock exchange was established in Mumbai. The BSE and the NSE, together hold a dominant position among the stock exchanges in terms of the number of listed companies, market capitalisation and trading activity.

Stock Exchange Regulation

Indian stock exchanges are regulated primarily by SEBI, as well as by the Government acting through the Ministry of Finance, Capital Markets Division, under the Securities Contracts (Regulation) Act, 1956 ("**SCRA**") and the Securities Contracts (Regulation) Rules, 1957 ("**SCRR**"). SEBI, in exercise of its powers under the SCRA and the SEBI Act, notified the SCR (SECC) Regulations, which regulate *inter alia* the recognition, ownership and governance of stock exchanges and clearing corporations in India together with providing for minimum capitalisation requirements for stock exchanges. The SCRA, the SCRR and the SCR (SECC) Regulations along with various rules, bye-laws and regulations of the respective stock exchanges, regulate the recognition of stock exchanges, the qualifications for membership thereof and the manner, in which contracts are entered into, settled and enforced between members of the stock exchanges.

The SEBI Act empowers SEBI to regulate the Indian securities markets, including stock exchanges and intermediaries in the capital markets, promote and monitor self-regulatory organisations and prohibit fraudulent and unfair trade practices. Regulations concerning minimum disclosure requirements by public companies, rules and regulations concerning investor protection, insider trading, substantial acquisitions of shares and takeover of companies, buy-backs of securities, employee stock option schemes, stockbrokers, merchant bankers, underwriters, mutual funds, foreign portfolio investors, credit rating agencies and other capital market participants have been notified by the relevant regulatory authority.

Listing and Delisting of Units

The InvIT Regulations provide for listing and delisting of units of infrastructure investment trusts on the stock exchanges.

BSE

Established in 1875, it is the oldest stock exchange in India. In 1957, it became the first stock exchange in India to obtain permanent recognition from the Government under the SCRA. It has evolved over the years into its present status as one of the premier stock exchanges of India.

NSE

NSE was established by financial institutions and banks to provide nationwide online, satellite-linked, screen-based trading facilities with market-makers and electronic clearing and settlement for securities including government securities, debentures, public sector bonds and units. It has evolved over the years into its present status as one of the premier stock exchanges of India. NSE was recognised as a stock exchange under the SCRA in April 1993 and commenced operations in the wholesale debt market segment in June 1994. The capital market (equities) segment commenced operations in November 1994 and operations in the derivatives segment commenced in June 2000.

Internet-based Securities Trading and Services

Internet trading takes place through order routing systems, which route client orders to exchange trading systems for execution. Stockbrokers interested in providing this service are required to apply for permission to the relevant stock exchange and also have to comply with certain minimum conditions stipulated by SEBI. The NSE became the first exchange to grant approval to its members for providing internet-based trading services. Internet trading is possible on both the "equities" as well as the "derivatives" segments of the NSE.

Trading Hours

Trading on both the NSE and the BSE occurs from Monday to Friday, between 9:15 a.m. and 3:30 p.m. 1ST (excluding the 15 minutes pre-open session from 9:00 a.m. to 9:15 a.m. that has been introduced). The NSE and the BSE are closed on public

holidays. The recognised stock exchanges have been permitted to set their own trading hours (in the cash and equity derivatives segments) subject to certain conditions.

Trading Procedure

In order to facilitate smooth transactions, the BSE replaced its open outcry system with BSE On-line Trading facility in 1995. This totally automated screen-based trading in securities and was put into practice nationwide. This has enhanced transparency in dealings and has assisted considerably in smoothening settlement cycles and improving efficiency in back-office work.

NSE has introduced a fully automated trading system called National Exchange for Automated Trading ("**NEAT**"), which operates on strict time/price priority besides enabling efficient trade. NEAT has provided depth in the market by enabling large number of members all over India to trade simultaneously, narrowing the spreads.

Depositories

The Depositories Act provides a legal framework for the regulation of depositories in securities and for matters connected therewith or incidental thereto. Further, SEBI has framed regulations in relation to the registration of such depositories, the registration of participants as well as the rights and obligations of the depositories, participants, companies and beneficial owners.

SELLING AND TRANSFER RESTRICTIONS

The distribution of this Final Placement Memorandum and the offer, sale or delivery of the Units is restricted by law in certain jurisdictions. Persons who may come into possession of this Final Placement Memorandum are advised to consult with their own legal advisors as to what restrictions may be applicable to them and to observe such restrictions. This Final Placement Memorandum may not be used for the purpose of an offer or invitation in any circumstances. Due to the following restrictions, investors are advised to consult their own advisors prior to purchasing or subscribing to the Units or making any resale, pledge or transfer of the Units.

Each purchaser of the Units in this Offer will be deemed to have made acknowledgments and agreements as described under "Notice to Investors – Representations by Eligible Investors" on page 2 of this Final Placement Memorandum.

Republic of India

This Final Placement Memorandum may not be distributed directly or indirectly in India or to residents of India and any Ordinary Units may not be offered or sold directly or indirectly in India to, or for the account or benefit of, any resident of India except as permitted by applicable Indian laws and regulations, under which an offer is strictly on a private and confidential basis and is limited to Eligible Investors and is not an offer to the public. This Final Placement Memorandum is neither a public issue nor a prospectus under the Companies Act, 2013 or an advertisement and should not be circulated to any person other than to whom this Offer is made. The Placement Memorandum and this Final Placement Memorandum has not been and will not be registered as a prospectus with any Registrar of Companies in India.

No action has been taken or will be taken by Cube Highways Trust, the Investment Manager, the Selling Unitholders or the Placement Agents that would permit a public offering of the Ordinary Units to occur in any jurisdiction, or the possession, circulation or distribution of this Final Placement Memorandum or any other material relating to the Trust or the Ordinary Units in any jurisdiction where action for such purpose is required. Accordingly, the Ordinary Units may not be offered or sold, directly or indirectly, and this Final Placement Memorandum, any offering materials and any advertisements in connection with the offering of the Ordinary Units may be distributed or published in or from any country or jurisdiction except under circumstances that will result in compliance with any applicable rules and regulations of any such country or jurisdiction. The Offer will be made in compliance with the applicable InvIT Regulations. Each purchaser of the Ordinary Units in this Offer will be deemed to have made acknowledgments and agreements as described under "*Notice to Investors*" on page 1, "*Notice to Investors - Representations by Eligible Investors*" on page 2 and these Selling and Transfer Restrictions.

All Non-Resident Investors should note that, any future transfer of ownership of the Ordinary Units, directly or indirectly, must be in compliance with the Foreign Exchange Management (Non-debt Instruments) Rules, 2019, as amended, including Press Note No.3 (2020 Series), dated April 17, 2020 issued by the DPIIT, to the extent applicable.

Australia

The Final Placement Memorandum:

1. does not constitute a product disclosure document or prospectus under Chapter 6D.2 of the Corporations Act, 2001 (Cth) ("**Australian Corporations Act**");

2. has not been, and will not be, lodged with the Australian Securities and Investments Commission ("**ASIC**"), as a disclosure document for the purposes of the Corporations Act and does not purport to include the information required of a disclosure document under Chapter 6D of the Australian Corporations Act;

3. does not constitute or involve a recommendation to acquire, an offer or invitation for issue or sale, an offer or invitation to arrange the issue or sale, or an issue or sale, of interests to a "retail client" (as defined in section 761G of Australian Corporations Act and applicable regulations) in Australia; and

4. may only be provided in Australia to select investors who are able to demonstrate that they fall within one or more of the categories of investors, or Exempt Investors, available under section 708 of the Australian Corporations Act.

The Units may not be directly or indirectly offered for subscription or purchased or sold, and no invitations to subscribe for or buy the Units may be issued, and no draft or definitive Placement Memorandum, advertisement or other offering material relating to any Units may be distributed in Australia, except where disclosure to investors is not required under Chapter 6D of the Australian Corporations Act or is otherwise in compliance with all applicable Australian laws and regulations. By submitting an application for the Units, you represent and warrant to us that you are an Exempt Investor.

As any offer of Units under this Final Placement Memorandum will be made without disclosure in Australia under Chapter 6D.2 of the Australian Corporations Act, the offer of those securities for resale in Australia within 12 months may, under section 707 of the Australian Corporations Act, require disclosure to investors under Chapter 6D.2 if none of the exemptions in section 708 applies to that resale. By applying for the Units you undertake to the Issuer that you will not, for a period of 12 months from the date of issue of the Units, offer, transfer, assign or otherwise alienate those securities to any person in Australia except in circumstances where disclosure to such person is not required under Chapter 6D.2 of the Australian Corporations Act or where a compliant disclosure document is prepared and lodged with ASIC.

Bahrain

All applications for investment should be received, and any allotments should be made, in each case from outside Bahrain. The Final Placement Memorandum has been prepared for private information purposes of intended investors only who will be high net worth individuals and institutions. The Cube Highways Trust has not made and will not make any invitation to the public in the Kingdom of Bahrain and the Final Placement Memorandum will not be issued, passed to, or made available to the public generally. The Bahrain Monetary Agency ("**BMA**") has not reviewed, nor has it approved, the Final Placement Memorandum or the marketing of Units in the Kingdom of Bahrain. Accordingly, Units may not be offered or sold in Bahrain or to residents thereof except as permitted by Bahrain law.

British Virgin Islands

The Units are not being, and may not be offered to the public or to any person in the British Virgin Islands for purchase or subscription by or on the behalf. The Units may be offered to companies incorporated under the BVI Business Companies Act, 2004 (British Virgin Islands) (each a "**BVI Company**"), but only where the offer will be made to, and received by, the relevant BVI Company entirely outside of the British Virgin Islands.

The Final Placement Memorandum has not been, and will not be, registered with the Financial Services Commission of the British Virgin Islands. No registered prospectus has been or will be prepared in respect of the Units for the purposes of the Securities and Investment Business Act, 2010 or the Public Issuers Code of the British Virgin Islands.

Canada

Units may be sold in Canada only to purchasers purchasing, or deemed to be purchasing, as principal that are accredited investors, as defined in National Instrument 45-106 Prospectus Exemptions of the Canadian Securities Administrators or subsection 73.3(1) of the Securities Act (Ontario), and are permitted clients, as defined in National Instrument 31-103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. Any resale of the Units must be made in accordance with an exemption from, or in a transaction not subject to, the prospectus requirements of applicable Canadian securities laws.

Securities legislation in certain provinces or territories of Canada may provide a purchaser with remedies for rescission or damages if this Final Placement Memorandum (including any amendment thereto) contains a misrepresentation, provided that the remedies for rescission or damages are exercised by the purchaser within the time limit prescribed by the securities legislation of the purchaser's province or territory. The purchaser should refer to any applicable provisions of the securities legislation of the purchaser's province or territory for particulars of these rights or consult with a legal advisor.

Pursuant to section 3A.3 of National Instrument 33-105 Underwriting Conflicts ("NI 33-105"), the Placement Agents are not required to comply with the disclosure requirements of NI 33-105 regarding underwriter conflicts of interest in connection with any offer of Units.

Upon receipt of this Final Placement Memorandum, each Canadian purchaser is hereby deemed to confirm that it has expressly requested that all documents evidencing or relating in any way to the sale of the Units described herein (including, for the avoidance of doubt, any purchase confirmation or any notice) be drawn up in the English language only.

Cayman Islands

No offer or invitation to subscribe for Units may be made to the public in the Cayman Islands to subscribe for any of the Units but an invitation or offer may be made to sophisticated persons (as defined in the Cayman Islands Securities Investment Business Law (the "**SIBL**"), high net worth persons (as defined in the SIBL) or otherwise in accordance with the SIBL.

The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved this document nor taken steps to verify the information set out in it and has no responsibility for it. The Units to which this Final Placement Memorandum relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the Units offered should conduct their own due diligence on the Units.

Dubai International Financial Centre

The Final Placement Memorandum relates to an Exempt Offer in accordance with the Markets Rules Module of the Dubai Financial Services Authority ("**DFSA**") Rulebook. This Final Placement Memorandum is intended for distribution only to persons of a type specified in the Markets Rules Module. It must not be delivered to, or relied on by, any other person. The DFSA has no responsibility for reviewing or verifying any documents in connection with Exempt Offers. The DFSA has not approved the Final Placement Memorandum nor taken steps to verify the information set forth herein and has no responsibility for this Final Placement Memorandum. The securities to which the Final Placement Memorandum relates may be illiquid and/or subject to restrictions on their resale. Prospective purchasers of the securities offered should conduct their own due diligence on the securities. If you do not understand the contents of the Final Placement Memorandum you should consult an authorized financial advisor.

In relation to its use in the Dubai International Financial Centre, the Final Placement Memorandum is strictly private and confidential and is being distributed to a limited number of investors and must not be provided to any person other than the original recipient and may not be reproduced or used for any other purpose. The interests in the securities may not be offered or sold directly or indirectly to the public in the Dubai International Financial Centre.

European Economic Area

In relation to each Member State of the European Economic Area (each a "**Relevant State**"), no Units have been offered or will be offered pursuant to the Offer to the public in that Relevant State prior to the publication of a prospectus in relation to the Units which has been approved by the competent authority in that Relevant State or, where appropriate, approved in another Relevant State and notified to the competent authority in that Relevant State, all in accordance with the Prospectus Regulation, except that the Units may be offered to the public in that Relevant State at any time:

a. to any legal entity which is a qualified investor as defined under Article 2 of the Prospectus Regulation;

b. to fewer than 150 natural or legal persons (other than qualified investors as defined under Article 2 of the Prospectus Regulation), subject to obtaining the prior consent of the Placement Agents for any such offer; or

c. in any other circumstances falling within Article 1(4) of the Prospectus Regulation, provided that no such offer of the Units shall require the Cube Highways Trust or any Placement Agents to publish a prospectus pursuant to Article 3 of the Prospectus Regulation or supplement a prospectus pursuant to Article 23 of the Prospectus Regulation.

For the purposes of this provision, the expression an "offer to the public" in relation to the Units in any Relevant State means the communication in any form and by any means of sufficient information on the terms of the offer and any Units to be offered so as to enable an investor to decide to purchase or subscribe for any Units, and the expression "Prospectus Regulation" means Regulation (EU) 2017/1129.

Hong Kong

Each Placement Agent has represented, warranted and agreed that:

(i) it has not offered or sold and will not offer or sell in Hong Kong, by means of any document, any Units other than (a) to "professional investors" as defined in the Securities and Futures Ordinance (Cap. 571) of Hong Kong (the "**SFO**") and any rules made under the SFO; or (b) in other circumstances which do not result in the document being a "prospectus" as defined in the Companies (Winding Up and Miscellaneous Provisions) Ordinance (Cap. 32) of Hong Kong (the "**CWUMPO**") or which do not constitute an offer to the public within the meaning of the CWUMPO; and

(ii) it has not issued or had in its possession for the purposes of the issue, and will not issue or have in its possession for the purposes of issue, whether in Hong Kong or elsewhere any advertisement, invitation or document relating to the Units, which is directed at, or the contents of which are likely to be accessed or read by, the public of Hong Kong (except if permitted to do so under the securities laws of Hong Kong), other than with respect to Units which are or are intended to be disposed of only to persons outside Hong Kong or only to "professional investors" as defined in the SFO and any rules made under the SFO.

Indonesia

The Units have not been, and will not be, registered with the Indonesia Financial Service Authority (Otoritas Jasa Keuangan or OJK) in Indonesia, and therefore, the Units may not be offered and/or sold within the territory of Indonesia or to Indonesian citizens or entities, wherever domiciled, or to Indonesian residents, in a manner which constitutes a public offering under Law No. 8 of 1995 on Capital Markets and the implementing regulations or private placement under OJK Regulation No. 30/POJK.04/2019 on the Privately Issued Debt-Linked Securities and/or Sukuk.

Japan

The Units have not been and will not be registered under the Financial Instruments and Exchange Act of Japan (Law. No. 25 of 1948 as amended) (the "**FIEA**") and disclosure under the FIEA has not been and will not be made with respect to the Units. No Units have, directly or indirectly, been offered or sold, and may not, directly or indirectly, be offered or sold in Japan or to, or for the benefit of, any resident of Japan as defined in the first sentence of Article 6, Paragraph 1, Item 5 of the Foreign Exchange and Foreign Trade Law of Japan ("**Japanese Resident**") or to others for re-offering or re-sale, directly or indirectly in Japan or to, or for the benefit of, any Japanese Resident except (i) pursuant to an exemption from the registration requirements of the FIEA and (ii) in compliance with any other relevant laws, regulations and governmental guidelines of Japan.

If an offeree does not fall under a "qualified institutional investor" (tekikaku kikan toshika), as defined in Article 10, Paragraph 1 of the Cabinet Office Ordinance Concerning Definition Provided in Article 2 of the Financial Instruments and Exchange Act (the "Qualified Institutional Investor"), the Units will be offered in Japan by a private placement to small number of investors (shoninzu muke kanyu), as provided under Article 23- 13, Paragraph 4 of the FIEA, and accordingly, the filing of a securities registration statement for a public offering pursuant to Article 4, Paragraph 1 of the FIEA has not been made.

If an offeree falls under the Qualified Institutional Investor, the Units will be offered in Japan by a private placement to the Qualified Institutional Investors (tekikaku kikan toshikamuke kanyu), as provided under Article 23-13, Paragraph 1 of the FIEA, and accordingly, the filing of a securities registration statement for a public offering pursuant to Article 4, Paragraph 1 of the FIEA has not been made. To subscribe the Units (the "**QII Units**") such offeree will be required to agree that it will be prohibited from selling, assigning, pledging or otherwise transferring the QII Units other than to another Qualified Institutional Investor.

Kuwait

The Units have not been authorised or licensed for offering, marketing or sale in the State of Kuwait. The distribution of the Final Placement Memorandum and the offering and sale of the Units in the State of Kuwait is restricted by law unless a license is obtained from the Kuwaiti Ministry of Commerce and Industry in accordance with Law 31 of 1990.

Malaysia

No prospectus or other offering material or document in connection with the offer and sale of the Units has been or will be registered with the Securities Commission of Malaysia ("**Commission**") for the Commission's approval pursuant to the Capital Markets and Services Act 2007. Accordingly, the Final Placement Memorandum, and any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of the Units may not be circulated or distributed, nor may the Units be offered or sold, or be made the subject of an invitation for subscription or purchase, whether directly or indirectly, to persons in Malaysia other than (i) a closed end fund approved by the Commission; (ii) a holder of a Capital Markets Services Licence; (iii) a person who acquires the Units, as principal, if the offer is on terms that the Units may only be acquired at a consideration of not less than RM250,000 (or its equivalent in foreign currencies) for each transaction; (iv) an individual whose total net personal assets or total net joint assets with his or her spouse exceeds RM3 million (or its equivalent in foreign currencies), excluding the value of the primary residence of the individual; (v) an individual who has a gross annual income exceeding RM300,000 (or its equivalent in foreign currencies) per annum in the preceding twelve months; (vi) an individual who, jointly with his or her spouse, has a gross annual income of RM400,000 (or its equivalent in foreign currencies), per annum in the preceding twelve months; (vii) a corporation with total net assets exceeding RM10 million (or its equivalent in a foreign currencies) based on the last audited accounts; (viii) a partnership with total net assets exceeding RM10 million (or its equivalent in foreign currencies); (ix) a bank licensee or insurance licensee as defined in the Labuan Financial Services and Securities Act 2010; (x) an Islamic bank licensee or takaful licensee as defined in the Labuan Financial Services and Securities Act 2010; and (xi) any other person as may be specified by the Commission; provided that, in the each of the preceding categories (i) to (xi), the distribution of the Units is made by a holder of a Capital Markets Services Licence who carries on the business of dealing in securities. The distribution in Malaysia of the Final Placement Memorandum is subject to Malaysian laws. The Final Placement Memorandum does not constitute and may not be used for the purpose of public offering or an issue, offer for subscription or purchase, invitation to subscribe for or purchase any securities requiring the registration of a prospectus with the Commission under the Capital Markets and Services Act 2007.

Mauritius

The Units may not be offered or sold, directly or indirectly, to the public in Mauritius. Neither the Final Placement Memorandum nor any offering material or information contained herein relating to the offer of the Units may be released or issued to the public in Mauritius or used in connection with any such offer. The Final Placement Memorandum does not constitute an offer to sell the Units to the public in Mauritius and is not a prospectus as defined under the Companies Act 2001.

New Zealand

The Final Placement Memorandum is not a prospectus. It has not been prepared or registered in accordance with the Securities Act 1978 of New Zealand (the "**New Zealand Securities Act**"). The Final Placement Memorandum is being distributed in New

Zealand only to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money, within the meaning of section 3(2)(a)(ii) of the New Zealand Securities Act ("**Habitual Investors**"). By accepting the Final Placement Memorandum, each investor represents and warrants that if they receive the Final Placement Memorandum in New Zealand they are a Habitual Investor and they will not disclose the Final Placement Memorandum to any person who is not also a Habitual Investor.

Sultanate of Oman

The Final Placement Memorandum and the Units to which it relates may not be advertised, marketed, distributed or otherwise made available to any person in Oman without the prior consent of the Capital Market Authority ("**CMA**") and then only in accordance with any terms and conditions of such consent. In connection with the offering of Units, no prospectus has been filed with the CMA. The offering and sale of Units described in the Final Placement Memorandum will not take place inside Oman. The Final Placement Memorandum is strictly private and confidential and is being issued to a limited number of sophisticated investors, and may neither be reproduced, used for any other purpose, nor provided to any other person than the intended recipient hereof.

Qatar (excluding the Qatar Financial Centre)

The Units have not been offered, sold or delivered, and will not be offered, sold or delivered at any time, directly or indirectly, in the State of Qatar in a manner that would constitute a public offering. The Final Placement Memorandum has not been reviewed or registered with Qatari Government Authorities, whether under Law No. 25 (2002) concerning investment funds, Central Bank resolution No. 15 (1997), as amended, or any associated regulations. Therefore, the Final Placement Memorandum is strictly private and confidential, and is being issued to a limited number of sophisticated investors, and may not be reproduced or used for any other purposes, nor provided to any person other than the recipient thereof.

The Capital Market Authority does not make any representation as to the accuracy or completeness of the Final Placement Memorandum, and expressly disclaims any liability whatsoever for any loss arising from, or incurred in reliance upon, any part of the Final Placement Memorandum. Prospective purchasers of the Units offered hereby should conduct their own due diligence on the accuracy of the information relating to the Final Placement Memorandum. If you do not understand the contents of the Final Placement Memorandum, you should consult an authorized financial adviser.

Qatar Financial Centre

The Final Placement Memorandum does not, and is not intended to, constitute an invitation or offer of securities from or within the Qatar Financial Center ("**QFC**"), and accordingly should not be construed as such. The Final Placement Memorandum has not been reviewed or approved by or registered with the Qatar Financial Centre Authority, the Qatar Financial Centre Regulatory Authority or any other competent legal body in the QFC. The Final Placement Memorandum is strictly private and confidential and may not be reproduced or used for any other purpose, nor provided to any person other than the recipient thereof. The Cube Highways Trust has not been approved or licensed by or registered with any licensing authorities within the QFC.

Saudi Arabia

The Final Placement Memorandum may not be distributed in the Kingdom of Saudi Arabia except to such persons as are permitted under the Offers of Securities Regulations as issued by the board of the Saudi Arabian Capital Market Authority ("**CMA**") pursuant to resolution number 2-11-2004 dated October 4, 2004 as amended by resolution number 1-28-2008, as amended (the "**CMA Regulations**"). The CMA does not make any representation as to the accuracy or completeness of the Final Placement Memorandum and expressly disclaims any liability whatsoever for any loss arising from, or incurred in reliance upon, any part of the Final Placement Memorandum. Prospective purchasers of the Units offered hereby should conduct their own due diligence on the accuracy of the information relating to the Units. If you do not understand the contents of the Final Placement Memorandum, you should consult an authorized financial adviser.

Singapore

The Final Placement Memorandum has not been and will not be registered as a prospectus in Singapore with the Monetary Authority of Singapore. Accordingly, the Final Placement Memorandum and any other document or material in connection with the offer or sale, or invitation for subscription or purchase, of the Units may not be circulated or distributed, nor may the Units be offered or sold, or be made the subject of an invitation for subscription or purchase, whether directly or indirectly, to any person in Singapore other than (i) to an institutional investor (as defined in Section 4A of the Securities and Futures Act, (Chapter 289), of Singapore as modified and amended from time to time (the "**Securities and Futures Act**")) pursuant to Section 274 of the Securities and Futures Act, (ii) to a relevant person (as defined in Section 275(2) of the Securities and Futures Act) pursuant to Section 275(1) of the Securities and Futures Act, or any person pursuant to Section 275(1A) of the Securities and Futures Act, and in accordance with the conditions specified in Section 275 of the Securities and Futures Act, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the Securities and Futures

Act.

Where the Units are subscribed or purchased under Section 275 of the Securities and Futures Act by a relevant person which is:

(a) a corporation (which is not an accredited investor (as defined in Section 4A of the Securities and Futures Act)) the sole business of which is to hold investments and the entire share capital of which is owned by one or more individuals, each of whom is an accredited investor; or

(b) a trust (where the trustee is not an accredited investor) whose sole purpose is to hold investments and each beneficiary of the trust is an individual who is an accredited investor,

securities or securities-based derivatives contracts (each as defined in Section 239(1) of the Securities and Futures Act) of that corporation or the beneficiaries' rights and interest (howsoever described) in that trust shall not be transferred within six months after that corporation or that trust has acquired the Units pursuant to an offer made under Section 275 of the Securities and Futures Act except:

(1) to an institutional investor or to a relevant person, or to any person arising from an offer referred to in Section 275(1A) or Section 276(4)(i)(B) of the Securities and Futures Act;

(2) where no consideration is or will be given for the transfer;

(3) where the transfer is by operation of law;

(4) as specified in Section 276(7) of the Securities and Futures Act; or

(5) as specified in Regulation 37A of the Securities and Futures (Offers of Investments) (Securities and Securities-based Derivatives Contracts) Regulations 2018 of Singapore.

Notification under Sections 309B(1)(a) and 309B(1)(c) of the SFA: The Cube Highways Trust determined, and hereby notifies all relevant persons (as defined in Section 309A of the SFA) that the Units are: (A) prescribed capital markets products (as defined in the Securities and Futures (Capital Markets Products) Regulations 2018) and (B) Excluded Investment Products (as defined in MAS Notice SFA 04-N12: Notice on the Sale of Investment Products and MAS Notice FAAN16: Notice on Recommendations on Investment Products).

South Korea

We are not making any representation with respect to the eligibility of any recipients of this document to acquire the Units therein under the laws of Korea, including, but without limitation, the Foreign Exchange Transaction Law and Regulations thereunder. The Units have not been and will not be registered under the Financial Investment Services and Capital Markets Act of Korea (the "**FSCMA**"). Accordingly, the Units may not be offered, sold or delivered, or offered or sold to any person for re-offering or resale, directly or indirectly, in Korea or to, or for the account or benefit of, any resident of Korea (as such term is defined under the Foreign Exchange Transaction Law of Korea and its Enforcement Decree), for a period of one year from the date of issuance of the Units, except (i) where relevant requirements are satisfied, the Units may be offered, sold or delivered to or for the account or benefit of a Korean resident which falls within certain categories of qualified professional investors as specified in the FSCMA, its Enforcement Decree and the Regulation on Securities Issuance and Disclosure promulgated thereunder, or (ii) as otherwise permitted under applicable Korean laws and regulations.

Furthermore, the Units may not be re-sold to Korea residents unless the purchaser of the Units complies with all applicable regulatory requirements (including, but not limited to, governmental approval requirements under the Foreign Exchange Transaction Law and its subordinate decrees and regulations) in connection with purchase of the Units.

Switzerland

The Units may not be publicly offered in Switzerland and will not be listed on the SIX Swiss Exchange ("**SIX**") or on any other stock exchange or regulated trading facility in Switzerland. The Final Placement Memorandum does not constitute a prospectus within the meaning of, and has been prepared without regard to the disclosure standards for issuance prospectuses under Article 652a or Article 1156 of the Swiss Code of Obligations or the disclosure standards for listing prospectuses under Articles 27 ff. of the SIX Listing Rules or the listing rules of any other stock exchange or regulated trading facility in Switzerland. Neither this document nor any other offering or marketing material relating to the Units or the Offer may be publicly distributed or otherwise made publicly available in Switzerland.

Neither this document nor any other offering or marketing material relating to the Units or the Offer or the Cube Highways Trust have been or will be filed with or approved by any Swiss regulatory authority. In particular, this document will not be filed with, and the Offer will not be supervised by, the Swiss Financial Market Supervisory Authority, and the Offer has not been

and will not be authorised under the Swiss Federal Act on Collective Investment Schemes ("**CISA**"). The investor protection afforded to acquirers of interests in collective investment schemes under the CISA does not extend to acquirers of the Units.

Taiwan

The Units have not and will not be registered with the Financial Supervisory Commission of Taiwan pursuant to relevant securities laws and regulations and may not be sold, issued or offered within Taiwan through a public offering or in circumstances which constitutes an offer within the meaning of the Securities and Exchange Act of Taiwan that requires a registration or approval of the Financial Supervisory Commission of Taiwan. No person or entity in Taiwan has been authorized to offer, sell, give advice regarding or otherwise intermediate the offering and sale of the Units in Taiwan.

United Arab Emirates (excluding the Dubai International Financial Centre)

This document does not constitute or contain an offer of securities to the general public in the United Arab Emirates ("**UAE**"). No offering, marketing, promotion, advertising or distribution (together, "**Promotion**") of this document or the Units may be made to the general public in the UAE unless: (a) such Promotion has been approved by the UAE Securities and Commodities Authority (the "**SCA**") and is made in accordance with the laws and regulations of the UAE, including SCA Board of Directors' Chairman Decision no. (3/R.M.) of 2017 (the "**Promotion and Introduction Regulations**"), and is made by an entity duly licensed to conduct such Promotion activities in the UAE; or (b) such Promotion is conducted by way of private placement made: (i) only to non-natural persons "Qualified Investors" (as such term is defined in the Promotion and Introduction Regulations); or (ii) otherwise in accordance with the laws and regulations of the UAE; or (c) such Promotion is carried out by way of reverse solicitation only upon an initiative made in writing by an investor in the UAE. None of the SCA, the UAE Central Bank, the UAE Ministry of Economy or any other regulatory authority in the UAE has reviewed or approved the contents of this document nor does any such entity accept any liability for the contents of this document.

United Kingdom

The Final Placement Memorandum is only directed at, and will only be provided to, persons to whom interests may lawfully be promoted pursuant to section 21 of the Financial Services and Markets Act 2000 (the "**FSMA**"). In particular, this Final Placement Memorandum is only directed at, and will only be provided to, investment professionals ("**Relevant Persons**") within the meaning of article 19 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 ("**FPO**"). Any investment or investment activity to which the Final Placement Memorandum relates is available only to Relevant Persons and dealings hereunder will be made only with Relevant Persons. Persons who are not investment professionals within the meaning of article 19 of the FPO should not rely on the Final Placement Memorandum.

The Final Placement Memorandum has not been delivered for approval to the United Kingdom Financial Conduct Authority in the United Kingdom or to an authorized person within the meaning of the FSMA. No approved prospectus within the meaning of section 85 of the FSMA or of the Prospectus Regulation has been published or is intended to be published in relation to the Offer. The Final Placement Memorandum does not constitute a prospectus for the purposes of the FSMA or the Prospectus Regulation.

United States of America

Each purchaser or subscriber of Units in the United States will be deemed to have represented and agreed that it has received a copy of this Final Placement Memorandum and such other information as it deems necessary to make an investment decision and that:

i. it understands and agrees that the Units have not been and will not be registered under the Securities Act or with any securities regulatory authority of any state, territory or other jurisdiction of the United States and may not be offered, resold, pledged or otherwise transferred, except (1) in an offshore transaction complying with Rule 903 or Rule 904 of Regulation S, (2) pursuant to an exemption from the registration requirements of the Securities Act or (3) pursuant to an effective registration statement under the Securities Act and (4) in accordance with all applicable securities laws of any state, territory or other jurisdiction of the United States;

ii. it understands that in the event Units are held in certificated form, such certificated Units will bear a legend substantially to the following effect:

"THE SECURITY EVIDENCED HEREBY HAS NOT BEEN AND WILL NOT BE REGISTERED UNDER THE UNITED STATES SECURITIES ACT OF 1933, AS AMENDED (THE "**SECURITIES ACT**"), ANY STATE SECURITIES LAWS IN THE UNITED STATES OR THE SECURITIES LAWS OF ANY OTHER JURISDICTION AND MAY NOT BE OFFERED, SOLD, PLEDGED OR OTHERWISE TRANSFERRED, EXCEPT: (A) IN AN OFFSHORE TRANSACTION IN ACCORDANCE WITH RULE 903 OR RULE 904 OF REGULATION S UNDER

THE SECURITIES ACT; (B) PURSUANT TO AN EXEMPTION FROM THE REGISTRATION REQUIREMENTS OF THE SECURITIES ACT; OR (C) PURSUANT TO AN EFFECTIVE REGISTRATION STATEMENT UNDER THE SECURITIES ACT, IN EACH CASE IN ACCORDANCE WITH ANY APPLICABLE SECURITIES LAWS OF ANY STATE OF THE UNITED STATES.";

iii. any resale made other than in compliance with the above stated restrictions shall not be recognised by the Trust;

iv. it agrees that it will give to each person to whom it transfers Units notice of any restrictions on transfer of such Units;

v. it agrees that neither it, nor any of its affiliates, nor any person acting on behalf of the purchaser or any of its affiliates, will make any "directed selling efforts" as defined in Regulation S under the Securities Act with respect to the Units; and

vi. it acknowledges that the Trust, the Sponsor and the Placement Agents and others will rely upon the truth and accuracy of the foregoing acknowledgements, representations and agreements and agrees that, if any of such acknowledgements, representations or agreements deemed to have been made by virtue of its purchase of Units are no longer accurate, it will promptly notify the Trust, the Sponsor and the Placement Agents, and if it is acquiring any Units as a fiduciary or agent for one or more accounts, it represents that it has sole investment discretion with respect to each such account and that it has full power to make the foregoing acknowledgements, representations and agreements on behalf of each such account.

Other Jurisdictions

The distribution of this Final Placement Memorandum and the offer and sale of the Units may be restricted by law in certain jurisdictions. Persons into whose possession this Final Placement Memorandum comes are required to inform themselves about, and to observe, any such restrictions to the extent applicable.

RIGHTS OF UNITHOLDERS

The rights and interests of Unitholders are included in this Final Placement Memorandum and the InvIT Regulations. Under the Trust Deed and the Investment Management Agreement, these rights and interests are safeguarded by the Trustee and the Investment Manager, respectively. Any rights and interests of Unitholders as specified in this Final Placement Memorandum would be deemed to be amended to the extent of any amendment to the InvIT Regulations.

Beneficial Interest

Each Unit represents an undivided beneficial interest in the Trust. A Unitholder has no equitable or proprietary interest in the Portfolio Assets of the Trust and is not entitled to transfer of the Initial Portfolio Assets (or any part thereof) or any interest in the Portfolio Assets (or any part thereof) of the Trust. A Unitholder's right is limited to the right to require due administration of the Trust in accordance with the provisions of the Trust Deed and the Investment Management Agreement.

Ranking

No Unitholder of the Trust shall enjoy superior voting or any other rights over another Unitholder subject to any Subordinate Units being issued to the Sponsors and their Associates. Further, the Units shall not have multiple classes, except the Subordinate Units issued only to the Sponsors and their Associates, where such Subordinate Units carry only inferior voting or any other rights compared to other Ordinary Units, in accordance with their terms and Regulation 4(2)(h) of the InvIT Regulations. For details in relation to the Subordinate Units, please see the section entitled "*Information Concerning the Units*" on page 226.

Redressal of grievances

The Trustee shall periodically review the status of Unitholders' complaints and their redressal undertaken by the Investment Manager. The Stakeholders' Relationship Committee of the Investment Manager shall monitor the status of complaints and their redressal. For details, please see the section entitled "*Corporate Governance*" on page 144.

Distribution

The Unitholders holding Ordinary Units ("**Ordinary Unit Holders**") shall have the right to receive distribution in accordance with the InvIT Regulations and in the manner provided in this Final Placement Memorandum. For details, please see the section entitled "*Distribution*" on page 243.

Meeting of the Ordinary Unit Holders

Meetings of the Ordinary Unit Holders will be conducted in accordance with the InvIT Regulations.

Passing of resolutions

1. With respect to any matter requiring approval of the Ordinary Unit Holders:

    (i) a resolution shall be considered as passed when the votes cast by Unitholders, so entitled and voting, in favour of the resolution exceed a certain percentage as specified in the InvIT Regulations, of votes cast against;
    (ii) the voting may also be done by postal ballot or electronic mode;
    (iii) a notice of not less than 21 (twenty one) days shall be provided to the Unitholders;
    (iv) voting by any Ordinary Unit Holder (including, the Sponsors in their capacity as a Ordinary Unit Holder), who is a related party in such transaction, as well as associates of such Unitholder(s) shall not be considered on the specific issue; and
    (v) the Investment Manager shall be responsible for all the activities pertaining to conducting of meeting of the Ordinary Unit Holders, subject to oversight by the Trustee.

    However, for issues pertaining to the Investment Manager, including a change in Investment Manager, removal of Investment Manager or change in control of Investment Manager; the Trustee shall convene and handle all activities pertaining to conduct of the meetings. Additionally, for issues pertaining to the Trustee, including change in Trustee, the Trustee shall not be involved in any manner in the conduct of the meeting.

2. For the Trust:

    (i) an annual meeting of all Ordinary Unit Holders shall be held not less than once a year within 120 days from the end of each financial year and the time between two meetings shall not exceed 15 months;

(ii) with respect to the annual meeting of the Ordinary Unit Holders,

(a) any information that is required to be disclosed to the Ordinary Unit Holders and any issue that, in the ordinary course of business, may require approval of the Ordinary Unit Holders may be taken up in the meeting including:
- latest annual accounts and performance of the Trust;
- approval of auditors and fee of such auditors, as may be required;
- latest valuation reports;
- appointment of valuer, as may be required; and
- any other issue.

(b) for any issue taken up in such meetings which require approval from the Ordinary Unit Holders other than as specified in Regulation 22(6) of the InvIT Regulations, votes cast in favour of the resolution shall be more than the votes cast against the resolution.

3. In case of the following, approval from the Ordinary Unit Holders shall be required where the votes cast in favour of the resolution shall be more than the votes cast against the resolution and the board of directors of the Investment Manager shall set forth clearly the recommendation of the Investment Manager in the notice to the Ordinary Unitholders:

(i) any approval from the Unitholders required in terms of Regulation 18 (*Investment conditions and dividend policy)*, Regulation 19 (*Related Party Transactions*) and Regulation 21 *(Valuation of assets*) of the InvIT Regulations;
(ii) any borrowings, in excess of the limits specified under Regulation 20(2) of the InvIT Regulations;
(iii) any transaction, other than any borrowing, the value of which is equal to or greater than 25% (twenty five per cent) of the InvIT Assets;
(iv) increasing period for compliance with investment conditions to one year in accordance with Regulation 18(5)(c) of the InvIT Regulations;
(v) any issue, in the ordinary course of business, which in the opinion of the Sponsors or the Trustee or the Investment Manager, is material and requires approval of the Ordinary Unit Holders, if any;
(vi) any issue for which SEBI or the Designated Stock Exchange requires approval; and
(vii) de-classification of the status of Sponsors.

4. In case of the following, approval from the Ordinary Unit Holders shall be required where the votes cast in favour of the resolution shall not be less than one and a half times the votes cast against the resolution:

(i) any change in the Investment Manager including the removal of Investment Manager or change in control of the Investment Manager;
(ii) any material change in the investment strategy or any change in the management fees of the Trust;
(iii) the Trustee and Investment Manager proposing to seek delisting of units of the Trust (under clause (e) of sub-regulation (1) of Regulation 17 of the InvIT Regulations);
(iv) any issue, not in the ordinary course of business, which in the opinion of the Sponsors or Investment Manager or Trustee requires approval of the Ordinary Unit Holders;
(v) any issue for which SEBI or the Designated Stock Exchange require approval;
(vi) any issue taken up on request of the Ordinary Unit Holders including:

(a) removal of the Investment Manager and appointment of another investment manager to the Trust;
(b) removal of the Auditors and appointment of another auditors to the Trust;
(c) removal of the Valuer and appointment of another valuer to the Trust;
(d) any issue which the Ordinary Unit Holders have sufficient reason to believe that is detrimental to the interest of the Ordinary Unit Holders; and
(e) change in the Trustee, if the Ordinary Unit Holders have sufficient reason to believe that acts of the Trustee are detrimental to the interest of the Ordinary Unit Holders.

With respect to the rights of the Ordinary Unit Holders under clause 4(iii) above:

(i) not less than 25% of the Ordinary Unit Holders by value, other than any party related to the transactions and its associates, shall apply, in writing, to the Trustee for the purpose;

(ii) on receipt of such application, the Trustee shall require, with the Investment Manager to place the issue for voting in the manner as specified in the InvIT Regulations;

(iii) with respect to clause 4(iii)(e) above, not less than 60% of the Unitholders by value shall apply, in writing, to the Trustee for the purpose.

5. In case of the following, approval from 75% of Ordinary Unit Holders by value shall be required:

(i) In case of any borrowing by the Trust in terms of limit specified in clause (b) of sub-regulation 3 of Regulation 20 of the InvIT Regulations;

(ii) In case that any person other than the Sponsor, its related parties and its associates, acquires Units of the Trust, which taken together with Units held by such person and by persons acting in concert with such persons in the Trust, exceeds 25% of the value of the outstanding Units of the Trust (value of Units held by parties related to the transaction shall not be considered for this specific purpose);

Provided that if the required approval is not received, the person acquiring the Units shall provide an exit option to the dissenting Ordinary Unitholders to the extent and in the manner as may be specified by SEBI;

(iii) Prior to any change in Sponsor or inducted Sponsor or change in control of Sponsor or inducted Sponsor (value of Units held by parties related to the transaction shall not be considered for this specific purpose).

If the required approval is not received:

a. in case of change in Sponsor or inducted Sponsor, the proposed inducted Sponsor shall provide the dissenting Unitholders an option to exit by buying their units in the manner specified by SEBI; and
b. in case of change in control of the Sponsor or inducted Sponsor, the said Sponsor or inducted Sponsor shall provide the dissenting Ordinary Unitholders an option to exit by buying their Ordinary Units in the manner specified by SEBI.

Information rights

The Investment Manager, on behalf of the Trust, shall also submit such information to the Stock Exchanges and the Ordinary Unit Holders, on a periodical basis as may be required under the InvIT Regulations and the Listing Agreement to be entered into with the Stock Exchanges. The Investment Manager (on behalf of the Trust) shall disclose to the Stock Exchanges, the Ordinary Unit Holders and SEBI, all such information and in such manner as specified under the InvIT Regulations and such other requirements as may be specified by SEBI. The Investment Manager, on behalf of the Trust, shall also provide disclosures or reports specific to the sector or sub-sector in which the Trust has invested or proposes to invest, in the manner as may be specified by SEBI.

Buyback and Delisting of Units

Any buyback or delisting of Units, shall be in accordance with the Trust Deed and the InvIT Regulations.

DILUTION

Dilution is the amount by which the Offer Price exceeds the net asset value ("**NAV**") per Ordinary Unit, immediately after the completion of this Offer. NAV per Ordinary Unit is determined by subtracting the total liabilities of the Trust from the total assets of the Trust and dividing by the number of Ordinary Units issued and outstanding immediately before this Offer. There was no *pro forma* NAV before this Offer for the Ordinary Units.

The Trust has undertaken an Offer of 522,582,727 Ordinary Units at an Offer Price of ₹ 100 for each Ordinary Unit. The aggregate outstanding Ordinary Units pursuant to the Offer will be 1,290,346,112 Ordinary Units. Accordingly, the combined NAV of the Trust on a per Ordinary Unit basis is higher than the Offer Price. Therefore, there will be no dilution to the Sponsors or Unitholders pursuant to the completion of the Offer and consequent Listing.

OFFER STRUCTURE

Initial offer of 522,582,727 Ordinary Units through a private placement at a price of ₹ 100 per Ordinary Unit, aggregating to ₹ 52,258.27 million and comprising of a fresh issue of 380,259,172 Ordinary Units aggregating to ₹ 38,025.92 million by the Trust and an offer for sale of 142,323,555 Ordinary Units aggregating to ₹ 14,232.36 million by the Selling Unitholders. In accordance with Regulation 14(1A) of the InvIT Regulations, this Offer shall constitute at least 25% of the total outstanding Ordinary Units on a post-Offer basis.

Particulars	Details
Number of Units available for Allotment/allocation	522,582,727 Ordinary Units
Basis of Allotment/ allocation	Discretionary
Minimum Bid	Such number of Ordinary Units that the Bid Amount is not less than ₹ 260 million, and in multiples of 1 Ordinary Unit thereafter
Maximum Bid	Such number of Ordinary Units (in multiples of 1 Ordinary Unit) not exceeding the size of this Offer, subject to applicable investment limits
Mode of Allotment	Compulsorily in dematerialised form
Bid Lot	A minimum of such number of Ordinary Units that the Bid Amount is not less than ₹ 260 million, and in multiples of 1 Ordinary Unit thereafter
Allotment Lot	A minimum of 2,600,000 Ordinary Units, and in multiples of 1 Ordinary Unit thereafter
Trading Lot[(1)]	Upon listing, such number of Ordinary Units, the value of which is, or exceeds, ₹ 20 million
Arrangements for Disposal of Odd Lots	The Stock Exchanges will provide for an odd lot window to facilitate the trading of odd lots of Ordinary Units that may be created from time to time on account of various events, including instances such as declaration of NAV and any distributions in respect of the Ordinary Units
Who can apply	(i) Institutional Investors; and (ii) Bodies Corporate
Terms of Payment	The entire Bid Amount was payable on or prior to the Bid/Offer Closing Date

(1) The trading lot post-listing of the Ordinary Units may be modified in accordance with the InvIT Regulations and other applicable law.

Indicative Offer Timeline

Event	Indicative Date
Bid/ Offer Opening Date	April 10, 2023
Bidders to submit completed Application Forms	Between April 10, 2023 and April 13, 2023
Bid/ Offer Closing Date	April 13, 2023
Dispatch of CANs to successful Bidders	On or about April 18, 2023*
Closing Date	On or about April 18, 2023*
Designated Date	On or about April 18, 2023
Initiation of refunds, if any, in the event of any failure to obtain final listing and trading approval within six Working Days from the Bid/ Offer Closing Date	On or about April 18, 2023
Listing Date	On or about April 21, 2023

***** *The date of dispatch of CANs to successful Bidders and the Closing Date is proposed to be April 17, 2023.*

The above timetable is indicative and does not constitute any obligation or liability on the Trust, the Investment Manager, the Trustee, the Sponsors, the Selling Unitholders or the Placement Agents.

While the Investment Manager shall ensure that all steps for the completion of the necessary formalities for the listing and the commencement of trading of the Ordinary Units on the Stock Exchanges is completed within six Working Days from the Bid/Offer Closing Date or such other timeline as may be prescribed by SEBI, the timetable may change due to various factors, such as, any extension of the Bid/Offer Period by the Investment Manager or any delay in receiving the final listing and trading approval from the Stock Exchanges. The commencement of trading of the Ordinary Units will be entirely at the discretion of the Stock Exchanges and in accordance with applicable law.

The Selling Unitholders confirm that they shall extend all reasonable co-operation required by the Trust, the Investment Manager and the Placement Agents for the completion of the necessary formalities for listing and commencement of trading of the Ordinary Units offered by the Selling Unitholders in the Offer for Sale on the Stock Exchanges within six Working Days from the Bid/Offer Closing Date.

OFFER INFORMATION

Please see below a summary, intended to provide a general outline of the procedures for the bidding, application, payment, Allocation and Allotment of the Ordinary Units to be offered pursuant to the Offer.

Eligible Investors were advised to inform themselves of any restrictions or limitations that may be applicable to them under applicable law to which they are subject, and should have consulted their respective advisors in this regard. Eligible Investors that have applied in this Offer were required to confirm, and were deemed to have represented, to the Trustee, the Investment Manager, the Placement Agents, the Selling Unitholders and their respective directors, officers, agents, affiliates and representatives, that they are eligible under all applicable laws, rules, regulations, guidelines and approvals to acquire the Ordinary Units. The Investment Manager, the Sponsors, the Selling Unitholders and the Placement Agents and their respective directors, officers, agents, affiliates and representatives accept no responsibility or liability for advising any investor on whether such investor is eligible to acquire the Ordinary Units.

Authority for the Offer

The Trust is undertaking this Offer in accordance with Regulation 14(2) of the InvIT Regulations. The Offer was authorised and approved by the board of directors of the Investment Manager on July 11, 2022 and March 22, 2023, respectively.

The Offer for Sale has been authorized by the board of directors of each of the Selling Unitholders on December 19, 2022. Further, with respect to the Ordinary Units offered by the Selling Unitholders in the Offer for Sale, the Selling Unitholders have each held equity shares of the Initial Portfolio Assets, against which such Ordinary Units have been allotted to the Selling Unitholders, for a period of at least one year immediately preceding the date of the Draft Placement Memorandum.

The Trust has received the in-principle approval of BSE and NSE for the listing of the Ordinary Units on BSE and NSE, pursuant to the letters dated August 3, 2022 and September 2, 2022, respectively. The validity of the in-principle approval from BSE has been extended by way of letters dated December 1, 2022 and March 10, 2023. The validity of the in-principle approval from NSE has been extended by way of letters dated November 3, 2022 and February 2, 2023. The Investment Manager has filed a copy of the Draft Placement Memorandum, the Placement Memorandum and this Final Placement Memorandum, with SEBI and the Stock Exchanges.

The Ordinary Units have not been, and will not be, registered, listed or otherwise qualified in any jurisdiction outside India and may not be offered or sold, and Bids may not be made by persons in any such jurisdiction, except in compliance with the applicable laws of such jurisdiction. The Ordinary Units shall not be offered or sold where such offer or sale would require registration, qualification or listing.

Bidders should note that Allotment to successful Bidders will only be in the dematerialized form. Application Forms which did not have the details of the Bidders' demat accounts including the DP ID, PAN and Client ID have been treated as incomplete and rejected. Bidders will not have the option of receiving Allotment in physical form. On Allotment, the Ordinary Units will be traded only on the dematerialized segment of the Stock Exchanges.

Offer Procedure

1. The Placement Agents, in consultation with the Investment Manager, had electronically circulated serially numbered copies of the Placement Memorandum and the Application Form to Eligible Investors. The Application Form has been specifically addressed to each Eligible Investor. The list of Eligible Investors to whom the serially numbered copies of the Placement Memorandum and the Application Form has been circulated, was determined by the Investment Manager, in consultation with the Placement Agents.

2. **Unless a serially numbered Placement Memorandum along with an Application Form was addressed to a particular Eligible Investor, no invitation to subscribe shall be deemed to have been made to such Eligible Investor.** Even if such documentation were to come into the possession of any person other than the intended recipient, no offer or invitation to offer shall be deemed to have been made to such person and such person would not be eligible to participate in the Offer.

3. Bidders were required to submit an Application Form to the Placement Agents, only during the Bid/Offer Period and not later than the Bid/Offer Closing Date.

4. Bidders were required, *inter alia*, to indicate the following in the Application Form:

    a. a representation that it is outside the United States acquiring the Ordinary Units in an offshore transaction under Regulation S and it has agreed to certain other representations set forth in "*Notice to Investors - Representations by Eligible Investors*" on page 2 and "*Selling and Transfer Restrictions*" on page 309 and certain other representations made in the Application Form;

b. name of the Bidder to whom the Ordinary Units are to be Allotted;

c. number of Ordinary Units Bid;

d. details of the demat accounts to which the Ordinary Units should be credited;

e. details of the Bid Amount deposited by the Bidder into the Cash Escrow Account;

f. a representation that such person is an "Institutional Investor" or a "Body Corporate" as defined under the InvIT Regulations;

g. the details of Bidder's bank account along with fund transfer details, in case of any refund; and

h. any other information which may be relevant to the Bid.

Note: The Bids made by asset management companies or custodians of Mutual Funds, as permitted under applicable law, should have specifically stated the names of the concerned schemes for which the Bids were made. In case of a Mutual Fund, a separate Bid should have been made in respect of each scheme of the Mutual Fund registered with SEBI and such Bids in respect of more than one scheme of the Mutual Fund have not been treated as multiple Bids provided that the Bids clearly indicate the scheme for which the Bid were made. Bidders were advised to ensure that any single Bid from them does not exceed the investment limits or maximum number of Ordinary Units that can be held by them under applicable law and the InvIT Regulations.

5. Each Bidder was required to make payment of the entire Bid Amount for the Ordinary Units at the Offer Price, only through electronic transfer to the Cash Escrow Account during the Bid/Offer Period, prior to the closure of the Bid/Offer Period.

6. No payment should have been made by Bidders in cash. Please note that any payment of Bid Amount for Ordinary Units should have been made from the bank account of the relevant Bidder applying for Ordinary Units, and the Placement Agents, on behalf of the Investment Manager, has kept a record of the bank account from where such Bid Amounts have been received. The Bid Amount payable on Ordinary Units to be held by joint holders should have been paid from the bank account of the person whose name appears first in the completed Application Form. Pending listing, all Bid Amounts received from Bidders have been kept in a separate bank account with a scheduled bank (i.e. the Cash Escrow Account).

7. Once a duly completed Application Form was submitted by a Bidder, such Application Form constituted an irrevocable offer and cannot be withdrawn.

8. Upon receipt of the completed Application Form and the receipt of the Bid Amount in the Cash Escrow Account, the Investment Manager and the Selling Unitholders shall, after Bid/Offer Closing Date, determine the number of the Ordinary Units to be Allotted pursuant to the Offer, in consultation with the Placement Agents.

9. Upon determination of the Bidders to whom Allocation shall be made, the Placement Agents, on behalf of the Investment Manager and the Selling Unitholders, have sent the CANs, along with a serially numbered Final Placement Memorandum, to the Bidders who have been Allocated Ordinary Units. The dispatch of a CAN shall be deemed a valid, binding and irrevocable contract in respect of the number of Units Allocated to the Bidder. **Please note that the Allocation and Allotment is at the discretion of the Investment Manager, in consultation with the Placement Agents, and in accordance with the InvIT Regulations**.

10. Upon the dispatch of CAN to successful Bidders, the Investment Manager and the Selling Unitholders shall Allot Ordinary Units of the Trust as per the details in the CAN sent to successful Bidders. The Investment Manager will intimate the Stock Exchanges about the details of the Allotment and apply for approval of the Ordinary Units for listing and trading of the Ordinary Units on the Stock Exchanges after the credit of Ordinary Units into the demat accounts of the successful Bidders.

11. Allottees are advised to instruct their respective Depository Participant to accept the Ordinary Units that may be Allotted to them pursuant to the Offer into their respective demat accounts.

12. In the event the Investment Manager and the Selling Unitholders are unable to Allot the Ordinary Units, in full or in part, or upon cancellation of the Offer, the Investment Manager and the Selling Unitholders shall be liable to refund the Bid Amounts with interest to the Bidders in accordance with applicable law. For each Bidder to whom any amounts are to be refunded, the refund shall be made to the same bank account from which the Bid Amount was remitted by such Bidder.

13. The Ordinary Units that have been credited to the demat accounts of the Bidders shall be listed and eligible for trading on the Stock Exchanges only upon the receipt of final listing and trading approvals from the Stock Exchanges. Bidders are advised to apprise themselves of the status of the receipt of the permissions from the Stock Exchanges or the Investment Manager.

14. The Bid Amount will be transferred to the accounts of the Trust and the Selling Unitholders from the Cash Escrow Account only after receipt of the final listing and trading approvals for the Ordinary Units from the Stock Exchanges.

Who can Bid?

Each Bidder must have checked if it is eligible to Bid for Ordinary Units in this Offer under applicable law. Furthermore, certain categories of Bidders may not have been permitted to Bid in the Offer or hold Ordinary Units in excess of the limits specified under applicable law.

Only Institutional Investors and Bodies Corporate were eligible to participate in this Offer.

An Institutional Investor is defined in Regulation 2(1)(ya) of the InvIT Regulations.

A Body Corporate is defined in Section 2(11) of the Companies Act, 2013 to include a company incorporated outside India, but does not include (i) a co-operative society registered under any law relating to co-operative societies; and (ii) any other body corporate (not being a company as defined in the Companies Act, 2013) which the Central Government may, by notification, specify in this regard.

Bodies Corporate incorporated outside India are permitted to participate in the Offer subject to compliance with Schedule VIII of the Foreign Exchange Management (Non-debt Instruments) Rules, 2019, as amended.

All Non-Resident Investors should note that, in accordance with the Foreign Exchange Management (Non-debt Instruments) Rules, 2019, as amended, including Press Note No.3 (2020 Series), dated April 17, 2020 issued by the DPIIT, where the beneficial owner of a proposed investment into India is situated in or is a citizen of a country that shares land border with India (but is not a multilateral bank or fund of which India is a member), approval of the Government will be required prior to such investment.

The Trustee, the Valuer and the employees of the Valuer who were involved in the valuation of the Trust are not permitted to Bid in this Offer.

Bids by FPIs

Foreign Portfolio Investors (other than individuals, corporate bodies and family offices) are permitted to participate in the Offer subject to compliance with Schedule II, Schedule VIII and other applicable provisions of the Foreign Exchange Management (Non-debt Instruments) Rules, 2019, as amended. In case of Bids by FPIs the payment should have been paid as inward remittance from abroad through banking channels or out of funds held in accounts maintained in accordance with the Foreign Exchange Management (Deposit) Regulations, 2016, along with documentary evidence in support of the remittance. In case of Bids made by FPIs, a certified true copy of the certificate of registration issued by the designated depository participant under the SEBI FPI Regulations was required to be attached along with the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by SEBI registered VCFs and AIFs

The SEBI VCF Regulations prescribe, amongst others, the investment restrictions on VCFs registered with SEBI. Further, the SEBI AIF Regulations prescribe, amongst others, the investment restrictions on AIFs. Further, VCFs which have not re-registered as an AIF under the SEBI AIF Regulations shall continue to be regulated by the SEBI VCF Regulations until the existing fund or scheme managed by the fund is wound up and such funds shall not launch any new scheme after the notification of the SEBI AIF Regulations. Additionally, VCFs and AIFs are subject to certain investment restrictions, including with respect to the percentage of investible funds held in each investee entity. Allotments made in respect of Bids by VCFs and AIFs in this Offer shall be subject to the rules and regulations that are applicable to each of them, respectively. In case of Bids made by VCFs or AIFs, a certified true copy of the issued by SEBI was required to be attached along with the Application Form failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by Banking Companies

Bids may have been made by banks as permitted by the RBI and were subject to conditions specified in the Prudential Guidelines – Banks' investment in units of REITs and InvITs dated April 18, 2017. In case of Bids made by banking companies registered with the RBI, certified copies of (i) the certificate of registration issued by the RBI, and (ii) the approval of such banking company's investment committee were required to be attached to the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by Provident Funds

On March 2, 2015, the Ministry of Finance issued a notification allowing investments by non-government provident funds, superannuation funds and gratuity funds up to 5% in infrastructure investment trusts, as specified. On May 29, 2015, the Ministry of Labour and Employment issued a notification allowing investments by provident funds up to 5% in infrastructure investment trusts, as specified. However, such investments by provident funds, superannuation funds and gratuity funds will be subject to, amongst others, the sponsor entity of the InvIT having a minimum of AA or equivalent rating in the applicable rating scale from at least two credit rating agencies registered with SEBI. In case of Bids made by provident funds, subject to applicable laws, with minimum corpus of ₹ 250 million, a certified copy of certificate from a chartered accountant certifying the corpus of the provident fund must have been attached to the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by NPS Schemes

The Pension Fund Regulatory and Development Authority ("**PFRDA**") issued circulars allowing investments by national pension fund schemes (other than corporate central government schemes, corporate state government schemes, central government sector schemes, state government sector schemes, NPS Lite Schemes of NPS and Atal Pension Yojana schemes) ("**Non- Govt. NPS Schemes**") and corporate central government schemes, corporate state government schemes, central government sector schemes, state government sector schemes, NPS Lite Schemes of NPS and Atal Pension Yojana schemes ("**Govt. NPS Schemes**" and together with the Non-Govt NPS Schemes, the "**NPS Schemes**") to invest in units of infrastructure investment trusts that are listed or proposed to be listed. The cumulative investment in units and debt instruments of InvITs and REITs by NPS Schemes is not permitted to exceed 3% of the assets under management of the relevant pension fund at any time. Non-Govt. NPS Schemes are also not permitted to invest more than 5% of the units issued by a single InvIT. Such investment will be subject to, amongst other conditions, (i) for Govt. NPS Schemes, the units being rated AAA (or equivalent) in the applicable rating scale of the InvIT from at least two credit rating agencies registered with SEBI ("**CRAs**") and the rating of the sponsor floating the trust being AAA (or equivalent) in the applicable rating scale of the InvIT from at least two CRAs, and (ii) for Non-Govt. NPS Schemes, such securities being rated AA (or equivalent) in the applicable rating scale of the InvIT from at least two CRAs In case of Bids made by NPS Schemes, with minimum corpus of ₹ 250 million, a certified copy of certificate from a chartered accountant certifying the corpus of the provident fund/pension fund must have been attached to the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by Mutual Funds

Bids may have been made by mutual funds under all its schemes, existing and future, subject to the investment conditions and other restrictions prescribed under the Securities and Exchange Board of India (Mutual Funds) Regulations, 1996 (including, the circular on mutual funds dated February 28, 2017 and any other circulars, notifications and guidelines issued thereunder). In case of Bids made by Mutual Funds, a certified true copy of the issued by SEBI was required to be attached along with the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

Bids by Eligible NRIs

In accordance with Schedule IV of the FEMA Rules, Eligible NRIs, including companies, trusts and partnership firms incorporated outside India which are owned and controlled by NRIs, were permitted to purchase units issued by an 'investment vehicle' without any limit, either on the stock exchange or outside it. The FEMA Rules define an 'investment vehicle' to mean an entity registered and regulated under the regulations framed by the SEBI or any other authority designated for that purpose, including an InvIT governed by the SEBI.

Investments by Eligible NRIs in the Ordinary Units must have been on a non-repatriation basis, and were deemed to be domestic investment at par with investments made by residents of India.

Bids by Insurance Companies

Bids may have been made by insurance companies as permitted by the Insurance Regulatory and Development Authority of India in terms of the Master Circular – Investments, 2016 and the circular issued by the IRDAI entitled, Investment in Units of Real Estate Investment Trusts (REIT) & Infrastructure Investment Trusts (InvIT), dated March 14, 2017.

Bids under Power of Attorney

In case of Bids made pursuant to a power of attorney by Institutional Investors or bodies corporate, a certified copy of the power of attorney or the relevant resolution or authority, as the case may be, along with a certified copy of the memorandum of

association and articles of association and/or bye laws must have been submitted along with the Application Form, failing which the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid.

The Investment Manager, in consultation with the Placement Agents, in its absolute discretion, reserved the right to relax the above condition of simultaneous lodging of the power of attorney along with the Application Form.

Allotments, if any, made to FVCIs in the Offer are subject to the respective rules and regulations that are applicable to each of them.

All Non-Resident Investors including Eligible NRIs and FPIs should note that refunds, dividends and other distributions, if any, will be payable in Indian Rupees only and net of bank charges and/or commission.

There was no reservation for NRIs, FPIs and FVCIs and all Bidders were treated on the same basis with other categories for the purpose of allocation.

The Parties to the Trust, the Selling Unitholders and the Placement Agents are not liable for any amendment or modification or change to applicable law or regulations, which may occur after the date of this Final Placement Memorandum. Eligible Investors are advised to make their independent investigations and satisfy themselves that they are eligible to apply in this Offer. Eligible Investors were advised to ensure that any single application from them does not exceed the investment limits or maximum number of Ordinary Units that can be held by them under applicable law or regulation or as specified in the Placement Memorandum.

Note: *Affiliates or associates of the Placement Agents who are Eligible Investors may participate in the Offer in compliance with applicable law.*

Maximum and Minimum Bid Size

(i) Each Bidder was required to Bid for a Minimum Bid Size of ₹ 260 million and in multiples of 1 Ordinary Unit thereafter.

(ii) No Bidder shall have Bid for such number of Ordinary Units that exceeds the Offer size.

Application Process

Application Form

Bidders shall have only used the serially numbered Application Forms provided to them, for the purpose of making a Bid in terms of the Placement Memorandum.

By making a Bid for the Ordinary Units through Application Forms, Bidders were deemed to have made the following representations and warranties, respectively:

(i). The Bidder confirms that it is an Institutional Investor or a Body Corporate, and is eligible to participate in the Offer;

(ii). The Bidder has deposited the Bid Amount in the Cash Escrow Account;

(iii). The Bidder has no right to withdraw its Bid once such Bid is submitted to the Placement Agents;

(iv). Revised Bids, if any, shall have been submitted during the Bid/Offer Period;

(v). The Bidder confirms that it is eligible to apply for, and hold, any Ordinary Units that may be Allotted to the Bidder pursuant to the Offer. The Bidder further confirms that any such Allotment of Units to, and the holding of Ordinary Units by, the Bidder does not, and shall not, exceed the level permissible as per any law applicable to the Bidder; and

(vi). The Bidder confirms that it is outside the United States and it is purchasing the Ordinary Units in an "offshore transaction" as defined under Regulation S under the Securities Act, and in either case is not our affiliate or a person acting on behalf of such an affiliate.

ELIGIBLE INVESTORS MUST HAVE PROVIDED THEIR DEMAT ACCOUNT DETAILS, THEIR DEPOSITORY PARTICIPANT'S NAME, DEPOSITORY PARTICIPANT IDENTIFICATION NUMBER, BENEFICIARY ACCOUNT NUMBER AND BANK ACCOUNT DETAILS IN THE APPLICATION FORM. ELIGIBLE INVESTORS MUST HAVE ENSURED THAT THE NAME GIVEN IN THE APPLICATION FORM IS EXACTLY THE SAME AS THE NAME IN WHICH THE DEMAT ACCOUNT IS HELD.

Demographic details such as address and bank account details will be obtained from the Depositories as per the demat account details given in the Application Form.

Instructions for completing the Application Form

Bidders may note that Application Forms not filled completely or correctly as per instructions provided in the Placement Memorandum and the Application Forms were liable to be rejected. The Bids should have adhered to the following:

(i) Bids must have been made only in the prescribed Application Form;

(ii) Application Form must have been completed in full, in BLOCK LETTERS in ENGLISH and in accordance with the instructions contained herein and in the Application Form. In case of incomplete Application Forms, the Investment Manager, in consultation with the Placement Agents, reserved the right to reject the Bid;

(iii) Bidders must have provided details of valid and active DP ID, Client ID and PAN clearly and without error. Invalid accounts, suspended accounts, or where such account was classified as invalid or suspended shall not have been considered for Allotment. Bidders should note that the Placement Agents, Registrar and the Investment Manager will not be liable for errors in data entry due to incomplete or illegible Application Forms; and

(iv) Bidders were required to sign the Application Form. Bidders should have ensured that the thumb impressions and signatures other than in the languages specified in the Eighth Schedule to the Constitution of India, were attested by a Magistrate or a Notary Public or a Special Executive Magistrate under official seal.

Submission of Application Form

All Application Forms had to be duly completed with information including the name of the Bidder, the number of the Ordinary Units applied for and the Bid Amount and the details of the bank account from which payment of the Bid Amount was made. The Application Form should have been submitted to the Placement Agents, with a copy to the Investment Manager, either through electronic mail or through physical delivery at the following address:

Cube Highways Fund Advisors Private Limited
19th Floor, Unit No. 1901
Tower-B, World Trade Tower, Plot No. C-1
Sector 16, Noida, Uttar Pradesh 201 301
Tel: +91 0120-4868300
E-mail: compliance.officer@cubehighways.com
Contact person: Mridul Gupta

Citigroup Global Markets India Private Limited
1202, 12th Floor
First International Financial Centre
G Block, Bandra Kurla Complex
Bandra – East
Mumbai 400 098
Tel: +91 22 6175 9999
E-mail: cubehighways.invit@citi.com
Contact Person: Abhishek Mawandiya

J.P. Morgan India Private Limited
J.P. Morgan Tower
Off C.S.T. Road, Kalina
Santacruz – East
Mumbai 400 098
Tel: +91 22 6157 3000
E-mail: cubehighways_invit@jpmorgan.com
Contact Person: Aanchal Mittal

The Placement Agents shall not be required to provide any written acknowledgement for receipt of the Application Form.

PAN

Each Eligible Investor must have mentioned its Permanent Account Number ("PAN") allotted under the IT Act. Each Eligible Investor was required to submit a copy of its PAN card along with the Application Form. Applications without this information were considered incomplete and were liable to be rejected, unless the investor was not required to hold or specify a PAN under applicable law. Eligible Investors should not have submitted the general index registrar number ("**GIR**") instead of the PAN as the Application Form was liable to be rejected on this ground.

Bank Account for Payment of Bid Amount

The Investment Manager has opened the Cash Escrow Account with Axis Bank Limited, acting as the Escrow Collection Bank in terms of the Cash Escrow Agreement. Bidders were required to deposit the entire Bid Amount during the Bid/Offer Period, together with the completed Application Form, in favour of "CUBE HIGHWAYS TRUST".

If the payment of the Bid Amount was not made favouring the Cash Escrow Account within the Bid/Offer Period, the Application Form of the Bidder was liable to be rejected.

The Trustee and the Investment Manager shall utilize the amount deposited in the Cash Escrow Account only for the purposes of: (i) adjustment against Allotment; or (ii) refund of Bid Amount in case of any failure to Allot Ordinary Units in the Offer. For further details, please see the section entitled "*Offer Information – Refunds*" on page 329.

Payment Instructions

The payment of Bid Amount shall have been made by the Bidders in the name of the Cash Escrow Account as per the payment instructions provided in the Placement Memorandum and the Application Form.

Payments were to be made only through electronic fund transfer. Payments through cheques or cash or any mode other than electronic mode shall have been rejected.

Allocation

The Bidders have submitted their Bids for the Ordinary Units within the Bid/Offer Period to the Placement Agents. The book has been maintained by the Placement Agents.

Method of Allocation

The Investment Manager has determined the Allocation in consultation with the Placement Agents on a discretionary basis, subject to the InvIT Regulations, and other applicable laws. After finalization of the Allocation, the Investment Manager has updated the Placement Memorandum with the Offer details and filed this Final Placement Memorandum with SEBI and the Stock Exchanges, and dispatched the CAN, together with a serially numbered Final Placement Memorandum to each successful Bidder.

THE DECISION OF THE INVESTMENT MANAGER, IN CONSULTATION WITH THE PLACEMENT AGENTS IN RESPECT OF ALLOCATION SHALL BE FINAL AND BINDING ON ALL BIDDERS. BIDDERS MAY NOTE THAT ALLOCATION OF THE ORDINARY UNITS IS AT THE SOLE AND ABSOLUTE DISCRETION OF THE INVESTMENT MANAGER, IN CONSULTATION WITH THE PLACEMENT AGENTS, AND BIDDERS MAY NOT RECEIVE ANY ALLOCATION EVEN IF THEY HAVE SUBMITTED VALID APPLICATION FORMS. NEITHER THE INVESTMENT MANAGER NOR THE PLACEMENT AGENTS ARE OBLIGED TO ASSIGN ANY REASON FOR ANY SUCH NON-ALLOCATION.

The Ordinary Units in the Offer will be Allotted in the following order: (i) first, 100% of the Ordinary Units pursuant to the Fresh Issue shall be Allotted prior to any Units offered in the Offer for Sale ("**Offered Units**"); and (ii) second, the Offered Units offered by CH-I received as consideration by CH-I for the transfer of its shareholding in JMTL, MBEL, WUPTL and APEL; and (iii) the remaining Offered Units shall be transferred on a pro rata basis in proportion to respective participation of CH-I, CH-II and CH-III in the Offer for Sale. In case of under-subscription in the Offer, the Ordinary Units in the Fresh Issue will be Allotted prior to any Ordinary Units in the Offer for Sale and the Ordinary Units in the Offer for Sale shall be Allotted in the manner set out above.**The Investment Manager in consultation with the Placement Agents reserves the right to withdraw the Offer any time after the Bid/Offer Opening Date but before the Allotment, without assigning any reasons whatsoever.**

Confirmation of Allocation Note or CAN

Based on the Application Forms and Bid Amounts received from Bidders, the Investment Manager, in consultation with the Placement Agents, in their sole and absolute discretion, has decided the Bidders to whom the serially numbered CANs shall be sent, pursuant to which the details of Ordinary Units Allocated to them shall be notified to such Bidders. Further, details of the amounts payable for Allotment of the Ordinary Units in their respective names shall be notified to such Bidders. Additionally, the CAN will include the probable designated date, being the date of credit of the Ordinary Units to the respective Bidder's demat account ("**Designated Date**").

Bidders, who have been Allocated Ordinary Units, would also be sent a serially numbered Final Placement Memorandum either in electronic form or by physical delivery along with the serially numbered CAN. The dispatch of the serially numbered Final Placement Memorandum and the CAN to Bidders shall be deemed a valid, binding and irrevocable contract in respect of the number of Ordinary Units Allocated to each successful Bidder.

Bidders are advised to instruct their Depository Participant to accept the Ordinary Units that may be Allotted to them pursuant to the Offer.

Bidders' Demat Account and Bank Account Details

On the basis of Bidders' PAN, DP ID and Client ID provided by them in the Application Form, the Registrar has obtained from the Depository the demographic details including the Bidders' address and bank account details (including the nine-digit Magnetic Ink Character Recognition ("**MICR**") code as appearing on a cheque leaf) (the "**Demographic Details**"), from the Depository. The Demographic Details will be used for giving refunds (including through direct credit, NACH, NEFT and RTGS) to the Bidders. It was mandatory to provide the bank account details in the space provided in the Application Form and Application Forms that did not contain such details were liable to be rejected. Hence, Bidders were advised to immediately update their bank account details, PAN and Demographic Details as appearing in the records of the Depository Participant and ensure that they are true and correct. Failure to do so could result in delays in credit of refunds to Bidders at their sole risk and none of the Placement Agents, the Registrar, the Escrow Collection Bank, the Investment Manager, the Selling Unitholders or the Trustee have any responsibility or undertake any liability for this. Accordingly, Bidders should have carefully filled in their demat account details in the Application Form.

By signing the Application Form, the Bidder was deemed to have authorized the Depositories to provide to the Registrar, on request, the required Demographic Details as available in their records.

Closing Date and Allotment of the Ordinary Units

The Trustee and the Investment Manager will endeavour to complete the Allotment by the Closing Date.

In accordance with the InvIT Regulations, the Ordinary Units will be offered and Allotment shall be made only in dematerialised form to the Allottees. The Investment Manager (on behalf of the Trust) and the Registrar have entered into agreements with NSDL and CDSL dated July 8, 2022 and September 28, 2022, respectively, in relation to the same.

The Trustee and/or the Investment Manager, in consultation with the Placement Agents, at their discretion, reserved the right to cancel or withdraw the Offer at any time after the Bid/ Offer Opening Date but prior to the issuance of CAN, without assigning any reasons whatsoever.

Following the Allotment of the Ordinary Units, the Investment Manager will apply for final listing and trading approval from the Stock Exchanges. The Investment Manager and the Placement Agents shall endeavour to list the Ordinary Units on the Stock Exchanges within six Working Days from the Bid/ Offer Closing Date.

Refunds

In the event Investment Manager and the Selling Unitholders are unable to Allot the Ordinary Units, in full or part or upon cancellation of the Offer or if refunds are required to be made in accordance with Applicable Law, the Investment Manager and the Selling Unitholders shall be liable to refund the Bid Amounts with interest to the Bidders in accordance with applicable law. For each Bidder to whom any amounts are to be refunded, the refund shall be made to the same bank account from which the Bid Amount was remitted by such Bidder. In the event of non-receipt of listing permission from the Stock Exchanges, the Ordinary Units shall not be eligible for listing and the Trust shall be liable to refund the Bid Amounts to the Allottees immediately along with interest at the rate of 15% per annum, from the date of Allotment till such time prescribed under, and in compliance with, the InvIT Regulations or such other rate as prescribed under applicable law.

Other Instructions

Right to Reject Applications

The Investment Manager, in consultation with the Placement Agents, may have reject Bids, in part or in full, without assigning any reason whatsoever. The decision of the Investment Manager in relation to the rejection of Bids shall be final and binding.

Ordinary Units in Dematerialised form with NSDL or CDSL

The Allotment shall be only in dematerialised form (i.e., not in physical certificates but represented by the statement issued through the electronic mode).

A Bidder applying for the Ordinary Units to be issued pursuant to the Offer must have at least one beneficiary account with a Depository Participant of either NSDL or CDSL prior to making the Bid. Allotment to a successful Bidder will be credited in electronic form directly to the beneficiary account (with the Depository Participant) of such Bidder.

Ordinary Units in electronic form can be traded only on the Stock Exchanges having electronic connectivity with NSDL and CDSL. BSE and NSE have electronic connectivity with NSDL and CDSL. The trading of the Ordinary Units would be in

dematerialised form only for all Unitholders in the respective demat segment of BSE and NSE. For details in respect of the minimum trading lot, please see the section entitled "*Offer Structure*" on page 321.

The Trustee, the Investment Manager, the Selling Unitholders or the Placement Agents, will not be responsible or liable for the delay in the credit of the Ordinary Units to be issued and transferred pursuant to the Offer due to errors in the Application Form, delay in payment of Bid Amount or otherwise on part of the Bidders.

Undertakings of the Investment Manager:

(i) There shall be only one denomination for the Ordinary Units of the Trust; and

(ii) It shall comply with such disclosure and accounting norms specified by the SEBI from time to time.

STATEMENT OF TAX BENEFITS

STATEMENT OF POSSIBLE DIRECT TAX BENEFITS AVAILBLE TO CUBE HIGHWAYS TRUST AND ITS UNIT HOLDERS UNDER THE INCOME TAX ACT, 1961 IN CONNECTION WITH PROPOSED PRIVATE PLACEMENT OF UNITS OF CUBE HIGHWAYS TRUST

To
The Board of Directors
Cube Highways Fund Advisors Private Limited (the "Investment Manager") in its capacity as an Investment Manager of the Cube Highways Trust (the "Trust" or the "InvIT")

Dear Sirs,

We refer to the proposed issue of the ordinary units of Cube Highways Trust ('the Trust' or 'the InvIT'). We enclose herewith the statement showing the current position of possible special/general direct tax benefits available to the InvIT, and its unitholders as per the provisions of the Income-tax Act 1961 ("Act"), as applicable as on date, for inclusion in the placement memorandum and the final placement memorandum for the proposed issue of ordinary units of the InvIT.

Several of these benefits are dependent on the InvIT or its unitholders fulfilling the conditions prescribed under the relevant provisions of the Act. Hence the ability of the InvIT or its unitholders to derive these direct tax benefits is dependent upon their fulfilling such conditions, which based on the business imperatives, the InvIT or its unitholders may or may not choose to fulfil.

The benefits discussed in the enclosed statement are neither exhaustive nor conclusive. The contents stated in the Annexure are based on the information and explanations obtained from the Investment Manager. This statement is only intended to provide general information to guide investors and is neither designed nor intended to be a substitute for professional tax advice. In view of the individual nature of the tax consequences and the changing tax laws, each investor is advised to consult their own tax consultant with respect to the specific tax implications arising out of their participation in the offering. We are neither suggesting nor are we advising the investor to invest money or not to invest money based on this statement.

We do not express any opinion or provide any assurance whether:

- The InvIT or its unitholders will continue to obtain these benefits in future;
- The conditions prescribed for availing the benefits have been/would be met;

We hereby give our consent to include enclosed statement regarding the tax benefits available to the InvIT and its unitholders in the placement memorandum and final placement memorandum for the proposed private placement of ordinary units, which the Investment Manager (on behalf of the InvIT) intends to submit to the Securities and Exchange Board of India, BSE Limited and National Stock Exchange of India Limited and any other authority, provided that the below statement of limitation is included in the placement memorandum and the final placement memorandum.

LIMITATIONS

Our views expressed in the statement enclosed are based on the facts and assumptions indicated above. No assurance is given that the revenue authorities/courts will concur with the views expressed herein. Our views are based on the existing provisions of law and its interpretation, which are subject to change from time to time. We do not assume responsibility to update the views consequent to such changes. Reliance on the statement is on the express understanding that we do not assume responsibility towards the investors who may or may not invest in the proposed issue relying on the statement.

This statement has been prepared solely in connection with the offering of units by the InvIT under the Securities and Exchange Board of India ("SEBI") (Infrastructure Investment Trusts) Regulations, 2014, as amended.

For S.B. Billimoria & Co. LLP
Chartered Accountants
(Firm's Registration No. 101496W/W100774)
Pramod B. Shukla
Partner
Membership No. 104337
UDIN: 23104337BGYEYP6861

Place: Gurugram
Date: April 3, 2023

STATEMENT OF POSSIBLE DIRECT TAX BENEFITS

The information provided below sets out the possible direct tax benefits available to the unitholders of the InvIT / business trust in a summary manner only based on the provisions of Income-tax Act, 1961 ('Act') as amended by the Finance Act, 2023 and is not a complete analysis or listing of all potential tax consequences of the subscription, ownership and disposal of the units, under the tax laws currently in force in India. Several of these benefits are dependent on the unitholders fulfilling the conditions prescribed under the Act and the SEBI regulations. Hence, the ability of the unitholders to derive the tax benefits is dependent upon fulfilling such conditions, which, based on the commercial imperatives, a unitholder may or may not choose to fulfill. The following overview is not exhaustive or comprehensive and is not intended to be a substitute for professional advice. Investors are advised to consult their own tax consultants with respect to the tax implications of an investment in the units particularly in view of the fact that certain recently enacted provisions under the Act may not have a direct legal precedent or may have a different interpretation on the benefits, which an investor can avail.

Further, the tax rates specified in this document are applicable for the Financial Year 2023-24 (i.e. Assessment Year 2024-25) as per the Finance Act, 2023 . The rates given in this statement are excluding surcharge and health and education cess, if any, as leviable. The rate of surcharge and health and education cess along with other key considerations are given in the Notes to this statement.

INVESTORS ARE ADVISED TO CONSULT THEIR OWN TAX CONSULTANT WITH RESPECT TO THE INDIAN TAX IMPLICATIONS AND CONSEQUENCES OF PURCHASING, OWNING AND DISPOSING OFF UNITS IN THEIR PARTICULAR SITUATION.

ANNEXURE

STATEMENT OF POSSIBLE INCOME TAX BENEFITS AVAILABLE TO CUBE HIGHWAYS INVIT ('TRUST') AND ITS UNITHOLDERS

I. Tax Implications and benefits in relation to InvITs

Cube Highways InvIT ('the Trust') has been constituted as an irrevocable determinate trust under the Indian Trusts Act, 1882. Further, the Trust is registered with the Securities and Exchange Board of India ('SEBI') as Infrastructure Investment Trust under the SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended ('SEBI InvIT Regulations').

The following implications/benefits under the Income- Tax Act, 1961 (`Act') are applicable/available to the Trust after fulfilling conditions as per the applicable provisions of the Act and the SEBI InvIT Regulations.

1. Taxability of interest and dividend income in the hands of trust from Special Purpose Vehicle(s)

As per the provisions of section 10(23FC) of the Act, any income of a trust by way of interest and dividend received or receivable from a special purpose vehicle (SPV) would be exempt from tax. For this purpose, SPV means a domestic company in which the business trust holds controlling interest and any specific percentage of shareholding or interest, as may be required by the regulations under which such trust is granted registration.

It is pertinent to note here that as per the provisions of section 14A of the Act, any expenditure incurred in relation to earning the above exempt income shall not be tax deductible. The provision of Rule 8D of the Income-tax Rules, 1962 read with section 14A of the Act shall be followed for calculating the quantum of disallowance.

2. Taxability of income of trust in general unless exempted / specified otherwise under provisions of the Act

As per section 115UA(2) read with section 10(23FC) of the Act, the taxable total income of a business trust would be charged to tax at the maximum marginal rate ('MMR') [i.e. the rates of income-tax (including surcharge and Cess on income-tax, if any) applicable in relation to the highest slab of income as specified in the relevant Finance Act] in force except for the income chargeable to tax on transfer of short term capital assets as per section 111A and long term capital assets as per section 112 and section 112A of the Act and income referred to in section 10(23FC) of the Act.

Please note that section 112A is not explicitly mentioned in section 115UA(2) and hence an ambiguity exists on the tax rate to be applicable on the gains referred to in section 112A of the Act earned by the trust.

Further, dividend and interest income earned by Trust from company other than SPV, shall be taxable at MMR.

As per section 57 of the Act, no deduction shall be allowable against the dividend income (which is taxable in the hands of the Trust) other than deduction on account of interest expense incurred wholly and exclusively for the purpose of earning such dividend and such interest expense shall not exceed 20% of the dividend income included in the total income for that year, without deduction under section 57 of the Act.

3. Taxability of Capital Gains in the hands of the Trust

a. Period of Holding

Capital assets are classified as long-term capital assets ('LTCA') or short-term capital assets ('STCA'), based on the period of holding of these assets. Depending on the period of holding for which the shares and securities are held, the gains should be taxable as short-term capital gains or long-term capital gains. As per the provisions of section 2(42A) of the Act, a capital asset is regarded as short-term capital asset ("STCA"), if:

Sr. no.	Nature of asset	Period of holding before the date of sale
(i)	Securities (other than units) listed in a recognised stock exchange in India or a unit of an equity- oriented fund or unit of the Unit Trust of India or Zero- coupon bond	12 months or less
(ii)	Shares (other than listed in a recognised stock exchange in India) including those offered through offer for sale as part of initial public offer or an immovable property being land or building or both	24 months or less
(iii)	Capital asset other than covered in (i) and (ii)	36 months or less

As per the provisions of section 2(29A) of the Act, LTCA means a capital asset which is not a STCA.

b. Short-term capital gains

As per the provisions of section 111A of the Act, any income arising from transfer of STCA being an equity share in a company or a unit of an equity oriented fund or a unit of a business trust pursuant to a transaction acted through a recognized stock exchange and subject to STT, will be taxable in the hands of the Trust at a concessional rate of 15% (plus applicable surcharge and cess). However, the condition of STT is not required if the transaction is undertaken on a recognised stock exchange located in any International Financial Services Centre and where the consideration for such transaction is paid or payable in foreign currency.

Short-term capital gains arising from transfer of STCA other than the shares and securities covered under section 111A of the Act, will be taxed at the maximum marginal rates in force.

c. Long-term capital gains

As per the provisions of section 112(1)(d) of the Act, gains arising on the transfer of LTCA shall be chargeable to tax in the hands of the Trust at the rate of 20% (plus applicable surcharge and cess). However, as per the proviso to section 112 of the Act, the tax on long-term capital gains on transfer of listed securities (other than units) or Zero-Coupon Bonds shall be taxable at a rate lower of the following:

- 10% (plus applicable surcharge and cess) without indexation benefit under second proviso to section 48; or
- 20% (plus applicable surcharge and cess) with indexation benefit under second proviso to section 48

Further, as per section 112A of the Act, gains exceeding INR 0.1 million arising on the transfer of LTCA, being an equity share in a company or a unit of an equity-oriented fund or a unit of a business trust, through a recognized stock exchange and subject to STT, shall be chargeable to tax in the hands of the Trust at the rate of 10% (plus applicable surcharge and cess) without indexation benefit under section 48 of the Act.

d. Cost of Acquisition

Section 48 of the Act prescribes the mode of computation of capital gains and provides for deduction of cost of acquisition/ improvement and expenses incurred in connection with the transfer of a capital asset, from the sale consideration to arrive at the amount of capital gains. However, in respect of long-term capital gains, section 48 of the Act provides for substitution of cost of acquisition/ improvement with indexed cost of acquisition/ improvement, which adjusts the cost of acquisition/ improvement by a cost inflation index as prescribed from time to time. Such indexation benefit would not be available on bonds, debentures, and listed equity shares in a company or units of equity-oriented funds or units of a trust referred to in section 112A of the Act.

e. Deemed sales consideration

As per section 50CA of the Act, where the consideration on transfer of unquoted shares of a company, is less than the fair market value of such share determined in such manner as may be prescribed, the value so determined shall for the purpose of section 48 of the Act, be deemed to the full value of consideration.

4. Income from buy back of shares by SPV

The provisions of section 115QA of the Act mandate domestic companies to pay an additional tax at the rate of 20% (plus applicable surcharge and cess) on buy-back of shares. Such tax is payable on the distributed income which is equal to the consideration paid by the company on buy-back of shares as reduced by the amount, which was received by the company for issue of such shares. Further, income arising from buy-back of unlisted shares shall not be taxable as per section 10(34A) of the Act in the hands of the shareholders.

Accordingly, in case income arises in hands of the Trust from buy-back of unlisted shares by the Project SPVs (held in the underlying SPVs), then such income shall be exempt in the hands of the Trust.

5. Set off and carry forward of capital losses

As per section 70 read with section 74 of the Act, long-term capital loss, if any arising during the year can be set-off only against long-term capital gain and shall be allowed to be carried forward up to eight assessment years immediately succeeding the assessment year for which the loss was first computed. The brought forward long-term capital loss can be set off only against long-term capital gains.

As per section 70 read with section 74 of the Act, short-term capital loss, if any arising during the year can be set-off against short-term capital gain as well as against the long-term capital gains and shall be allowed to be carried forward up to eight assessment years immediately succeeding the assessment year for which the loss was first computed. The brought forward short-term capital loss can be set off against capital gains (both long-term and short-term capital gains).

II. Tax Implications and benefits in relation to all unitholders

Following tax benefit is specifically available to the unitholders of the Trust subject to the fulfillment of the conditions specified in the Act and the SEBI Regulations:

a) Tax exemption in respect of income distributed by Trust

As per the provisions of section 115UA(1) of the Act, the income distributed by the Trust shall be deemed to be of the same nature and in the same proportion in the hands of the unitholders as if such income was received by or accrued to the Trust.

As per the provisions of section 10(23FD) of the Act, any income referred to in section 115UA(1) of the Act and distributed by the Trust shall not be included in the total income of the unitholders except for the following income:

- Interest referred to in Section 10(23FC) of the Act; and
- Specified dividend i.e., dividend income received in cases where SPV has exercised the option under section 115BAA of the Act.

SPVs have the option, subject to certain condition, to choose a concessional tax rate of 22 percent (plus 10% surcharge and 4% cess) under section 115BAA of the Act. In case, SPV has exercised the option under section 115BAA of the Act, any dividend distributed by the Trust out of the dividend paid by such SPV shall be taxable in the hands of unitholder. In other cases, the dividend distributed by Trust out of the dividend paid by SPV which has not exercised the option under section 115BAA of the Act, shall be exempt in the hands of unitholders under section 10(23FD) of the Act.

The Finance Act, 2023 has amended section 56(2) of the Act to add a new clause (xii) which provides that any distribution received by unitholders that is not covered under section 10(23FC) or 10(23FCA) of the Act and that which is not chargeable to tax under section 115UA(2) of the Act shall be charged to tax as 'income from other sources' provided such amount received (including similar distributions in earlier years to the same unitholder or any other unitholder) is in excess of the amount at which units are issued by the InvIT, as reduced by the amount which would have been charged to tax earlier under this provision. Such income shall be chargeable to tax at the rates applicable based on the status of the unitholder.

b) Implications on transfer of shares held by Sponsor in Project SPVs to trust

According to section 47(xvii) of the Act, any transfer of a capital asset, being shares of an SPV to a business trust in exchange of units allotted by that trust to the transferor shall not be regarded as transfer and accordingly not be liable to capital gains tax.

According to section 49(2AC) of the Act, the cost of units acquired in lieu of shares in SPV shall be deemed to be cost of acquisition of shares in SPV.

As per the amendment by the Finance Act, 2023, the amount of distribution received to the extent not chargeable to tax under section 56(2)(xii) of the Act and not covered under sections 10(23FC), 10(23FCA) or 115UA(2) of the Act shall be reduced from the cost of units.

As per clause (hc) of explanation 1 of section 2(42A) of the Act, for ascertaining the period of holding of such units, the period of holding of shares in SPV shall also be included.

c) Avoidance of tax by certain transaction in securities- section 94 of the Act

As per section 94(1) of the Act, where any person owning securities sells or transfers the same or similar securities and buys back or reacquires those securities and the result of the transaction is that any interest becoming payable in respect of the securities is receivable otherwise than by such owner, the said interest, whether it would or would not have been chargeable to income-tax apart from the provisions of section 94(1) of the Act, would be deemed to be the income of the owner of the securities and not to be the income of any other person subject to certain specified conditions.

As per section 94(2) of the Act, where any person has had at any time during any previous year any beneficial interest in any securities, and the result of any transaction relating to such securities or the income thereof is that, in respect of such securities within such year, either no income is received by him or the income received by him is less than the sum to which the income would have amounted if the income from such securities had accrued from day to day and been apportioned accordingly, then the income from such securities for such year shall be deemed to be the income of such person.

Section 94(7) of the Act provides that losses arising from the sale/ transfer of securities or units of a mutual fund or the Unit Trust of India or Business Trust or Alternative Investment Fund purchased within a period of three months prior to the record date and sold/ transferred within three (for shares)/ nine (for units) months after such date, will be disallowed to the extent dividend income on such shares is claimed as exempt from tax.

Further, as per section 94(8) of the Act, if an investor purchases securities or units of mutual fund or the Unit Trust of India or Business Trust or Alternative Investment Fund within three months prior to record date for entitlement of bonus securities or units and is allotted bonus securities or units without any payment on the basis of original holding on the record date and such person sells/ redeems the original units within nine months of the record date, then the loss arising from sale/ redemption of the original units within nine months of the record date will be ignored for the purpose of computing income chargeable to tax and the amount of such loss ignored shall be regarded as cost of acquisition of the securities or bonus units.

III. Tax Implications and benefits in relation to Resident unitholders

a) As stated in Part II above, income distributed by the Business Trust being in the nature of dividend from SPVs which is not exempt under section 10(23FD) of the Act, interest from SPVs, and income chargeable to tax under section 56(2)(xii) of the Act, shall be taxable in the hands of resident unitholders as under:

Status of unitholder	Tax rate (exclusive of surcharge and education cess)
Resident companies (Refer Note 1,2 and 3)	30%
Firms / LLPs	30%
Others (Refer Note 4)	As per applicable rates, for instance in case of individuals income has to be taxed as per applicable slab rates, maximum being 30%

Note 1: As per the Finance Act, 2023, the tax rate is 25% (plus applicable surcharge and health and education cess) shall be applicable to a domestic company for Financial year 2023-24 if the total turnover or gross receipts of such company are not exceeding INR 4,000 million in the Financial Year 2021-22 (Assessment Year 2022-23).

Note 2: Further, the tax rates for resident companies exercising the option under section 115BAA and section 115BAB of the Act shall be chargeable to concessional tax rate of 22% (plus surcharge at the rate of 10% and health and education cess at the rate of 4%), subject to fulfilment of conditions prescribed in the said sections.

Note 3: The Finance Act, 2020 has also inserted section 80M of the Act to eliminate the cascading tax effect in case of intercorporate dividends by providing a deduction in respect of dividends received from a company (including foreign company) and business trust to the extent such dividend is distributed before the specified time.

Note 4:
As per the Finance Act, 2023, section 115BAC of the Act has been amended to provide that the Individual, HUF, AOP (other than a co-operative society), BOI and AJP will be taxed on its total income at the reduced tax rates ('New Regime'). The income would however have to be computed without claiming prescribed deductions or exemptions. However, such person will have the option to be taxed on its total income as per the tax rates under the old regime. The option is required to be exercised – (i) on or before the due date specified under section 139(1) of the Act for furnishing the return of income for such assessment year, in case of a person having income from business or profession and such option once exercised shall apply to subsequent assessment years; or (ii) along with the return of income to be furnished under section 139(1) of the Act for such assessment year in case of a person not having income referred to in clause (i). A person having income from business or profession who has exercised the above option of shifting out of the New Regime shall be able to exercise the option of opting back to the New Regime only once. However, a person not having income from business or profession shall be able to exercise this option every year.

b) Income in nature of Capital gains on sale of units of the Trust

Period of holding: Capital assets are classified as LTCA or STCA, based on the period of holding of these assets. The determinative period of holding for units of the Trust held by the unitholders to qualify as LTCA is more than 36 months. The units held for less than 36 months would be STCA.

Taxation of capital gains on sale of units of the Trust:

Nature of capital gains	Tax rate (exclusive of surcharge and education cess)

	Unitholders being resident companies	Unitholders being resident Firms / LLPs	Other unitholders
Short-term capital gains on sale of units of the Trust being a listed InvIT, subject to STT	15%	15%	15%
Long-term capital gains on sale of units of the Trust being a listed InvIT, subject to STT	10% (on capital gains exceeding INR 0.1 million)	10% (on capital gains exceeding INR 0.1 million)	10% (on capital gains exceeding INR 0.1 million)

As per the amendment made by the Finance Act, 2023, the amount of distribution to the extent not chargeable to tax under section 56(2)(xii) of the Act and not covered under sections 10(23FC), 10(23FCA) or 115UA(2) of the Act shall be reduced from the cost of units, for computing capital gains.

c) Set off of Losses: Please refer point 5 under *'Tax implications and benefits in relation to InvITs'*

d) Applicability of Minimum Alternate tax (MAT)/ Alternate Minimum Tax (AMT)

In case of domestic companies that are liable to pay MAT under provisions of section 115JB of the Act, the gains arising, if any, on sale of units of trust are to be included as part of book profits for the purpose of computing MAT liability. MAT paid by such companies should be available as credit for set-off against future tax liability, provided such companies do not opt to be governed by the concessional tax rates u/s 115BAA or 115BAB of the Act. Companies exercising the option to be taxed as per section 115BAA and 115BAB of the Act have been excluded from the applicability of MAT.

However, as per clause (iie)/(fc) to explanation 1 to section 115JB of the Act, the following shall not be considered while computing book profits for levy of MAT:

- notional gain/loss on transfer of shares of SPV in exchange of units allotted by the business trust referred to in clause (xvii) of section 47; or
- notional gain/loss resulting from any change in carrying amount of said units; or
- gain/loss on transfer of units allotted by the business trust referred to in clause (xvii) of section 47.

Further, as per clause (k)/(iif) of explanation 1 to section 115JB of the Act, any gain/loss on transfer of units referred to in clause (xvii) of section 47 of the Act shall be considered while computing the book profit for levy of MAT by taking into account the cost of the shares exchanged with units referred to in the said clause or the carrying amount of the shares at the time of exchange where such shares are carried at a value other than the cost through statement of profit and loss, as the case may be.

In case of unitholders, other than companies, that are liable to Alternate Minimum Tax (AMT) under provisions of section 115JC of the Act, the gains arising, if any, on sale of units of InvIT are to be included as part of adjusted total income for the purpose of computing AMT liability. AMT paid by such unitholders should be available as credit for set-off against future tax liability, provided they do not opt to be governed by the concessional tax rates u/s 115BAC or 115BAD of the Act.

e) Other income (income other than interest or dividend income or income chargeable to tax under section 56(2)(xii) of the Act) received from Trust

Other income (income other than interest or dividend income or income chargeable to tax under section 56(2)(xii) of the Act) such as treasury income earned by Trust and distributed to unitholder shall be exempt in hands of unitholders as the same shall be taxable in the hands of Trust. Further, there shall be no withholding on distribution of such other income by the Trust to the unitholders.

IV. Tax benefits/ provisions applicable to Non-resident Unitholders

1. As per section 2(30) of the Act, non-resident is defined to mean a person who is not a "resident".

   A non-resident unit holder should be subject to taxation in India only if:

   - it is regarded a tax resident of India; or
   - being a non-resident in India, it derives: (a) if any income is received / deemed to be received in India; or (b) if any income has accrued or arisen / deemed to have accrued or arisen in India in terms of the provisions of the Act.

   Section 6 of the Act provides that a foreign company should be treated as a tax resident in India if its place of effective management ('POEM') is in India in that year. POEM has been defined to mean a place where key management and commercial decisions that are necessary for the conduct of the business of an entity as a whole are, in substance made.

2. As per section 90(2) of the Act, the provisions of the Act should apply to the extent they are more beneficial than the provisions of the Double Taxation Avoidance Agreement ('tax treaty') between India and the country of residence of the offshore unit holder to the extent of availability of tax treaty benefits to the offshore unit holders. However, no assurance can be provided that the treaty benefits should be available to the offshore unit holder or the terms of the tax treaty will not be subject to amendment or reinterpretation in the future.

3. The taxability of income of non-resident unit holders on different income streams, should be as per the provisions of the Act or tax treaty (whichever is beneficial) as discussed below. However, for claiming the tax treaty benefit, the non-resident would have to provide relevant documents/declarations viz. tax residency certificate, etc. as per the requirements of the Act/tax treaty.

a) Dividend which is not exempt under section 10(23FD) of the Act (where dividend received by the Trust from the SPV who has exercised the option under section 115BAA of the Act)

The dividend income will be taxable at the rate of 20% (plus applicable surcharge and cess) under the Act. This is subject to benefits, if any, under the applicable tax treaty.

b) Interest income distributed by the Trust earned from the SPV

Interest income earned from the SPV and distributed by Trust to non-resident unitholder is not exempt under section 10(23FD) of the Act in the hands of unit holder and would be taxable at 5% (plus applicable surcharge and cess). This is subject to benefits, if any, under the applicable tax treaty.

c) Other distribution by the Trust not covered under section 115UA(2) of the Act

As per newly inserted section 56(2)(xii) of the Act, any distribution received by unitholders that is not covered under section 10(23FC) or 10(23FCA) of the Act and that which is not chargeable to tax under section 115UA(2) of the Act shall be charged to tax as 'income from other sources' provided such amount received (including similar distributions in earlier years to the same unitholder or any other unitholder) is in excess of the amount at which units are issued by the InvIT, as reduced by the amount which would have been charged to tax earlier under this provision. This is subject to benefits, if any, under the applicable tax treaty.

Such income shall be chargeable to tax at the rates applicable based on the status of the unitholder.

Status of unitholder	**Tax rate (exclusive of surcharge and education cess)**
Non-resident companies	40%
Firms / LLPs	30%
Others	As per applicable rates, for instance in case of individuals income has to be taxed as per applicable slab rates

d) Capital gains on sale of units of the Trust

Period of holding: Capital assets are classified as LTCA or STCA, based on the period of holding of these assets. The determinative period of holding for units of the Trust (being a business trust) held by the unitholders to qualify as LTCA is more than 36 months. The units held for less than 36 months would be STCA. While determining the period of holding for units of business trust allotted pursuant to exchange of shares of SPV as per clause (hc) of explanation 1 to section 2(42A) of the Act, the period of holding for the units shall include the period for which the shares were held in the SPV.

Depending on the classification of capital gains, the non-resident unit holders should be chargeable to tax under the Act as under. This is subject to benefits, if any, under the applicable tax treaty.

Nature of capital gains	**Tax rate under the Act (excluding surcharge and cess)**
Short-term capital gains on sale of units of the Trust being a listed InvIT, subject to STT	15%
Long-term capital gains on sale of units of the Trust being a listed InvIT, subject to STT	10%

As per the amendment by the Finance Act, 2023, the amount of distribution to the extent not chargeable to tax under section 56(2)(xii) of the Act and not covered under sections 10(23FC), 10(23FCA) or 115UA(2) of the Act, shall be reduced from the cost of units, for computing capital gains.

e) Set off of Losses: Please refer point 5 under *'Tax implications and benefits in relation to InvITs'*

4. Applicability of Minimum Alternate tax (MAT)

While computing book profits to determine the applicability of MAT, any income accruing or arising to a foreign company from (i) capital gains earned from sale of shares or other instruments that qualify as "securities" (as per the securities Contract (Regulation) Act, 1956) or (ii) interest, royalties or fees for technical services, and which are credited by the foreign company to its profit and loss account should be excluded.

The MAT provisions should not be applicable in case of foreign company:

- if such foreign company is a resident of a country with which India has entered into a tax treaty and such foreign company does not have a permanent establishment in India in terms of provisions of applicable tax treaty; or
- if such foreign company is a resident of a country with which India does not have an agreement of the nature referred to in above clause and such foreign company is not required to seek registration under any law for the time being in force relating to companies.

V. Special tax benefits/ provisions applicable to Foreign Institutional Investors ("FIIs") / Foreign Portfolio Investors ("FPIs")

1. In case of FII or FPI registered under SEBI (Foreign Portfolio Investors) Regulations 2014 ('FII/FPI'), as per section 2(14) of the Act, shares/ securities (other than those held as stock in trade) which were invested in accordance with the regulations made under the Securities and Exchange Board of India Act, 1992 shall be deemed to be capital assets. Accordingly, any income from transfer of such capital assets shall be deemed as a capital gain.

2. Long term capital gains arising in hands of FPI or FII on transfer of units of the Trust through a recognized stock exchange, on which STT is paid shall be taxable u/s 112A of the Act as stated above under *'III- Tax benefits/ provisions applicable to Non-resident Unitholders'.*

   Long term capital gains arising in hands of FPI or FII on transfer of units of the Trust, which is not transferred through a recognized stock exchange and not subject to STT, shall be chargeable to tax at 10%, without benefit of indexation under section 48 of the Act, (plus applicable surcharge and cess) in accordance with section 115AD of the Act.

3. Similarly, Short term capital gains on transfer of the units of the Trust will be chargeable to tax at the rate of 15% (plus applicable surcharge and cess) as per the provisions of section 111A of the Act provided such transfer is made through a recognized stock exchange and the transaction is subject to STT.

   However, as per section 115AD(1)(ii) of the Act, STCG arising to the FII/ FPI on transfer of units of the Trust, which is not through a recognized stock exchange and not subject to STT, shall be chargeable at a rate of 30% (plus applicable surcharge and cess)

4. As per section 196D(2) of the Act, no deduction of tax at source will be made in respect of income by way of capital gain arising from the transfer of securities referred to in section 115AD of the Act.

5. On any other income in respect of securities referred to in section 115AD(1)(a) of the Act, other than capital gains and interest income subject to TDS u/s 194LD of the Act, tax shall be withheld at lower of 20% as per section 196D of the Act or the rates provided in the tax treaty, subject to the following conditions:

   - Tax treaty exists between India and the respective jurisdiction of the FII/FPI; and
   - FII/FPI has furnished a TRC to the payer.

VI. Special tax benefits/ provisions applicable to Alternative Investment Fund (Category I and II)

1. Under section 10(23FBA) of the Act, any income of an investment fund other than the income chargeable under the head "Profits and gains of business or profession" is exempt from income tax.

2. As per section 115UB (4) of the Act, the total income of the investment fund shall be charged to tax:

   a) at the rate or rates as specified in the Finance Act of the relevant year, where such fund is a company or a firm; or
   b) at maximum marginal rate in any other case

3. The losses incurred by AIF shall be treated in accordance with the provisions of section 115UB(2) and 115UB(2A) of the Act.

VII. Special tax benefits/ provisions applicable to unitholder being a Mutual Fund

1. Exemption is provided under section 10(23D) of the Act in respect of income of:

   (a) Mutual Funds registered under the Securities and Exchange Board of India Act, 1992 or Regulations made thereunder; and

   (b) Mutual Funds set up by public sector banks or public financial institutions and Mutual Funds authorised by the Reserve Bank of India will be exempt from income tax, subject to such conditions as the Central Government may, by notification in the Official Gazette, specify in this behalf.

2. In light with the provisions of section 196 of the Act, no deduction of tax shall be made on any sum payable to a Mutual Fund specified under clause (23D) of section 10 of the Act. Accordingly, the Trust is not required to withhold tax on any sum payable to Mutual Fund specified under section 10(23D) of the Act.

VIII. Special tax benefits/ provisions applicable to certain specified person

1. As per section 10(23FE) of the Act, dividend, interest, income taxable under section 56(2)(xii) of the Act and long-term capital gains arising from investments made by 'specified person' in India, whether in the form of debt or share capital or unit, shall be exempt, if such investment is:
   - made on or after the 01 April 2020 but on or before the 31 March 2024
   - is held for at least 3 years
   - inter alia, is in a business trust

   Further, such specified person (subject to certain conditions prescribed in section 10(23FE) of the Act) shall include:
   a) Wholly owned subsidiary of Abu Dhabi Investment Authority (ADIA) which is a resident of United Arab Emirates ('UAE') and makes investment directly or indirectly, out of funds owned by Government of UAE
   b) Sovereign Wealth Funds (SWF)
   c) Pension funds

IX. Specific provisions relating to Tax deduction at Source ('TDS')

1. Withholding of tax by SPVs

   The interest payable by SPV to the trust will not be subject to withholding tax as per section 193 and 194A of the Act.

   As per section 194 of the Act, the SPVs will not be required to withhold taxes when they make payment of dividend to the Trust.

2. Withholding of tax by trust

   As per the provisions of section 115UA(1) of the Act, the income distributed by the Trust shall be deemed to be of the same nature and in the same proportion in the hands of the unitholder as if such income was received by or accrued to the Trust.

   The distribution of income, in the nature of interest or dividend, by the trust to the unit holders, would be subject to withholding tax under section 194LBA of the Act at the time of credit of such payment to the account of the unitholder or at the time of payment thereof, whichever is earlier. The rate of withholding as per section 194LBA of the Act shall be as under

   - On interest income:
     - 10% in case of resident unitholder; and
     - 5% (plus applicable surcharge and education cess) in case of non-resident unitholder

   - On dividend income, being that proportion of dividend earned from an SPV which has exercised the option of beneficial tax regime under section 115BAA of the Act:
     - 10% in case of resident unitholder; and
     - 10% (plus applicable surcharge and education cess) in case of non-resident unitholder

   - On dividend income, being that proportion of dividend earned from an SPV which has not exercised the option of beneficial tax regime under section 115BAA of the Act, no withholding tax is required.

   - On certain distributions proposed to be considered as income for the unitholders, as per the amendment introduced in the Finance Act, 2023, it would be pertinent to note the Finance Act, 2023 has not introduced any separate withholding tax provisions with respect to such distributions. Accordingly, the Trust maybe required to withhold tax under section 195 of the Act. The withholding tax rate applicable on such distributions shall be determined on the basis of the tax status of the unitholder and applicable treaty benefits, if any.

3. Withholding of tax in case of transfer of shares/securities

   No income tax is deductible at source from income by way of capital gains arising to a resident unitholder under the present provisions of the Act.

   However, as per the provisions of section 195 of the Act, any income on transfer of unit of the Trust by non-residents may be subject to withholding of tax at the rate under the domestic tax laws or under the DTAA, whichever is beneficial to the assessee (other than FPIs/ FIIs which are subject to provisions of section 196D(2) of the Act). Provision of section 196D of the Act have been covered under *'Part IV- Special tax benefits/ provisions applicable to Foreign Institutional Investors ("FIIs") / Foreign Portfolio Investors ("FPIs")'* of this document.

   However, the non-resident investor will have to furnish a certificate of his being a tax resident in a country outside India and a suitable declaration for not having a fixed base/ permanent establishment in India, to get the benefit of the applicable DTAA and such other document as may be prescribed as per the provision of section 90(4) of the Act.

   Buyer and seller of unlisted shares/securities also need to check the applicability of TDS u/s 194Q of the Act read with provision of Tax Collection at Source (TCS) u/s 206C(1H) of the Act. As per the clarification issued by CBDT, the transaction in shares not taken place through recognized stock exchange/ recognised clearing corporations may also fall under the ambit of section 194Q/206C(1H)

of the Act since CBDT has clarified that the said provisions of section 194Q/206C(1H) of the Act are not applicable to transactions in securities and commodities transacted through recognised stock exchanges/ recognised clearing corporations, including those located in International Financial Service Centre.

4. Withholding at higher rate where PAN details are not furnished- section 206AA of the Act

As per section 206AA of the Act, where a taxpayer does not possess a PAN, taxes have to be withheld on payment of income to the taxpayer (where chargeable to tax) at higher of the following:

- at the rate specified in the Act; or
- at the rate or rates in force; or
- at the rate of 20%

Further, CBDT has issued a notification no. 53/2016 for relaxation from deduction of tax at a higher rate under Section 206AA of the Act in the case of non-resident investor or a foreign company and not having PAN by inserting a new rule 37BC. The provisions of Section 206AA of the Act shall not apply in respect of payments in the nature of interest, royalty, fees for technical services and payments on transfer of any capital asset, if the deductee furnishes certain details and specified documents to the deductor.

The Finance Act, 2021 had amended the aforesaid provision so as to provide that where the tax is required to be deducted under section 194Q of the Act and deductee has not furnished PAN to the deductor, then, the 5% should be considered as the rate for purpose of section 206AA of the Act and tax should be deducted accordingly.

Please note that similar provisions are there under section 206CC of the Act in relation to TCS.

5. Withholding at higher rate on non-filers of income tax return- section 206AB of the Act

The Finance Act, 2021 had introduced a new provision - section 206AB in the Act for deducting tax at higher rates on payments made to non-filers of income-tax returns. Section 206AB of the Act applies where any sum or income or amount is paid, or payable or credited, by a person to a specified person and tax is required to be deducted at source as per provisions of the Act (except under sections 192, 192A, 194B, 194BB, 194-IA, 194-IB, 194LBC, 194M or 194N of the Act).

Specified person means a person who has not filed the return of income for the assessment year relevant to the previous year immediately preceding the financial year in which tax is required to be deducted for which time limit for furnishing return of income under section 139(1) of the Act has expired and the aggregate of TDS and TCS is INR 50,000 or more in the said previous year. Further, specified person shall not include a non-resident who does not have a permanent establishment in India or any other person who is not required to furnish return of income and is notified by the Government in this regard.

In case the aforesaid section is applicable, tax shall be deducted at higher of the followings rates:

- twice the rate specified in the relevant provision of the Act; or
- twice the rate or rates in force; or
- the rate of 5%.

If provisions of section 206AA and section 206AB of the Act are applicable to a specified person, then, tax shall be deducted at higher of the two rates provided under the respective sections of the Act.

Please note that similar provisions are there under section 206CCA of the Act in relation to TCS.

Notes to statement:
General tax rates and provisions:

1. The income-tax rates specified in this note are as applicable for the financial year 2023-24, and are exclusive of surcharge and education cess, if any. Rate of surcharge and cess are provided below:

Rate of Surcharge:

Domestic companies other than companies covered under section 115BAA and 115BAB of the Act, surcharge rates are as below:

a) If the total income does not exceed INR 10 million – Nil
b) If the total income exceeds INR 10 million but does not exceed INR 100 million - 7 %
c) If the total income exceeds INR 100 million - 12 %

In case of domestic companies having income chargeable under Section 115BAA and 115BAB of the Act, surcharge of 10% is applicable irrespective of taxable income.

Foreign companies:

a) If the total income does not exceed INR 10 million - Nil
b) If the total income exceeds INR 10 million but does not exceed INR 100 million – 2%
c) If the total income exceeds INR 100 million – 5%

For individuals, Hindu Undivided Family, association of person, body of individuals (including non-resident)

a) If the total income does not exceed INR 5 million - Nil
b) If the total income (including dividend income or capital gains on specified securities) exceeds INR 5 million but does not exceed INR 10 million – 10%
c) If the total income (including dividend income or capital gains on specified securities) exceeds INR 10 million but does not exceed INR 20 million – 15%
d) If the total income (excluding dividend income or capital gains on specified securities) exceeds INR 20 million but does not exceed INR 50 million – 25%
e) If the total income (excluding dividend income or capital gains on specified securities) exceeds INR 50 million – 37%

However, *in case total income includes any income by way of dividend or income referred to in section 111A or section 112 or section 112A of the Act, surcharge on such income shall not exceed 15%.*

The above surcharge is subject to marginal tax benefit as per the Act.

As per the Finance Act, 2023, in case of the Individual/HUF/AOP (other than co-operative)/ BOI/Artificial Juridical Person ('AJP') taxable under the New Regime prescribed under the Act, the surcharge on the amount of income-tax shall not exceed 25% where taxable income exceeds INR 20 million.

As per the Finance Act, 2023, in the case of an AOP being a non-resident, and consisting of only companies as its members, surcharge shall be calculated at the rate of 10%, where the aggregate income exceeds INR 5 million but does not exceed INR 10 million; at the rate of 15%, where the aggregate income exceeds INR 10 million.

For Partnership or LLPs:

a) If the total income does not exceed INR 10 million – NIL
b) If the total income exceeds INR 10 million - 12 %

The above surcharge is subject to marginal tax benefit as per the Act

Health and Education cess:

In all cases, Health and education cess will be levied at the rate of 4 per cent of income-tax and surcharge.

2. The stated benefits will be available only to the sole/ first named holder in case the units are held by joint holders.

3. Please note that the TDS rates mentioned in the given document may be subject to any concessions introduced/ allowed by the Government under any policy, press release, etc. Also, the same may also be subject to lower/ nil withholding tax certificates which may be furnished by the unit holders.

4. In respect of non-residents, the tax rates and the consequent taxation mentioned above shall be further subject to any benefits available under the applicable DTAA, if any, between India and the country in which the non-resident has fiscal domicile. Further, it is pertinent to meet the terms and condition viz. Principal purpose test, beneficial ownership test etc. as enacted in DTAAs entered into by India with various countries based on Multilateral Convention to implement tax treaty related measures to prevent Base Erosion and Profit Shifting ('MLI').

5. The tax implications/ benefits stated in this document are subject to General Anti Avoidance Rules (GAAR) provisions under the Act. GAAR may be invoked by the Indian income-tax authorities in case arrangements are found to be impermissible avoidance arrangements. Further, in case GAAR provisions are invoked, the onus to prove that the main purpose of an arrangement was not to obtain any tax benefit is on the taxpayer. Also, any resident or non-resident may approach the Authority for Advance Rulings to determine whether an arrangement can be regarded as an impermissible avoidance arrangement.

6. This statement does not discuss any tax consequences in the country outside India of an investment in the units of trust. The unit holders / investors in the country outside India are advised to consult their own professional advisors regarding possible Income tax consequences that apply to them.

7. This statement is intended only to provide general information to the investors and is neither designed nor intended to be substituted for professional tax advice. In view of the individual nature of tax consequences, each investor is advised to consult his/her own tax advisor with respect to specific tax consequences of his/her participation in the scheme.

8. No assurance is given that the revenue authorities/courts will concur with the views expressed herein. Our views are based on the existing provisions of law and its interpretation, which are subject to changes from time to time. We do not assume responsibility to update the views consequent to such changes.

9. This statement of possible direct tax benefits enumerated above is as per the Act as amended by the Finance Act, 2023. The above statement of possible Direct-tax Benefits sets out the possible tax benefits available to the Trust and its unitholders under the current tax laws presently in force in India. Several of these benefits available are dependent on the Trust or its unitholders fulfilling the conditions prescribed under the relevant tax laws.

10. The information provided above sets out the possible tax benefits available to the unit holders in a summary manner only and is not a complete analysis or listing of all potential tax consequences of the purchase, ownership, transfer and disposal of equity shares and units, under the current tax laws presently in force in India. It is not exhaustive or comprehensive and is not intended to be a substitute for professional advice. Investors are advised to consult their own tax consultant with respect to the tax implications arising on account of any investment in equity shares or units (including tax implications on account of any distributions by/ receipts from the Trust), particularly in view of the fact that certain recently enacted legislation may not have a direct legal precedent or may have a different interpretation impacting the benefits, which an investor can avail.

For and on behalf of Board of Directors of Cube Highways Fund Advisors Private Limited in its capacity as an Investment Manager of Cube Highways Trust

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: April 3, 2023

LEGAL MATTERS

Each of Cyril Amarchand Mangaldas, S&R Associates and Linklaters Singapore Pte. Ltd. do not make, or purport to make, any statement in this Final Placement Memorandum and are not aware of any statement in this Final Placement Memorandum which purports to be based on a statement made by each of them, and it makes no representation, express or implied, regarding, and to the extent permitted by law takes no responsibility for, any statement in or omission from this Final Placement Memorandum.

INDEPENDENT ACCOUNTANTS

The Audited Special Purpose Combined Financial Statements have been prepared in accordance with the requirements of the InvIT Regulations, the accounting principles generally accepted in India, including Ind AS. The Audited Special Purpose Combined Financial Statements included in this Final Placement Memorandum have been audited by S.B. Billimoria & Co. LLP, Chartered Accountants, the statutory auditors of the Trust, as stated in their audit report dated January 20, 2023 included in this Final Placement Memorandum.

(*This page has been left intentionally blank*)

S. B. BILLIMORIA & CO. LLP

Chartered Accountants
7th floor, Building 10
Tower B
DLF Cyber City Complex
DLF City Phase II
Gurugram-122 002
Haryana, India

Tel: +91 124 679 2000
Fax: +91 124 679 2012

INDEPENDENT AUDITOR'S REPORT ON SPECIAL PURPOSE COMBINED FINANCIAL STATEMENTS OF THE PROPOSED TRUST GROUP

To
The Board of Directors,
Cube Highways Fund Advisors Private Limited (the "Investment Manager") in its capacity as an Investment Manager of Cube Highways Trust (the "Issuer" or the "Trust")
B-376, Upper Ground Floor,
Nirman Vihar,
New Delhi 110092

Report on the Audit of the Special Purpose Combined Financial Statements of the Proposed Trust Group

Opinion

We have audited the accompanying Special Purpose Combined Financial Statements of Cube Highways Trust (the "Issuer" or the "Trust") and its proposed subsidiaries comprising of:

1. Jaipur-Mahua Tollway Limited;
2. Mahua Bharatpur Expressways Limited;
3. Western UP Tollway Limited;
4. Farakka-Raiganj Highways Limited;
5. DA Toll Road Private Limited;
6. Nelamangala Devihalli Expressway Private Limited (formerly known as "Gradient Infra Assets Advisors Private Limited");
7. Walayar Vaddakencherry Expressways Private Limited (formerly known as "KNR Walayar Tollways Private Limited");
8. Hazaribagh Tollway Limited;
9. Kotwa-Muzaffarpur Tollway Limited;
10. Jhansi-Lalitpur Tollway Limited;
11. Jhansi-Vigakhet Tollway Limited;
12. Lucknow-Raebareli Tollway Limited;
13. Madurai-Kanyakumari Tollway Limited;
14. Kanyakumari-Etturavattam Tollway Limited;
15. Salaipudhur-Madurai Tollway Limited;
16. Nanguneri-Kanyakumari Tollway Limited;
17. Ghaziabad Aligarh Expressway Private Limited; and
18. Andhra Pradesh Expressway Limited

(collectively, the "Proposed Trust Group") as described in Note 1 of the Special Purpose Combined Financial Statements, which comprise the Special Purpose Combined Balance Sheet as at October 31, 2022 and as at March 31, 2022, 2021 and 2020, the Special

Purpose Combined Statement of Profit and Loss (including Other Comprehensive Income), the Special Purpose Combined Statement of Cash Flows and the Special Purpose Combined Statement of Changes in Equity for the seven month period ended October 31, 2022 and for the years ended March 31, 2022, 2021 and 2020, and a summary of significant accounting policies and other explanatory information (together referred to as the "Special Purpose Combined Financial Statements").

In our opinion and to the best of our information and according to the explanations given to us and based on the consideration of report of other auditors on the special purpose financial statements of Ghaziabad Aligarh Expressway Private Limited ("GAEPL") referred to in the Other Matter section below, the aforesaid Special Purpose Combined Financial Statements give a true and fair view in accordance with the basis of preparation set out in Note 2(I) to the Special Purpose Combined Financial Statements, of the combined state of affairs of the Proposed Trust Group as at October 31, 2022 and as at March 31, 2022, 2021 and 2020 and of their combined loss, their combined total comprehensive loss, their combined cash flows and their combined changes in equity for the seven month period ended October 31, 2022 and of their combined loss, their combined total comprehensive loss, their combined cash flows and their combined changes in equity for the years ended March 31, 2022, 2021 and 2020.

Basis for Opinion

We conducted our audit of the Special Purpose Combined Financial Statements in accordance with the Standards on Auditing (SAs) issued by the Institute of Chartered Accountants of India (ICAI). Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the audit of the Special Purpose Combined Financial Statements section of our report. We are independent of the Proposed Trust Group in accordance with the Code of Ethics issued by the ICAI and we have fulfilled our ethical responsibilities in accordance with the ICAI's Code of Ethics. We believe that the audit evidence obtained by us and the audit evidence obtained by the other auditors in terms of their report referred to in the Other Matter section below, is sufficient and appropriate to provide a basis for our audit opinion on the Special Purpose Combined Financial Statements.

Emphasis of Matters

i. Basis of Accounting and Restriction on Use - We draw attention to Note 2(I) to the Special Purpose Combined Financial Statements, which describes the purpose and basis of preparation of the Special Purpose Combined Financial Statements. The Special Purpose Combined Financial Statements have been prepared by the Investment Manager to meet the requirements of the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended and the circulars issued thereunder (the "InvIT Regulations") and for inclusion in the Placement Memorandum and Final Placement Memorandum (collectively, the "Offer Documents") prepared by the Investment Manager in connection with the proposed private placement of the units of the Trust. As a result, the Special Purpose Combined Financial Statements may not be suitable for another purpose. Our report is intended solely for the purpose of inclusion in Offer Documents and is not to be used, referred to or distributed for any other purpose without our prior written consent.

ii. We draw attention to Note 54(ii) of the Special Purpose Combined Financial Statements, which describes about settlement of certain transactions through DA Toll Road Private Limited on acquisition of shareholding of DA Toll Road Private Limited by the New Shareholder and accounting thereof, during the year ended March 31, 2021.

iii. We draw attention to Note 54(iii) of the Special Purpose Combined Financial Statements, which describes about settlement of certain transactions through Farakka-Raiganj Highways Limited on acquisition of shareholding of Farakka-Raiganj Highways Limited by the New Shareholder and accounting thereof, during the year ended March 31, 2021.

Our opinion is not modified in respect of these matters.

Management's Responsibility for the Special Purpose Combined Financial Statements

The Investment Manager's Board of Directors is responsible for the preparation and presentation of these Special Purpose Combined Financial Statements that give a true and fair view of the financial position, financial performance including other comprehensive profit/(loss), cash flows and changes in equity of the Proposed Trust Group in accordance with the basis of preparation as set out in Note 2(I) to the Special Purpose Combined Financial Statements for the purpose set out in "Emphasis of Matter- Basis of Accounting and Restriction on Use" paragraph above.

The respective Board of Directors of the companies included in the Proposed Trust Group and the Board of Directors of Investment Manager are responsible for maintenance of adequate accounting records for safeguarding of the assets of the Proposed Trust Group and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the Special Purpose Combined Financial Statements that give a true and fair view and are free from material misstatement, whether due to fraud or error, which have been used for the purpose of preparation of the Special Purpose Combined Financial Statements by the Board of Directors of the Investment Manager, as aforesaid.

In preparing the Special Purpose Combined Financial Statements, the Board of Directors of the Investment Manager and the respective Board of Directors of companies included in the Proposed Trust Group are responsible for assessing the ability of the Proposed Trust Group and the respective entities to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the Board of Directors of the Investment Manager and the respective Board of Directors of companies included in the Proposed Trust Group either intends to liquidate their respective entities or to cease operations, or has no realistic alternative but to do so.

The Board of Directors of the Investment Manager and the respective Board of Directors of companies included in the Proposed Trust Group are also responsible for overseeing the Proposed Trust Group's financial reporting process.

Auditor's Responsibilities for the Audit of the Special Purpose Combined Financial Statements

Our objectives are to obtain reasonable assurance about whether the Special Purpose Combined Financial Statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these Special Purpose Combined Financial Statements.

As part of our audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the Special Purpose Combined Financial Statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal financial control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for expressing an opinion on the effectiveness of the Proposed Trust Group's internal financial control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors of the Investment Manager.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Proposed Trust Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the Special Purpose Combined Financial Statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Proposed Trust Group to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the Special Purpose Combined Financial Statements, including the disclosures, and whether the Special Purpose Combined Financial Statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities within the Proposed Trust Group to express an opinion on the Special Purpose Combined Financial Statements. We are responsible for the direction, supervision and performance of the audit of the Special Purpose Combined Financial Statements of such entities included in the Special Purpose Combined Financial Statements of which

we are the independent auditors. For the other entity included in the Special Purpose Combined Financial Statements, which have been audited by the other auditors, such other auditors remain responsible for the direction, supervision and performance of the audits carried out by them. We remain solely responsible for our audit opinion.

Materiality is the magnitude of misstatements in the Special Purpose Combined Financial Statements that, individually or in aggregate, makes it probable that the economic decisions of a reasonably knowledgeable user of the Special Purpose Combined Financial Statements may be influenced. We consider quantitative materiality and qualitative factors in (i) planning the scope of our audit work and in evaluating the results of our work; and (ii) to evaluate the effect of any identified misstatements in the Special Purpose Combined Financial Statements.

We communicate with those charged with governance of the Proposed Trust Group and such other entities included in the Special Purpose Combined Financial Statements of which we are the independent auditors regarding, among other matters, the planned scope and timing of the audit and significant audit findings that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

Other Matter

We did not audit the special purpose financial statements of GAEPL, whose special purpose financial statements reflect total assets, total revenues and net cash (outflows)/ inflows, for the relevant period/years is tabulated below, as considered in the Special Purpose Combined Financial Statements. These special purpose financial statements have been audited by other auditors whose report have been furnished to us by the Management and our opinion on the Special Purpose Combined Financial Statements, in so far as it relates to the amounts and disclosures included in respect of GAEPL, and our report on other legal and regulatory requirements mentioned below, in so far as it relates to the aforesaid GAEPL is based solely on the report of the other auditors.

(Amount Rs. in million)

Particulars	As at/for the seven month period ended October 31, 2022	As at/for the year ended March 31, 2022	As at/for the year ended March 31, 2021	As at/for the year ended March 31, 2020
Total assets	20,151.47	17,485.57	17,692.59	18,146.12
Total revenue	1,848.29	2,255.02	2,017.79	2,531.17
Net cash inflows/ (outflows)	1,133.57	(8.55)	10.99	(55.61)

Our opinion on the Special Purpose Combined Financial Statements above and our report on Other Legal and Regulatory Requirements below, is not modified in respect of the above matter with respect to our reliance on the work done and the report of the other auditors.

Report on Other Legal and Regulatory Requirements

As required by the InvIT Regulations, based on our audit and on the consideration of the report of the other auditors on the special purpose financial statements of GAEPL referred to in the Other Matter section above, we report, to the extent applicable that:

a) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit of the aforesaid Special Purpose Combined Financial Statements;

b) The Special Purpose Combined Balance Sheet, the Special Purpose Combined Statement of Profit and Loss (including Other Comprehensive Income), the Special Purpose Combined Statement of Cash Flows and the Special Purpose Combined Statement of Changes in Equity, dealt with by this Report are in agreement with the relevant books of account maintained for the purpose of preparation of the Special Purpose Combined Financial Statements;

c) In our opinion, the aforesaid Special Purpose Combined Financial Statements comply with the basis of preparation as stated in Note 2(I) to the Special Purpose Combined Financial Statements; and

d) In our opinion and to the best of our information and according to the explanations given to us, the Special Purpose Combined Financial Statements give the disclosures, in accordance with the InvIT Regulations, in respect of the Net Assets at fair value as at October 31, 2022 and the Total Returns at fair value for the seven month period ended October 31, 2022 and for the year ended March 31, 2022.

For S.B. Billimoria & Co. LLP
Chartered Accountants
(Firm's Registration No. 101496W/W100774)

Pramod B. Shukla
Partner
Membership No. 104337
UDIN: 22104337BABCSQ1777

Place: Noida
Date: January 20, 2022

CUBE HIGHWAYS TRUST

Special Purpose Combined Balance Sheet
(All amounts in ₹ million unless otherwise stated)

	Notes	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
ASSETS					
Non-current assets					
Property, plant and equipment	3	156.12	166.93	110.13	50.46
Capital work-in-progress	4	4.45	3.94	13.82	0.58
Investment properties	5	7.35	7.35	7.35	7.92
Intangible assets	6	123,925.88	119,777.48	121,536.39	63,953.30
Intangible assets under development	7	416.12	7,260.76	10,422.91	9,706.31
Financial assets:					
Investments	8	0.01	0.01	0.01	-
Other financial assets	9	742.94	970.67	1,731.54	2,529.42
Deferred tax assets (net)	26	257.04	215.70	198.94	494.29
Current tax assets (net)	10	461.14	433.58	128.44	239.54
Other non-current assets	11	765.05	141.48	66.27	90.98
Total non-current assets		**126,736.10**	**128,977.90**	**134,215.80**	**77,072.80**
Current assets					
Inventories	12	119.75	41.84	23.02	12.98
Financial assets					
Investments	13	2,798.38	-	1,159.46	224.46
Trade receivables	14	798.08	751.21	755.54	658.89
Cash and cash equivalents	15	10,718.79	18,490.11	8,851.89	2,424.36
Bank balances other than cash and cash equivalents	16	3,435.88	2,633.84	4,284.98	3,907.77
Other financial assets	17	2,187.91	3,135.74	10,238.34	1,392.13
Current tax assets (net)	10	-	-	40.04	31.82
Other current assets	18	1,417.77	985.83	385.42	391.43
Total current assets		**21,476.56**	**26,038.57**	**25,738.69**	**9,043.84**
Assets held for sale	19	4.67	4.67	4.67	-
Total assets		**148,217.33**	**155,021.14**	**159,959.16**	**86,116.64**
EQUITY AND LIABILITIES					
EQUITY					
Capital	20	8,522.87	8,522.87	7,792.87	7,337.16
Other equity	21	(7,636.53)	(8,283.01)	(4,478.78)	2,923.95
Total equity		**886.34**	**239.86**	**3,314.09**	**10,261.11**
LIABILITIES					
Non-current liabilities					
Financial liabilities					
Borrowings	22	119,130.54	112,338.40	110,138.20	50,469.38
Trade payables	24				
- total outstanding dues of micro enterprises and small enterprises		0.41	6.04	1.65	0.96
- total outstanding dues of creditors other than micro enterprises and small enterprises		32.73	6.52	8.66	23.15
Other financial liabilities	23	4,777.49	3,335.10	1,615.73	809.51
Provisions	25	3,559.83	3,303.47	3,401.34	3,927.10
Deferred tax liabilities (net)	26	610.50	777.11	1,071.73	468.77
Total non-current liabilities		**128,111.50**	**119,766.64**	**116,237.31**	**55,698.87**
Current liabilities					
Financial liabilities					
Borrowings	27	6,122.31	17,502.62	13,156.01	9,533.58
Trade payables	28				
- total outstanding dues of micro enterprises and small enterprises		143.31	144.75	148.88	57.86
- total outstanding dues of creditors other than micro enterprises and small enterprises		2,490.04	1,876.01	2,465.72	1,687.61
Other financial liabilities	29	4,239.65	4,193.14	10,337.88	8,791.24
Other current liabilities	30	70.20	226.30	294.67	81.00
Provisions	31	6,153.98	11,071.82	12,964.96	5.37
Current tax liabilities (net)	10	-	-	1,039.64	-
Total current liabilities		**19,219.49**	**35,014.64**	**40,407.76**	**20,156.66**
Total liabilities		**147,330.99**	**154,781.28**	**156,645.07**	**75,855.53**
Total equity and liabilities		**148,217.33**	**155,021.14**	**159,959.16**	**86,116.64**

The above Special Purpose Combined Balance Sheet should be read in conjunction with the accompanying notes (1 - 61)

As per our report of even date attached

For S.B. Billimoria & Co. LLP
Chartered Accountants

For and on behalf of the Board of Directors of
Cube Highways Fund Advisors Private Limited
(the "Investment Manager") in its capacity
as the Investment Manager of Cube Highways Trust

Pramod B. Shukla
Partner

Place: Gurugram
Date: January 20, 2023

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: January 20, 2023

CUBE HIGHWAYS TRUST

Special Purpose Combined Statement of Profit and Loss

(All amounts in ₹ million unless otherwise stated)

	Notes	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
Income					
Revenue from operations	32	14,180.96	20,550.40	16,285.19	13,270.92
Other income	33	378.36	1,021.91	513.40	622.26
Total Income		**14,559.32**	**21,572.31**	**16,798.59**	**13,893.18**
Expenses					
Cost of construction	34	799.02	1,387.77	2,308.40	1,073.05
Operation and maintenance expenses	35	2,477.52	8,404.82	3,799.46	3,532.06
Employee benefits expense	36	191.86	306.41	210.65	211.32
Other expenses	37	629.94	1,298.28	1,015.11	351.11
Total expenses		**4,098.34**	**11,397.28**	**7,333.62**	**5,167.54**
Earnings before finance costs, depreciation, amortisation, impairment, exceptional item and tax		**10,460.98**	**10,175.03**	**9,464.97**	**8,725.64**
Finance costs	38	7,934.11	13,940.24	10,417.46	6,837.75
Depreciation and amortisation expense	39	3,535.41	5,492.71	3,778.03	3,255.73
Impairment charge/(reversal) of impairment of intangible assets	57	-	(268.67)	167.40	156.09
Loss before exceptional item and tax		**(1,008.54)**	**(8,989.25)**	**(4,897.92)**	**(1,523.93)**
Exceptional items:					
Claims receivable on NHAI settlement	54 (iii)	-	-	3,243.74	-
Loss before tax		**(1,008.54)**	**(8,989.25)**	**(1,654.18)**	**(1,523.93)**
Less: Tax expense/(income)	41				
Current tax		93.85	85.67	1,122.94	44.52
Deferred tax		(534.62)	(823.25)	(367.76)	(231.58)
		(440.77)	**(737.58)**	**755.18**	**(187.06)**
Loss for the period/year		**(567.77)**	**(8,251.67)**	**(2,409.36)**	**(1,336.87)**
Other comprehensive income					
Items that will not be reclassified to profit or loss					
Re-measurement (losses)/gains on defined benefit obligations		**(2.87)**	**(1.59)**	**18.94**	**(7.47)**
Income tax relating to these items		0.75	0.32	(4.65)	1.95
Total other comprehensive (loss)/income for the period/year		**(2.12)**	**(1.27)**	**14.29**	**(5.52)**
Total comprehensive loss for the period/year		**(569.89)**	**(8,252.94)**	**(2,395.07)**	**(1,342.39)**

Earnings Per Unit - Refer note 40

The above Special Purpose Combined Statement of Profit and Loss should be read in conjunction with the accompanying notes (1 - 61)

As per our report of even date attached

For S.B. Billimoria & Co. LLP
Chartered Accountants

For and on behalf of the Board of Directors of
Cube Highways Fund Advisors Private Limited
(the "Investment Manager") in its capacity
as the Investment Manager of Cube Highways Trust

Pramod B. Shukla
Partner

Place: Gurugram
Date: January 20, 2023

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: January 20, 2023

CUBE HIGHWAYS TRUST
Special Purpose Combined Statement of Cash Flows
(All amounts in ₹ million unless otherwise stated)

	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
A. Cash flows from operating activities				
Loss before tax	**(1,008.54)**	**(8,989.25)**	**(1,654.18)**	**(1,523.93)**
Adjustments for:				
Depreciation and amortisation expense	3,535.41	5,492.71	3,778.03	3,255.73
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	(0.15)	(2.12)	0.44	0.06
Net gain on sale of mutual funds	(1.99)	(95.49)	(11.12)	(7.11)
Net loss on investments/ derivatives measured at fair value through profit or loss	0.33	29.64	92.81	39.08
Liabilities no longer required written back/ Remission of loan liability	(44.43)	(220.68)	(55.80)	(125.32)
Interest income	(307.33)	(420.59)	(284.95)	(183.12)
Claims for compensation/ concession extension	-	-	(576.30)	(41.19)
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	(268.67)	167.87	157.50
Impairment loss allowance on financial assets (including write-offs)	1.08	44.82	46.19	17.23
Gain on cash flows changes on non-convertible debentures (net)	-	-	(19.38)	-
Finance costs (excluding derivative hedging cost)	7,921.94	13,910.60	10,316.38	6,797.55
Provision for damages	-	-	41.61	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	(96.75)	310.51
Operating cash flows before working capital changes and other adjustments	**10,096.32**	**9,480.97**	**11,744.85**	**8,696.99**
Working capital changes and other adjustments:				
Decrease/(Increase) in inventories	(77.91)	(18.80)	(10.04)	(2.73)
Decrease/(Increase) in trade receivables	(46.87)	(20.62)	(130.13)	188.46
Decrease/(Increase) in financial assets and non financial assets	818.51	3,353.13	(2,883.80)	(675.35)
(Decrease)/Increase in trade payables	677.44	(371.00)	1,120.34	379.76
(Decrease)/Increase in provisions	(4,356.86)	4,904.79	1,587.66	253.79
(Decrease)/Increase in financial liabilities and non financial liabilities	(889.18)	(7,314.79)	2,100.31	88.83
Cash flow generated from operating activities post working capital changes	**6,221.45**	**10,013.68**	**13,529.19**	**8,929.75**
Income tax (paid)/ refund (net)	(120.02)	(1,385.88)	32.19	21.45
Net cash generated from operating activities (A)	**6,101.43**	**8,627.80**	**13,561.38**	**8,951.20**
B. Cash flows from investing activities				
Payment towards property, plant and equipment & intangible assets (after adjustment of increase/decrease in capital work-in progress, intangible assets under development (net) and advances for capital expenditure)	(1,645.90)	(9,375.92)	(59,726.08)	(1,116.11)
Proceeds from sale of property, plant and equipment	0.27	2.13	1.49	0.01
Proceeds from NHAI on settlement [Refer note 54(iii)]	-	5,253.91	-	-
Movement in bank balances (including deposits) not considered as cash and cash equivalents (net)	449.13	(306.07)	(1,506.65)	(2,163.60)
Investment in equity shares	-	-	(0.01)	-
Investment/(redemption) from mutual funds (net)	(2,784.55)	1,254.97	(915.62)	(206.22)
Interest received	296.07	409.28	221.34	136.03
Net cash used in investing activities (B)	**(3,684.98)**	**(2,761.70)**	**(61,925.53)**	**(3,349.89)**
C. Cash flows from financing activities				
Proceeds from share application money pending allotment	-	-	-	5.20
Proceeds from issue of capital (including security premium)	-	730.00	6,653.02	180.90
Payment for capital reduction [Refer note 21]	-	-	(600.00)	-
Proceeds from long term borrowings	14,306.79	42,184.30	69,458.25	730.00
Repayment of long term borrowings	(14,695.79)	(32,221.95)	(11,402.46)	(3,162.52)
(Repayments)/proceeds from short term borrowings (net)	(3,134.24)	346.06	11.48	1,219.84
Interest paid (including interest capitalised)	(5,391.29)	(9,204.41)	(10,458.04)	(5,578.64)
Net cash generated from/(used in) financing activities (C)	**(8,914.53)**	**1,834.00**	**53,662.25**	**(6,605.22)**
D. Net increase/(decrease) in cash and cash equivalents (A+B+C)	**(6,498.08)**	**7,700.10**	**5,298.10**	**(1,003.91)**
E. Cash and cash equivalents at the beginning of the period/year	14,780.62	7,080.52	1,782.42	2,786.33
Cash and cash equivalents at the end of the period/year (D+E) (Refer reconciliation below)	**8,282.54**	**14,780.62**	**7,080.52**	**1,782.42**
Reconciliation of cash and cash equivalents as per Special Purpose Combined Statement of Cash Flows				
Cash and cash equivalents as per above comprise of following:				
Cash and cash equivalents [Refer note 15]	10,718.79	18,490.11	8,851.89	2,424.36
Less: Earmarked balances [Refer note 15]	(2,436.25)	(3,709.49)	(1,771.37)	(641.94)
Balance as per Special Purpose Combined Statement of Cash Flows	**8,282.54**	**14,780.62**	**7,080.52**	**1,782.42**

Note:
The above cash flows has been prepared under the 'Indirect Method' as set out in Ind AS 7, 'Statement of Cash Flows'.

Changes in liabilities arising from financing activities

For the seven month ended October 31, 2022

Particulars	Balance as at April 01, 2022	Cash flows from financing activities		Conversion of sub-ordinate loan into borrowings/remission of borrowings	Unrealised foreign exchange	Valuation gain on non-convertible debentures	Impact in equity	Finance costs (Non-cash adjustment)	Reclassification	Balance as at October 31, 2022
		Inflow	Outflow							
Long Term Borrowiungs										
Term loan	67,981.51	4,956.79	(10,317.31)	-	-	-	-	54.46	-	62,675.45
Non Convertible Debentures and Optionally Convertible Debentures	55,032.53	9,350.00	(960.16)	-	-	-	(1,259.36)	134.06	-	62,297.07
Other long term borrowings	3,692.74	-	(3,418.32)	-	-	-	-	5.91	-	280.33
TOTAL (A)	**126,706.78**	**14,306.79**	**(14,695.79)**	**-**	**-**	**-**	**(1,259.36)**	**194.43**	**-**	**125,252.85**
Short Term Borrowings										
Loans from others	3,134.24	-	(3,134.24)	-	-	-	-	-	-	-
TOTAL (B)	**3,134.24**	**-**	**(3,134.24)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total liabilities from financing activities (C = A+B)	**129,841.02**	**14,306.79**	**(17,830.03)**	**-**	**-**	**-**	**(1,259.36)**	**194.43**	**-**	**125,252.85**

For the year ended March 31, 2022

Particulars	Balance as at April 01, 2021	Cash flows from financing activities		Conversion of sub-ordinate loan into borrowings/remission of borrowings	Unrealised foreign exchange	Valuation gain on non-convertible debentures	Impact in equity	Finance costs (Non-cash adjustment)	Reclassification	Balance as at March 31, 2022
		Inflow	Outflow							
Long Term Borrowiungs										
Term loan	76,239.70	19,273.30	(27,598.15)	-	-	-	-	66.66	-	67,981.51
Non Convertible Debentures and Optionally Convertible Debentures	39,776.39	21,661.00	(4,475.35)	-	-	-	(2,091.79)	162.28	-	55,032.53
Other long term borrowings	3,004.48	1,250.00	(148.45)	-	-	-	(413.29)	-	-	3,692.74
TOTAL (A)	**119,020.57**	**42,184.30**	**(32,221.95)**	**-**	**-**	**-**	**(2,505.08)**	**228.94**	**-**	**126,706.78**
Short Term Borrowings										
Loans from others	4,273.64	458.00	(111.94)	-	-	-	(1,485.46)	-	-	3,134.24
TOTAL (B)	**4,273.64**	**458.00**	**(111.94)**	**-**	**-**	**-**	**(1,485.46)**	**-**	**-**	**3,134.24**
Total liabilities from financing activities (C = A+B)	**123,294.21**	**42,642.30**	**(32,333.89)**	**-**	**-**	**-**	**(3,990.54)**	**228.94**	**-**	**129,841.02**

For the year ended March 31, 2021

Particulars	Balance as at April 01, 2020	Cash flows from financing activities		Conversion of sub-ordinate loan into borrowings/remission of borrowings	Unrealised foreign exchange	Valuation gain on non-convertible debentures	Impact in equity	Finance costs (Non-cash adjustment)	Reclassification	Balance as at March 31, 2021
		Inflow	Outflow							
Long Term Borrowiungs										
Term loan	40,520.92	40,429.96	(4,176.89)	-	(96.75)	-	-	(437.54)	-	76,239.70
Non Convertible Debentures and Optionally Convertible Debentures	11,724.59	29,028.29	(4,053.82)	6,310.83	-	(19.38)	(3,227.28)	13.16	-	39,776.39
Other long term borrowings	3,314.79	-	(3,171.75)	2,906.34	-	(160.58)	111.18	4.50	-	3,004.48
TOTAL (A)	**55,560.30**	**69,458.25**	**(11,402.46)**	**9,217.17**	**(96.75)**	**(179.96)**	**(3,116.10)**	**(419.88)**	**-**	**119,020.57**
Short Term Borrowings										
Loans from others	4,442.66	64.58	(53.10)	(180.50)	-	-	-	-	-	4,273.64
TOTAL (B)	**4,442.66**	**64.58**	**(53.10)**	**(180.50)**	**-**	**-**	**-**	**-**	**-**	**4,273.64**
Total liabilities from financing activities (C = A+B)	**60,002.96**	**69,522.83**	**(11,455.56)**	**9,036.67**	**(96.75)**	**(179.96)**	**(3,116.10)**	**(419.88)**	**-**	**123,294.21**

For the year ended March 31, 2020

Particulars	Balance as at April 01, 2019	Cash flows from financing activities		Conversion of sub-ordinate loan into borrowings/remission of borrowings	Unrealised foreign exchange	Valuation gain on non-convertible debentures	Impact in equity	Finance costs (Non-cash adjustment)	Reclassification	Balance as at March 31, 2020
		Inflow	Outflow							
Long Term Borrowiungs										
Term loan	42,308.22	660.00	(2,810.67)	-	310.51	-	-	52.86	-	40,520.92
Non Convertible Debentures and Optionally Convertible Debentures	12,109.16	70.00	(351.85)	(120.00)	-	-	-	17.28	-	11,724.59
Other long term borrowings	3,664.12	-	-	-	-	-	-	-	(349.33)	3,314.79
TOTAL (A)	**58,081.50**	**730.00**	**(3,162.52)**	**(120.00)**	**310.51**	**-**	**-**	**70.14**	**(349.33)**	**55,560.30**
Short Term Borrowings										
Loans from others	2,873.49	1,284.84	(65.00)	-	-	-	-	-	349.33	4,442.66
TOTAL (B)	**2,873.49**	**1,284.84**	**(65.00)**	**-**	**-**	**-**	**-**	**-**	**349.33**	**4,442.66**
Total liabilities from financing activities (C = A+B)	**60,954.99**	**2,014.84**	**(3,227.52)**	**(120.00)**	**310.51**	**-**	**-**	**70.14**	**-**	**60,002.96**

The above Special Purpose Combined Statement of Cash Flows should be read in conjunction with the accompanying notes (1-61)

As per our report of even date attached

For S.B. Billimoria & Co. LLP
Chartered Accountants

For and on behalf of the Board of Directors of
Cube Highways Fund Advisors Private Limited
(the "Investment Manager") in its capacity
as the Investment Manager of Cube Highways Trust

Pramod B. Shukla
Partner

Place: Gurugram
Date: January 20, 2023

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: January 20, 2023

CUBE HIGHWAYS TRUST
Special Purpose Combined Statement of Changes in Equity
(All amounts in ₹ million unless otherwise stated)

A Capital

i) For the seven month ended October 31, 2022

Balance as at April 01, 2022	Issue of capital during the seven month period	Reduction in capital during the seven month period	Balance as at October 31, 2022
8,522.87	-	-	**8,522.87**

ii) For the year ended March 31, 2022

Balance as at April 01, 2021	Issue of capital during the year	Reduction in capital during the year	Balance as at March 31, 2022
7,792.87	730.00	-	**8,522.87**

iii) For the year ended March 31, 2021

Balance as at April 01, 2020	Issue of capital during the year	Reduction in capital during the year	Balance as at March 31, 2021
7,337.16	546.62	(90.91)	**7,792.87**

iv) For the year ended March 31, 2020

Balance as at April 01, 2019	Issue of capital during the year	Reduction in capital during the year	Balance as at March 31, 2020
7,156.26	180.90	-	**7,337.16**

B Other equity

Particulars	Share application money pending allotment	Equity component of financial instruments				Deemed capital contribution	Reserves and surplus				Total
		Equity component of interest on non-convertible debentures	Equity component of non-cumulative, non-convertible redeemable preference shares	Equity component of optionally convertible debentures	Equity component of subordinate debt/seller loans		Securities premium	Debenture redemption reserve	Capital reserve	Retained earnings	
Balance as at April 01, 2022	**-**	**193.42**	**400.48**	**4,648.36**	**338.17**	**5,522.07**	**7,761.59**	**490.43**	**830.00**	**(28,467.53)**	**(8,283.01)**
Net loss for the period	-	-	-	-	-	-	-	-	-	(567.77)	**(567.77)**
Other comprehensive income/(loss):											
Re-measurement loss on defined benefit obligations (net of income tax)	-	-	-	-	-	-	-	-	-	(2.12)	**(2.12)**
Total comprehensive loss for the period	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(569.89)**	**(569.89)**
Equity component of optionally convertible debentures (net of tax)	-	-	-	931.92	-	-	-	-	-	-	**931.92**
Waiver of interest on Shareholder loans [Refer note 54 (iv)]	-	-	-	-	-	24.67	-	-	-	-	**24.67**
Interest on interest free shareholder loans of GAEPL	-	-	-	-	-	61.26	-	-	-	-	**61.26**
Waiver of interest by the fellow subsidiary of WUPTL [Refer note 58]	-	-	-	-	-	198.52	-	-	-	-	**198.52**
Balance as at October 31, 2022	**-**	**193.42**	**400.48**	**5,580.28**	**338.17**	**5,806.52**	**7,761.59**	**490.43**	**830.00**	**(29,037.42)**	**(7,636.53)**

CUBE HIGHWAYS TRUST
Special Purpose Combined Statement of Changes in Equity
(All amounts in ₹ million unless otherwise stated)

Particulars	Share application money pending allotment	Equity component of financial instruments				Deemed capital contribution	Reserves and surplus				Total
		Equity component of interest on non-convertible debentures	Equity component of non-cumulative, non-convertible redeemable preference shares	Equity component of optionally convertible debentures	Equity component of subordinate debt/seller loans		Securities premium	Debenture redemption reserve	Capital reserve	Retained earnings	
Balance as at April 01, 2021	**-**	**397.75**	**400.48**	**3,068.85**	**338.17**	**2,448.54**	**7,761.59**	**490.43**	**830.00**	**(20,214.59)**	**(4,478.78)**
Net loss for the year	-	-	-	-	-	-	-	-	-	(8,251.67)	**(8,251.67)**
Other comprehensive income/(loss):											
Re-measurement loss on defined benefit obligations (net of income tax)	-	-	-	-	-	-	-	-	-	(1.27)	**(1.27)**
Total comprehensive loss for the year	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(8,252.94)**	**(8,252.94)**
Equity component of optionally convertible debentures (net of tax)	-	-	-	1,579.51	-	-	-	-	-	-	**1,579.51**
Remission of shareholder loan [Refer note 54 (iv)]	-	-	-	-	-	1,898.80	-	-	-	-	**1,898.80**
Waiver of interest on Shareholder loans [Refer note 54 (iv)]	-	-	-	-	-	365.53	-	-	-	-	**365.53**
Interest on interest free shareholder loans of GAEPL	-	-	-		-	470.60	-	-	-	-	**470.60**
Adjustment to equity component of interest accrued on non-convertible debentures of fellow subsidiary [Refer note 58]	-	(204.33)	-	-	-	-	-	-	-	-	**(204.33)**
Waiver of interest by the fellow subsidiary of WUPTL [Refer note 58]	-	-	-	-	-	338.60	-	-	-	-	**338.60**
Balance as at March 31, 2022	**-**	**193.42**	**400.48**	**4,648.36**	**338.17**	**5,522.07**	**7,761.59**	**490.43**	**830.00**	**(28,467.53)**	**(8,283.01)**

CUBE HIGHWAYS TRUST
Special Purpose Combined Statement of Changes in Equity
(All amounts in ₹ million unless otherwise stated)

Particulars	Share application money pending allotment	Equity component of financial instruments				Deemed capital contribution	Reserves and surplus				Total
		Equity component of interest on non-convertible debentures	Equity component of non-cumulative, non-convertible redeemable preference shares	Equity component of optionally convertible debentures	Equity component of subordinate debt/seller loans		Securities premium	Debenture redemption reserve	Capital reserve	Retained earnings	
Balance as at April 01, 2020	**5.20**	**-**	**400.48**	**-**	**8,414.20**	**1,351.81**	**1,649.99**	**490.43**	**830.00**	**(10,218.16)**	**2,923.95**
Net loss for the year	-	-	-	-	-	-	-	-	-	(2,409.36)	**(2,409.36)**
Other comprehensive income/(loss):											
Re-measurement gain on defined benefit obligations (net of income tax)	-	-	-	-	-	-	-	-	-	14.29	**14.29**
Total comprehensive loss for the year	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(2,395.07)**	**(2,395.07)**
Securities premium arising on issue of capital	-	-	-	-	-	-	6,111.60	-	-	-	**6,111.60**
Settlement pursuant to Share Purchase Agreement (SPA) [Refer note 54 (ii) and 54 (iii)]	-	-	-	-	-	-	-	-	-	(7,092.27)	**(7,092.27)**
Reclassifications to borrowings [Refer note 54 (i)]	-	-	-	-	(3,796.85)	-	-	-	-	-	**(3,796.85)**
Effect of fair value of above borrowings [Refer note 54 (i)]	-	-	-	-	160.58	-	-	-	-	-	**160.58**
Capital reduction of JMTL [Refer note 21]	-	-	-	-	-	-	-	-	-	(509.09)	**(509.09)**
Equity component of optionally convertible debentures (net of tax)	-	-	-	3,068.85	-	-	-	-	-	-	**3,068.85**
Cancellation of corporate guarantee	-	-	-	-	-	(49.77)	-	-	-	-	**(49.77)**
Waiver of interest on shareholder loan [Refer note 54 (iv)]	-	-	-	-	-	367.79	-	-	-	-	**367.79**
Interest on interest free shareholder loans of GAEPL	-	-	-	-	-	440.11	-	-	-	-	**440.11**
Converted in to NCD - DATRL [Refer note 54 (ii)]	-	-	-	-	(4,449.10)	-	-	-	-	-	**(4,449.10)**
Waiver of interest by the fellow subsidiary of WUPTL [Refer note 58]	-	-	-	-	-	338.60	-	-	-	-	**338.60**
Equity component of interest accrued on non-convertible debentures of fellow subsidiary of WUPTL [Refer note 58]	-	397.75	-	-	-	-	-	-	-	-	**397.75**
Share application money transferred to capital	(5.20)	-	-	-	-	-	-	-	-	-	**(5.20)**
Other [Refer note 54 (i)]	-	-	-	-	9.34	-	-	-	-	-	**9.34**
Balance as at March 31, 2021	**-**	**397.75**	**400.48**	**3,068.85**	**338.17**	**2,448.54**	**7,761.59**	**490.43**	**830.00**	**(20,214.59)**	**(4,478.78)**

CUBE HIGHWAYS TRUST
Special Purpose Combined Statement of Changes in Equity
(All amounts in ₹ million unless otherwise stated)

Particulars	Share application money pending allotment	Equity component of financial instruments				Deemed capital contribution	Reserves and surplus				Total
		Equity component of interest on non-convertible debentures	Equity component of non-cumulative, non-convertible redeemable preference shares	Equity component of optionally convertible debentures	Equity component of subordinate debt/seller loans		Securities premium	Debenture redemption reserve	Capital reserve	Retained earnings	
Balance as at April 01, 2019	**-**	**-**	**400.48**	**-**	**8,414.20**	**563.46**	**1,649.99**	**490.43**	**830.00**	**(8,875.77)**	**3,472.79**
Net loss for the year	-	-	-	-	-	-	-	-	-	(1,336.87)	**(1,336.87)**
Other comprehensive income/(loss):											
Re-measurement loss on defined benefit obligations (net of income tax)	-	-	-	-	-	-	-	-	-	(5.52)	**(5.52)**
Total comprehensive loss for the year	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(1,342.39)**	**(1,342.39)**
Waiver of interest on Shareholder loan [Refer note 54 (iv)]	-	-	-	-	-	261.66	-	-	-	-	**261.66**
Interest on interest free shareholder loans of GAEPL	-	-	-	-	-	187.17	-	-	-	-	**187.17**
Waiver of interest by the fellow subsidiary of WUPTL [Refer note 58]	-	-	-	-	-	339.52	-	-	-	-	**339.52**
Share application money received	5.20	-	-	-	-	-	-	-	-	-	**5.20**
Balance as at March 31, 2020	**5.20**	**-**	**400.48**	**-**	**8,414.20**	**1,351.81**	**1,649.99**	**490.43**	**830.00**	**(10,218.16)**	**2,923.95**

Note:

The amount attributable to non controlling interest is immaterial and hence not disclosed separately.

The above Special Purpose Combined Statement of Changes in Equity should be read in conjunction with the accompanying notes (1 - 61)

As per our report of even date attached

For S.B. Billimoria & Co. LLP
Chartered Accountants

For and on behalf of the Board of Directors of
Cube Highways Fund Advisors Private Limited
(the "Investment Manager") in its capacity
as the Investment Manager of Cube Highways Trust

Pramod B. Shukla
Partner

Place: Gurugram
Date: January 20, 2023

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: January 20, 2023

CUBE HIGHWAYS TRUST

Notes forming part of Special Purpose Combined Financial Statements

1. Corporate Information

Cube Highways Trust (the "Trust") was set up on December 7, 2021, as a contributory irrevocable trust under the provision of the Indian Trusts Act, 1882. The Trust was registered as an infrastructure investment trust under the Securities Exchange Board of India ("SEBI") (Infrastructure Investment Trust) Regulations, 2014 as amended read together with circulars and guidelines issued thereunder (the "SEBI InvIT Regulations") on April 5, 2022, having registration number IN/InvIT/22-23/0022. The registered office address of the Trust is B-376, UGF, Nirman Vihar, New Delhi 110092.

Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd., companies registered in Singapore are the Sponsors of the Trust.

The Trustee to the Trust is Axis Trustee Services Limited (the "Trustee"). Investment manager for the Trust is Cube Highways Fund Advisors Private Limited (the "Investment Manager").

The investment objective of the Trust is to carry on the activities of an infrastructure investment trust, as permissible under the SEBI InvIT Regulations. The Trust has been formed to invest in infrastructure assets primarily being in the road sector in India. All the Road projects of entities proposed to be included in the Proposed Trust Group are implemented and held through special purpose vehicles ("SPVs" together with the Trust referred as "Proposed Trust Group").

The details of incorporation of the SPVs included in the Proposed Trust Group along with brief of principal activities and shareholding pattern of the SPVs are as given below:

Sr. No.	Name of SPVs	Date of incorporation	Principal activity	Name of the shareholders along with percentage of Shareholding as at October 31, 2022
1	Western UP Tollway Limited (WUPTL)	20-Apr-05	Construction, operation & maintenance of toll roads including toll collection	Cube Highways and Infrastructure Pte Limited, along with nominees – 100%
2	Andhra Pradesh Expressway Limited (APEL)	11-Nov-05		Cube Highways and Infrastructure Pte Limited, along with nominees – 100%
3	Jaipur-Mahua Tollway Limited (JMTL)	18-Mar-05		Cube Highways and Infrastructure Pte Limited, along with nominees – 100%
4	Mahua Bharatpur Expressways Limited (MBEL)	23-Mar-05		Cube Highways and Infrastructure Pte Limited, Singapore along with nominees – 99.97% Madhucon Infra Limited- 0.03%
5	Farakka-Raiganj Highways Limited (FRHL)	11-Mar-10		Cube Highways and Infrastructure II Pte Limited, Singapore along with its nominees – 100%
6	DA Toll Road Private Limited (DATRL)	26-Jun-10		Cube Highways and Infrastructure-III Pte Limited, along with nominee – 100%

Sr. No.	Name of SPVs	Date of incorporation	Principal activity	Name of the shareholders along with percentage of Shareholding as at October 31, 2022
7	Ghaziabad Aligarh Expressway Private Limited (GAEPL)	18-Dec-09		Cube Highways and Infrastructure Pte Ltd along with Nominee holds 100% (w.e.f May 25, 2022)
8	Walayar Vaddakencherry Expressways Private Limited (formerly known as "KNR Walayar Tollways Private Limited") (WVEPL)	16-Aug-12		Cube Highways and Infrastructure-III Pte Limited, along with nominees – 100%
9	Nelamangala Devihalli Expressway Private Limited (formerly known as "Gradient Infra Assets Advisors Private Limited") (NDEPL)	20-Nov-17	Toll collection from the users and operation and maintenance of Road Projects.	Cube Highways and Infrastructure I-D Pte. Limited, along with nominees – 100%
10	Hazaribagh Tollway Limited (HTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
11	Jhansi-Lalitpur Tollway Limited (JLTL)	17-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
12	Jhansi-Vigakhet Tollway Limited (JVTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
13	Kanyakumari-Etturavattam Tollway Limited (KETL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
14	Kotwa-Muzaffarpur Tollway Limited (KMTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
15	Lucknow-Raebareli Tollway Limited (LRTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
16	Madurai-Kanyakumari Tollway Limited (MKTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%

Sr. No.	Name of SPVs	Date of incorporation	Principal activity	Name of the shareholders along with percentage of Shareholding as at October 31, 2022
17	Nanguneri-Kanyakumari Tollway Limited (NKTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%
18	Salaipudhur-Madurai Tollway Limited (SMTL)	13-Dec-19		Cube Mobility Investment Pte Limited along with its nominees – 100%

Under the share purchase agreements proposed to be entered amongst the Sponsors, the Trustee, the Investment Manager, and the relevant SPVs and their respective shareholders, Cube Highways Trust shall acquire 100% of fully paid-up equity shares of the SPVs except MBEL where 99.97% of fully paid-up equity shares will be acquired from their respective holders who shall be issued and allotted units of Cube Highways Trust.

Pursuant to the proposed acquisition of equity of the SPVs by the Trust, the SPVs are required to obtain No Objection Certificates/ Consent from the Lenders and concessioning authorities for the proposed transfer of shareholding of SPVs to the Trust. The Project SPVs and the Board of Directors of Investment Manager, acting on behalf of the Trust believes that the requisite approvals will be received and the conditions, if any, mentioned in the approvals will be complied before the proposed acquisition of shareholding of Project SPV by the Trust.

2. Basis of preparation and significant accounting policies

I. Purpose and basis of preparation of the Special Purpose Combined Financial Statements

The Special Purpose Combined Financial Statements of the Proposed Trust Group comprises of the Special Purpose Combined Balance Sheet as at October 31, 2022, March 31, 2022, March 31, 2021 and March 31, 2020, the Special Purpose Combined Statement of Profit and Loss (including other Comprehensive income), the Special Purpose Combined Statement of Changes in Equity and the Special Purpose Combined Statement of Cash Flows for seven month period ended October 31, 2022 and for the years ended March 31, 2022, March 31, 2021 and March 31, 2020 and a summary of significant accounting policies and other explanatory information ("Special Purpose Combined Financial Statements").

During filing of the Draft Placement Memorandum (DPM), the Special Purpose Combined Financial Statements as at and for the years ended March 31, 2022, 2021 and 2020 of the Proposed Trust Group prepared by the Investment Manager included financial information of the Trust and its proposed subsidiaries comprising of WUPTL, APEL, JMTL, MBEL, FRHL, DATRL, N.A.M. Expressway Limited (NAMEL), GAEPL, WVEPL, NDEPL, HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL in connection with the proposed private placement of units.

Due to certain commercial considerations, the Investment Manager concluded that NAMEL will not be part of the Proposed Trust Group in connection with the proposed private placement of units at this stage and therefore, the Special Purpose Combined Financial Statements as at and for the seven month period ended October 31, 2022 and as at and for the years ended March 31, 2022, 2021 and 2020 prepared by the Investment Manager does not include financial information of NAMEL for the purpose of inclusion in the Placement Memorandum and Final Placement Memorandum (collectively, the "Offer Documents").

Accordingly, the Special Purpose Combined Financial Statements as at and for the seven month period ended October 31, 2022 and as at and for the years ended March 31, 2022, 2021 and 2020 of the Proposed Trust Group comprise of the financial information of the Trust and its proposed subsidiaries comprising of WUPTL, APEL, JMTL, MBEL, FRHL, DATRL, GAEPL, WVEPL, NDEPL, HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL.

The Special Purpose Combined Financial Statements of the Proposed Trust Group were approved by the Board of Directors of the Investment Manager and authorised for issuance by the Investment Manager by circular resolution dated January 20, 2023.

The Special Purpose Combined Financial Statements have been prepared in accordance with the Guidance Note on Reports in Company Prospectuses (Revised 2019), and the Guidance Note on Combined and Carve Out Financial Statements issued by the Institute of Chartered Accountants of India ("ICAI") (the "Guidance Notes") using the recognition and measurement principles of Indian Accounting Standards as defined in Rule 2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015 read with Section 133 of the Companies Act, 2013 ('Ind AS'), as amended and other generally accepted accounting principles and other relevant provisions relating to disclosures required as per the SEBI InvIT Regulations.

The Special Purpose Combined Financial Statements have been prepared by applying consistent accounting policies mentioned in subsequent paragraphs.

The Special Purpose Combined Financial Statements have been prepared by the Investment Manager to meet the requirements of the SEBI InvIT Regulations for inclusion in the Offer Documents prepared by the Investment Manager in connection with the proposed private placement of units of the Trust to be listed on BSE Limited and National Stock Exchange of India Limited. As a result, the Special Purpose Combined Financial Statements may not be suitable for any other purpose.

In accordance with the requirements of the SEBI InvIT Regulations, since the Trust is newly set up on December 7, 2021 and has been in existence for a period lesser than three completed financial years, the Special Purpose Combined Financial Statements are prepared based on an assumption that all the SPVs were part of Trust for such period when the Trust was not in existence i.e. for the entire portion of the reporting period of three years i.e. years ended March 31, 2022, March 31, 2021, March 31, 2020 and seven month period ended October 31, 2022. However, the Special Purpose Financial Statements may not be representative of the position which may prevail after the SPVs are transferred to the Trust.

These Special Purpose Combined Financial Statements have been prepared considering the underlying historical financial information of the SPVs in the Proposed Trust Group and not using the accounting principle required to be followed as per Ind AS 103 "Business Combination". However, the SPVs under the Proposed Trust Group will be accounted as per the requirements of Ind AS 103 "Business Combination" on the actual date of acquisition by the Trust on a future date. Accordingly, the Special Purpose Combined Financial Statements may not be representative of the actual financial position, financial performance including other comprehensive income/(loss), cash flows and changes in equity which may prevail after the SPVs under the Proposed Trust Group is acquired by the Trust.

The Special Purpose Combined Financial Statements are presented in Indian rupees, which is also its functional currency and all the values are rounded to nearest millions (INR 000,000), except when otherwise indicated.

Basis of Combination

The Special Purpose Combined Financial Statements have been prepared using uniform accounting policies for like transactions and other events in similar circumstances. The financial information of all the SPVs used for the purpose of combination are drawn up to the same reporting date.

The procedure for preparing Special Purpose Combined Financial Statements of the Proposed Trust Group are stated below:

i. The Special Purpose Combined Financial Statements were combined by combining/adding like items of assets, liabilities, equity, income, expenses and cash flows of the Trust and the SPVs for seven month period ended October 31, 2022 and years ended March 31, 2022, March 31, 2021, March 31, 2020.

ii. All intragroup assets and liabilities, equity, income, expenses and cash flows relating to transactions between entities of the Proposed Trust Group are eliminated in full. Ind AS 12 "Income Taxes" applies to

temporary differences that arise from the elimination of profits and losses resulting from intragroup transaction.

Further, the Special Purpose Combined Financial Statements are not prepared in accordance with the requirements of Schedule III notified under the Companies Act, 2013, as amended.

Historical cost convention

The Special Purpose Combined Financial Statements have been prepared on the historical cost basis using uniform policies as explained above for like transactions and other events in similar circumstances, except for following assets and liabilities that are measured at fair values at the end of each reporting period:

- certain financial assets and liabilities measured at fair value (refer accounting policy regarding financial instruments);
- defined benefit plans - plan assets measured at fair value; and
- Assets held for sale- measured at the lower of carrying amount and fair value less costs to sell.

II. Summary of Significant Accounting Policies

a) Current and non-current classification

The Proposed Trust Group presents assets and liabilities in the Special Purpose Combined Balance Sheet based on current/non-current classification. An asset is current when:

- It is expected to be realised, or is intended to be sold or consumed, in the normal operating cycle; or
- It is held primarily for the purpose of trading; or
- It is expected to realise the asset within 12 months after the reporting period; or
- The asset is a cash or equivalent unless it is restricted from being exchanged or used to settle a liability for at least twelve months after the reporting period.

All other assets are classified as non-current.

Similarly, a liability is classified as current if:

- It is expected to be settled in the normal operating cycle; or
- It is held primarily for the purpose of trading; or
- It is due to be settled within 12 months after the reporting period; or
- The Proposed Trust Group does not have an unconditional right to defer the settlement of the liability for at least 12 months after the reporting period. Terms of a liability that could result in its settlement by the issue of equity instruments at the option of the counterparty does not affect this classification.

All other liabilities are classified as non-current.

Deferred tax assets and liabilities are classified as non-current assets and liabilities.

Operating cycle

Based on the nature of activities of the Proposed Trust Group and the normal time between acquisitions of assets and their realisation in cash or cash equivalents, the Proposed Trust Group has determined its operating cycle as twelve months for the purpose of classifications of its assets and liabilities as current and non-current.

b) Critical accounting judgements and key sources of estimation uncertainty

The preparation of these Special Purpose Combined Financial Statements in conformity with Ind AS requires the management to make judgements, estimates and assumptions that affect the reported amounts of assets, liabilities, income and expenses, and the accompanying disclosures.

The Management believes that the estimates used in preparation of the Special Purpose Combined Financial Statements are prudent and reasonable. Actual results could differ due to these estimates and the differences between the actual results and the estimates are recognised in the periods in which the results are known / materialise.

1. **Applicability of service concession arrangement accounting to toll roads concessionaire arrangements**

The Proposed Trust Group has determined that Appendix to Ind AS 115 "Revenue from Contracts with Customers" relating to 'Service Concession Arrangements' is applicable to the SPVs which provides on accounting by the operators for public to private service concession arrangements. The SPVs have entered into concession arrangement with National Highway Authorities of India (NHAI) (the "Concessionaire") as per which the individual SPVs would participate in Design, Build, Finance, Operate and Transfer (DBFOT) or Toll Operate Transfer (TOT) of the toll roads infrastructure. After the end of the Concession arrangement, the SPVs have to transfer the infrastructure i.e. toll roads constructed to the Concessionaire.

Accordingly, the SPVs other than APEL have recognized the intangible assets as per the accounting policy mentioned in Note (d) Intangible Assets.

APEL has the right to receive fixed annuity payments from NHAI during the concession period and has adopted Cash flow financial model. The Cash flow financial model indicates the cash flow to be generated over the project lifecycle. The key inputs of the model comprise of revenue inflows (annuity), expenses to incurred to earn the revenue, estimations on cost to build and maintain the asset, interest obligations based on financing pattern and other operational efficiencies. These inputs are based on circumstances existing and management judgement / assumption on the future expectations based on current situations. Judgements include management view on changes in interest rates, cost inflation, government policy changes, etc. which are reviewed periodically by the management.

2. **Future revenue projections for the balance concession period**

The revenue projection is based on assumptions made by the management regarding future traffic growth and inflation factor for assessing user toll fee as supported by the studies from the third-party independent consultant for individual SPV done at reasonable intervals.

The Proposed Trust Group uses the future revenue projections for the following purposes:

a) **Amortisation of Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway**: Certain SPVs (viz. MBEL, JMTL, WUPTL and GAEPL) recognizes the amortization of intangible assets relating to Service Concession Arrangement based on proportion of actual revenue earned for the period over the projected revenue from Toll Road Carriageway expected to be earned over the balance concession period as estimated by the management. For other SPVs, the intangible assets relating to Service Concession Agreements is being amortised over the estimated useful life (being the concession period). The concession period is specified as per SCA agreement entered by the respective SPVs. However, the same is dependent on the revenue generated during the concession period as per the terms of Service Concession Agreement with NHAI and it may vary based on the estimation. The estimated useful life of Rights under Service Concession Arrangement – Intangible assets and the projected revenue is reviewed at the end of each reporting period, with the effect of any changes in estimate being accounted for on a prospective basis.

b) The Proposed Trust Group also uses future revenue projections for accounting of the claim/compensation granted by the Concessionaire by way of extension of concession period.

3. **Provision for periodic maintenance (overlay expenses)**

The Proposed Trust Group estimates and provides for contractual obligations as per Service Concession Arrangement (SCA) with the Concessionaire to restore the infrastructure to a specified level of serviceability at periodic intervals during the SCA period or before it is handed over to the Concessionaire. These estimates are corroborated through purchase orders/ work orders placed or to be placed by the Proposed Trust Group as per the road survey reports issued by an independent field expert and major maintenance strategy/ methodology approved by the Independent Consultant appointed by the Concessionaire. As the estimated cost is based on the various assumptions such as current infrastructure (road, pavements, etc.) condition, expected timings of costs, inflation in material cost, discount rate, government policies etc., hence the Management is required to apply judgement over these factors for revalidating the provision for expenses which is reviewed on annual basis.

4. **Provision for Improvement works**

Certain SPVs estimates and provides for contract liability in respect of unavoidable obligations to improve/upgrade the infrastructure to be undertaken as per the Concession Agreement with the Concessionaire. These estimates are corroborated through purchase orders/ work orders placed or to be

placed by these SPVs as per the road survey reports issued by an independent field expert. As the estimated cost is based on the various assumptions such as current infrastructure (road, pavements, etc.) condition, inflation in material cost etc., hence the Management is required to apply judgement over these factors.

5. Provision for income taxes and deferred tax

Judgements are involved in determining the provision for income taxes including judgement on whether tax positions are probable of being sustained in tax assessments. A tax assessment can involve interpretation issues, which can only be resolved over extended time periods.

Significant management judgement is also required to determine the amount of deferred tax assets that can be recognised, based upon the likely timing and the level of future taxable profits together with future tax planning strategies.

The Proposed Trust Group reviews the carrying amount of deferred tax assets (net) at the end of each reporting period. The Proposed Trust Group has recognised the deferred tax assets relating to carried forward losses and minimum alternate tax (MAT) credit to the extent there are sufficient taxable temporary differences available against which the unused tax losses can be utilized. Further, deferred tax assets have been recognised to the extent of deferred tax liabilities, in the absence of reasonable certainty that future taxable amounts will be available to utilize temporary differences.

The Proposed Trust Group has not recognised the deferred tax assets and liabilities on deductible temporary differences and tax losses reversing or originating and reversing during tax holiday period under section 80IA of the Income-tax Act, 1961 which have been estimated basis the future projections.

6. Impairment of financial assets

The impairment provision for financial assets is based on assumptions about risk of default and expected loss rates. The Proposed Trust Group uses judgement in making these assumptions and selecting the inputs to the impairment calculation, based on the Proposed Trust Group's history, existing market conditions as well as forward looking estimates at the end of each reporting period.

7. Impairment of intangible assets - Rights under Service Concession Arrangements

Management uses the estimated future cash flows in assessing value in use for intangible assets. Future estimated cash flows are discounted to their present value using a pre-tax discount rate that reflects the current market assessments of the time value of money and the risks specific to the asset for which the estimated future cash flows have not been adjusted.

The inputs to the valuation models are taken from observable markets where possible, but where this is not feasible, a degree of judgment is required in establishing fair values. Judgments include considerations of inputs such as Traffic growth rates, WACC, Tax rates, Inflation rates, and uncertainties relating to COVID -19 etc.

8. Accounting of Compound financial instruments

i. Certain SPVs included in the Proposed Trust Group have issued Unsecured, Optionally Convertible Debentures (OCDs) on private placement basis to various related parties (Subscribers). The OCD Subscribers have the right to seek premature redemption of the OCDs at face value with any accrued but unpaid interest on the OCDs, at any time prior to the Final Redemption Date subject to the SPV having met all the restricted payment conditions under the senior loan agreements. In case where the redemption rights as per terms of the respective agreement are not exercised by the Subscribers, then on the Final Redemption Date such OCDs will be, at the option of the Subscribers, convertible into equity shares of the respective SPV as per the conversion terms agreed in the respective agreement.

   For the purpose of accounting of interest accrued on OCDs, the respective SPV has estimated the future cash flows which is being used for bifurcating the outstanding interest on OCDs into liability and equity components.

ii. During the year ended March 31, 2021, DATRL and FRHL issued non-convertible debentures (Seller Debentures) of Rs. 1.00 each fully paid up on private placement by conversion of its subordinate debts/ liabilities. For the purpose of valuation of Seller Debentures on the issue date and on subsequent measurement dates, these SPVs have used the estimated redemption dates for each

redemption events based on probability of occurring of redemption events, applicable incremental borrowing rate and estimated the specific deductions to be made from tranches in case the Redemption Event is delayed beyond the dates envisaged in the Share Purchase Agreement for respective SPV [also refer note 54(ii) and 54(iii)].

9. Useful lives of property, plant, and equipment

Management reviews the useful lives of property, plant and equipment at each reporting date. As at each balance sheet date, management assessed that the useful lives represent the expected utility of the assets to the Proposed Trust Group.

10. Obligations relating to employee benefits

The employee benefit obligation depends on several factors that are determined on an actuarial basis using several assumptions. The assumptions used in determining the net cost/ (income) include the discount rate, inflation and mortality assumptions. Any changes in these assumptions will impact upon the carrying amount of employee benefit obligations.

c) Property, plant, and equipment

Property, plant and equipment are stated at historical cost/deemed cost (elected in accordance with Ind AS 101, First-time Adoption of Indian Accounting Standards) , as applicable, less accumulated depreciation and cumulative impairment losses, if any.

Historical cost includes purchase price, borrowing costs and any cost directly attributable to bringing the assets to its working condition for its intended use.

Subsequent costs are included in the asset's carrying amount or recognised as a separate asset, as appropriate, only when it is probable that the future economic benefits associated with the item will flow to the entity and the cost of the item can be measured reliably. Cost includes expenditure that is directly attributable to qualifying assets and includes borrowing costs capitalised in accordance with the Proposed Trust Group's accounting policy. Such properties are classified to the appropriate categories of property, plant, and equipment when completed and ready for intended use.

Depreciation on Plant and Equipment is provided using straight-line method based on estimated useful life. The estimated useful life of all the property, plant and equipment is ascertained by the management using the best estimate on the basis of technical evaluation, which is depreciated based on useful life as prescribed in Schedule II of the Companies Act, 2013. Depreciation on additions/ deductions is calculated pro-rata from/ to the month of additions/ deductions.

The residual values, useful lives and methods of depreciation of Property, plant and equipment are reviewed at each period end and adjusted prospectively, if appropriate.

Non-current assets classified as held for sale are measured at the lower of carrying amount and fair value less costs to sell.

Gains or losses arising from derecognition of a Property, plant and equipment are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognised in the Special Purpose Combined Statement of Profit and Loss when the asset is derecognised.

d) Intangible assets

Intangible assets are recognised when it is probable that future economic benefits that are attributable to the asset will flow to the Proposed Trust Group and the cost of the asset can be measured reliably. Intangible assets are stated at original cost net of tax/duty credits availed, if any, or deemed cost less accumulated amortisation, and cumulative impairment, if any.

Intangible Assets are stated at historical cost/deemed cost in certain SPVs (elected in accordance with Ind AS 101), as applicable, less accumulated amortisation and cumulative impairment losses, if any.

(i) Rights under Service Concession Arrangements (SCA)

Rights under SCA obtained in consideration for concession fee or development of toll roads under Toll-Operate-Transfer (TOT) or Build-Operate-Transfer (BOT) basis respectively represent the right to collect toll revenue during the concession period. The cost also include corresponding obligations of the SPV under the

Concession Agreement entered with the Concessionaire related to construction /improvements of the Project Highway granted to the SPV. Rights under SCA are capitalized as intangible assets upon obtaining the commencement of operation certificate from the authorities at cumulative development costs. The revenue from toll collection/other income during the construction period is reduced from cost of development of intangible assets. Till the completion of the construction, the development costs are recognised under intangible assets under development.

Obligation towards negative grants and the cost incurred for work beyond the original scope per SCA (normally referred as "Change of Scope") or upgrade services is capitalized as intangible assets under development as and when incurred. Reimbursement in respect of such amounts from the Concessionaire are reduced from the carrying amount intangible assets under development to the extent of actual receipts. Any grant from the Concessionaire in connection with project development is reduced from the cost of the intangible assets.

Extension of concession period by the Concessionaire in respect of compensation for claims made by the SPV are capitalized as part of Toll Collection Rights on acceptance of the claim. Where the SPV has a contractual right to an extension in the concession period as per the concession agreement, the same is capitalized when the right to extension in the concession period is established at the estimated amount of eligible claims.

Pre-operative expenses including administrative and other general overhead expenses that are directly attributable to the development or acquisition of intangible assets are allocated and capitalized as part of cost of the intangible assets.

Amortisation of intangible assets (Rights under SCA)

The Rights under SCA in respect of road projects of certain SPVs (viz. MBEL, JMTL, WUPTL and GAEPL) are amortized over the period of concession using the revenue-based amortization method prescribed under Schedule II to the Companies Act, 2013. Under the revenue-based method, amortization is based on proportion of actual revenue earned for the year/period over the sum of actual revenue for the current year/period and projected revenue from Toll Road Carriageway expected to be earned over the balance concession period as estimated by the management. Total projected revenue is reviewed at the end of each period end and is adjusted to reflect the changes in earlier estimate vis-a-vis the actual revenue earned till the end of the period so that the whole of the cost of the intangible asset is amortized over the concession period.

For all the other SPVs, the Rights under SCA are amortised over the shorter of the estimated period of future economic benefits which the intangible assets are expected to generate or the concession period, from the date they are available for use. The estimated useful life is reviewed at the end of each reporting period, with the effect of any changes in estimate being accounted for on a prospective basis.

An asset carried under concession arrangements is derecognised on disposal or when no future economic benefits are expected from its future use or disposal.

(ii) Other intangible assets

Historical costs of other intangible assets comprise of cost for software acquired / developed for in-house use. Intangible assets are derecognized when no future economic benefits are expected from use or disposal.

Gains or losses arising from derecognition of an intangible asset are measured as the difference between the net disposal proceeds and the carrying amount of the asset and are recognised in the Special Purpose Combined Statement of Profit or Loss when the asset is derecognised.

Intangible assets that are not ready for the intended use on the date of the Balance Sheet are disclosed as "Intangible assets under development".

Amortization of other intangible assets

Other Intangible assets with finite lives are amortised over the useful economic life and assessed for impairment whenever there is an indication that the intangible asset may be impaired. The amortisation period and the amortisation method for an intangible asset with a finite useful life are reviewed at least at the end of each reporting period. Changes in the expected useful life or the expected pattern of consumption of future economic benefits embodied in the asset are considered to modify the amortisation period or

method, as appropriate, and are treated as changes in accounting estimates. The amortisation expense on intangible assets with finite lives is recognised in the Special Purpose Combined Statement of Profit and Loss unless such expenditure forms part of carrying value of another asset.

e) Foreign currency transactions and translations

The Special Purpose Combined Financial Statements are presented in Indian Rupee (INR), which is the Proposed Trust Group's functional and presentational currency. Foreign currency transactions are recorded at the exchange rate prevailing on the date of the respective transactions between the functional currency and the foreign currency

Monetary items

Monetary foreign currency assets and liabilities remaining unsettled at the Balance Sheet date are translated at the rates of exchange prevailing on that date. Gains / losses arising on account of realisation / settlement of foreign currency transactions and on translation of foreign currency assets and liabilities are recognized in the Special Purpose Combined Statement of Profit and Loss.

Exchange differences arising on the settlement of monetary items or on reporting date's monetary items at rates different from those at which they were initially recorded during the period, or reported in previous financial statements, are recognized as income or as expenses in the period in which they arise.

Non-monetary items

Non–monetary items which are carried in terms of historical cost denominated in a foreign currency are reported using the exchange rate at the date of the transaction; and non–monetary items which are carried at fair value or other similar valuation denominated in a foreign currency, are reported using the exchange rates that existed when the values were determined.

The gain or loss arising on translation of non-monetary items measured at fair value is treated in line with the recognition of the gain or loss on the change in fair value of the item (i.e., translation differences on items whose fair value gain or loss is recognised in OCI or profit or loss are also recognised in OCI or profit or loss, respectively).

f) Revenue recognition

Revenue is measured based on fair value of consideration received or receivable and excludes amounts collected on behalf of third parties. A performance obligation is a promise in a contract to transfer a distinct good or service (or a bundle of goods and services) to the customer and is the unit of account in Ind AS 115. A contract's transaction price is allocated to each distinct performance obligation based on their relative stand-alone selling prices.

Revenue is recognised to the extent that it is probable that the economic benefits will flow to the Proposed Trust Group and the revenue can be reliably measured, regardless of when the payment is being made.

Revenue is recognised either at a point in time or over time, when (or as) the Proposed Trust Group satisfies performance obligations by transferring the promised goods or services to its customers.

Service concession arrangements - Recognition and measurement
The Proposed Trust Group builds, operate and maintain roads and other infrastructure assets under public-to-private Service Concession Arrangements (SCAs), which is an arrangement between the "grantor" (a public sector entity/authority/the Concessionaire) and the "operator" (a private sector entity) to provide services that give the public access to major economic and social facilities utilizing private-sector funds and expertise.

More specifically, it applies to public to private service concession arrangement if the grantor:

i. Controls or regulates what services the operators must provide with the infrastructure, to whom it must provide them, and at what price, and

ii. Controls through ownership /principal entitlement or otherwise -any significant residual interest in the infrastructure at the end of the term of the arrangement.

The Proposed Trust Group through individual SPVs has entered into a concession arrangement to build, operate and maintain the roads and other infrastructure assets.
Under SCA, there are two types of models on which the SPV's operates:

1) Where the SPV has a right to receive toll revenue in lieu of its services agreed, it falls under 'Intangible asset model'. Under this model, on initial recognition, an intangible asset is recognised, based on the construction / acquisition costs incurred including related borrowing costs and expected margin earned in case of construction or upgrade services and replacement services.
2) Where the SPV has acquired contractual rights to receive specified determinable amounts, it falls under 'Financial assets model'. Under this model, such rights are recognised and classified as "Financial Assets", even though payments are contingent on SPV ensuring that the infrastructure meets the specified quality and efficiency requirements. Such financials assets are classified as "Receivables against Service Concession Arrangements".

With respect to SCA, revenue and costs are allocated between those relating to construction services and those relating to operation and maintenance services are accounted for separately. Consideration received or receivable is allocated by reference to the relative fair value of services delivered when the amounts are separately identifiable. For operation & maintenance services, such costs are executory in nature and are expensed off as and when incurred.

Revenue recognition for Service concession arrangements

The Proposed Trust Group's revenue is divided into following categories:

1. Once the infrastructure is in operation, the treatment of income is as follows:

Under financial asset model, finance income for SCA is recognized using effective interest method. Revenues from operations and maintenance services and overlay services are recognized in each period as and when services are rendered in accordance with Ind AS 115.

Under built-operate-transfer (BOT) or toll-operate-transfer (TOT) model, toll collections from the users of the infrastructure facility constructed or operated or maintained by the Proposed Trust Group under the Service Concession Arrangements are accounted for based on actual collection.

2. Revenue from construction contracts

Contract revenue for fixed price contracts is recognized only to the extent of cost incurred that it is probable will be recoverable till such time the outcome of the job cannot be ascertained reliably. When the outcome of the contract is ascertained reliably, contract revenue is recognized at cost of work performed on the contract plus proportionate margin, using the percentage of completion method.

Percentage of completion is determined based on the proportion of actual cost incurred to the total estimated cost of the project. The percentage of completion method is applied on a cumulative basis in each accounting period to the current estimates of contract revenue and contract costs. The effect of a change in the estimate of contract revenue or contract costs, or the effect of a change in the estimate of the outcome of a contract, is accounted for as a change in accounting estimate and the effect of which are recognized in the Special Purpose Combined Statement of Profit and Loss in the period in which the change is made and in subsequent periods.

For the purposes of recognising revenue, contract revenue comprises the initial amount of revenue agreed in the contract, the variations in contract work, claims and incentive payments to the extent that it is probable that they will result in revenue and they are capable of being reliably measured.

When it is probable that total contract costs will exceed total contract revenue, the expected loss is recognized as an expense in the Special Purpose Combined Statement of Profit and Loss in the period in which such probability occurs.

Interest income
Interest income from a financial asset is recognized when it is probable that the economic benefits will flow to the Proposed Trust Group and the amount of income can be measured reliably. Interest is accrued on time proportion basis, by reference to the principle outstanding at the effective interest rate.

Dividends
Income from dividend on investments is accrued in the period in which it is declared, whereby the Proposed Trust Group's right to receive is established.

g) Government grants

Grants from governments are recognized at fair value where there is reasonable assurance that the Proposed Trust Group will comply with the conditions attaching to them and that the grants will be received.

Government grants related to income are deferred and recognized in profit or loss over the periods in which the Proposed Trust Group recognizes as expenses the related costs for which the grants are intended to compensate.

Government grants whose primary condition is that the Proposed Trust Group should purchase, construct, or otherwise acquire non-current assets are deducted from the carrying amount of such non-current assets.

h) Financial instruments

Financial assets and financial liabilities are recognized when the Proposed Trust Group become a party to the contractual provisions of the instruments.

Financial assets and financial liabilities are initially measured at fair value. Transaction costs that are directly attributable to the acquisition or issue of financial assets and financial liabilities are added to or deducted from the fair value of the financial assets or financial liabilities, as appropriate, on initial recognition. However, transaction costs directly attributable to the acquisition of financial assets or financial liabilities at fair value through profit or loss ("FVTPL") are recognized immediately in the Special Purpose Combined Statement of Profit and Loss.

If the Proposed Trust Group determines that the fair value at initial recognition differs from the transaction price, the Proposed Trust Group accounts for that instrument at that date as follows:
- at the measurement basis mentioned above if that fair value is evidenced by a quoted price in an active market for an identical asset or liability (i.e. a Level 1 input) or based on a valuation technique that uses only data from observable markets. The Proposed Trust Group recognises the difference between the fair value at initial recognition and the transaction price as a gain or loss.

- in all other cases, at the measurement basis mentioned above, adjusted to defer the difference between the fair value at initial recognition and the transaction price. After initial recognition, the Proposed Trust Group recognises that deferred difference as a gain or loss only to the extent that it arises from a change in a factor (including time) that market participants would take into account when pricing the asset or liability.

Subsequent measurement of financial assets and financial liabilities is described below:

i. Financial assets

All regular way purchases or sales of financial assets are recognized and derecognized on a trade date basis. Regular way purchases or sales are purchases or sales of financial assets that require delivery of assets within the time frame established by regulation or convention in the marketplace. All recognized financial assets are subsequently measured in their entirety at either amortised cost or fair value, depending on the classification of the financial assets

Classification of Financial Assets
Investments in debt instruments that meet the following conditions are subsequently measured at amortised cost (unless the same are designated as fair value through profit or loss (FVTPL)):
- The asset is held within a business model whose objective is to hold assets in order to collect contractual cash flows; and
- The contractual terms of instrument give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

Debt instruments that meet the following conditions are subsequently measured at fair value through other comprehensive income (unless the same are designated as fair value through profit or loss)

- The asset is held within a business model whose objective is achieved both by collecting contractual cash flows and selling financial assets; and
- The contractual terms of instrument give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

Debt instruments at FVTPL is a residual category for debt instruments and all changes are recognized in profit or loss.

Amortized cost and effective interest method
Income is recognized on an effective interest method as per Ind AS 109 "Financial Instruments" for debt instruments other than those financial assets classified as at FVTPL. Interest income is recognized in the Special Purpose Combined Statement of Profit and Loss and is included in the "Other income" line item.

Impairment of financial assets (Expected credit loss model)
An impairment loss on financial asset is established when there is objective evidence that the Proposed Trust Group will not be able to collect all amounts due according to the original terms of the receivables. Impairment loss if any are recognised in Special Purpose Combined Statement of Profit or Loss for the period.

De-recognition of financial assets
The Proposed Trust Group derecognize a financial asset when the contractual rights to the cash flows from the asset expire, or when it transfers the financial asset and substantially all the risks and rewards of ownership of the asset to another party.
On de-recognition of a financial asset in its entirety, the difference between the asset's carrying amount and the sum of the consideration received and receivable and the cumulative gain or loss that had been recognized in other comprehensive income and accumulated in equity is recognized in profit or loss if such gain or loss would have otherwise been recognized in the Special Purpose Combined Statement of Profit or Loss on disposal of that financial asset.

ii. Financial Liabilities

Financial liabilities are classified at initial recognition, as financial liabilities as fair value through profit or loss, loans and borrowings, payables, or as derivatives designated as hedging instruments in an effective hedge, as appropriate. All financial liabilities are recognized initially at fair value and, in the case of loans and borrowings and payables, net of directly attributable transaction costs.

Loans and borrowings are subsequently measured at amortized costs using Effective Interest Rate method.

Financial liabilities at fair value through profit or loss (FVTPL) are subsequently measured at fair value.
Financial guarantee contracts are subsequently measured at the higher of the amount of loss allowance determined as per impairment requirements of Ind AS 109 and the amount recognized less cumulative amortization.

De-recognition of financial liabilities
Financial liability is derecognized when the obligation under the liability is discharged or cancelled or expires. When an existing financial liability is replaced by another from the same lender on substantially different terms, or the terms of an existing liability substantially modified, such an exchange or modification is treated as the de-recognition of the original liability and the recognition of the new liability. The difference in the respective carried amount is recognized in the Special Purpose Combined Statement of Profit and Loss.

iii. Classification as debt or equity

Debt and equity instruments issued by Proposed Trust Group are classified as either financial liabilities or as equity in accordance with the substance of the contractual arrangements and the definitions of a financial liability and an equity instrument.

iv. Derivative financial instruments

The Proposed Trust Group holds foreign exchange forward contracts to mitigate the risk of changes in exchange rates on foreign currency exposures. The counterparty for these contracts is generally a bank.

Derivatives not designated as hedging instruments

This category has derivative financial assets or liabilities which are not designated as hedges. Any derivative that is not designated a hedge is categorized as a financial asset or financial liability, at fair value through profit or loss.

Derivatives not designated as hedges are recognized initially at fair value and attributable transaction costs are recognized in the Special Purpose Combined Statement of Profit and Loss when incurred. Subsequent to initial recognition, these derivatives are measured at fair value through profit or loss and the resulting exchange gains or losses are included in other income. Assets/liabilities in this category are presented as current assets/current liabilities if they are either held for trading or are expected to be realized within 12 months after the balance sheet date.

Derecognition of financial instruments

The Proposed Trust Group derecognizes a financial asset when the contractual rights to the cash flows from the financial asset expire or it transfers the financial asset and transfer qualifies for derecognition under Ind AS 109. A financial liability (or a part of a financial liability) is derecognized from the Proposed Trust Group's balance sheet when the obligation specified in the contract is discharged or cancelled or expires.

v. Fair value

Fair value is the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date, regardless of whether that price is directly observable or estimated using another valuation technique. In estimating the fair value of an asset or a liability, the Proposed Trust Group considers the characteristics of the asset or liability if market participants would take those characteristics into account when pricing the asset or liability at the measurement date. Fair value for measurement and/or disclosure purposes in these financial statements is determined on such a basis and measurements that have some similarities to fair value but are not fair value, such as net realisable value in Ind AS 2 "Inventory" or value in use in Ind AS 36 "Impairment of Assets".

In addition, for financial reporting purposes, fair value measurements are categorized into Level 1, 2 or 3 based on the degree to which the inputs to the fair value measurements are observable and the significance of the inputs to the fair value measurement in its entirety, which are described as follows:

• Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities that entity can access at measurement date

• Level 2 inputs other than quoted prices included in Level 1, that are observable for the asset or liability, either directly (as prices) or indirectly (derived from prices); and

• Level 3 inputs for the asset or liability that are not based on observable market data (unobservable inputs).

i) Cash and cash equivalents

Cash and cash equivalents in the Special Purpose Combined Balance Sheet comprise cash at banks and on hand and short-term deposits with an original maturity of three months or less and which are subject to an insignificant risk of changes in value. For purpose of Special Purpose Combined Statement of Cash Flows, cash and cash equivalents consist of cash and short-term deposits, as defined above, net of outstanding bank overdrafts as they are considered an integral part of the Proposed Trust Group's cash management.

j) Special Purpose Combined Statement of Cash Flows

Special Purpose Combined Statement of Cash flows is prepared segregating the cash flows from operating, investing and financing activities. Cash flows from operating activities is reported using indirect method. Under the indirect method, the net profit/(loss) is adjusted for the effects of:

a. transactions of a non-cash nature;
b. any deferrals or accruals of past or future operating cash receipts or payments and,
c. all other items of income or expense associated with investing or financing cash flows.

The cash flows from operating, investing and financing activities of the Proposed Trust Group are segregated based on the available information. Cash and cash equivalents are reflected as such in the Special Purpose Combined Statement of Cash Flow. Those cash and cash equivalents which are not available for general use as on the date of Special Purpose Combined Balance Sheet are also included under this category with a specific disclosure.

k) Investment property

Property that is held for long-term rental yields or for capital appreciation (including property under construction for such purposes) or both and that is not occupied by the Proposed Trust Group, is classified as investment property. Investment property are measured initially at cost, including related transaction costs and where applicable borrowing costs. Subsequent expenditure is capitalized to the assets carrying amount only when it is probable that future economic benefits associated with the expenditure will flow to the Proposed Trust Group and the cost of the item can be measured reliably.

An investment property is derecognized upon disposal or when the investment property is permanently withdrawn from use and no future economic benefits are expected from the disposal. Any gain or loss arising on derecognition of the property (calculated as the difference between the net disposal proceeds and the carrying amount of the asset) is included in profit or loss in the period in which the property is derecognized.

l) Borrowings

Borrowings are initially recognized at fair value, net of transaction costs incurred. Borrowings are subsequently measured at amortized cost. Any difference between the proceeds (net of transaction costs) and the redemption amount is recognized in profit or loss over the period of the borrowings using effective interest method. Fees paid on the establishment of loan facilities are recognized at transaction costs of the loan to the extent that it is probable that some or all the facility will be drawn down. In this case, the fee is deferred until the draw-down occurs. To the extent there is no evidence that it is probable that some or all the facility will be drawn down, the fee is capitalized as prepayment for liquidity services and amortized over the period of the facility to which it relates.

The fair value of the liability portion of the optionally convertible debentures is determined by discounting the projected future cashflows of the principal and interest component at coupon rate. The amount is recorded as a liability on an amortized cost basis until extinguished on conversion or redemption of debentures. The reminder of the proceeds is attributable to the equity portion of the compound instrument. This is recognized and included in shareholders' equity, net of income tax effects, and not subsequently remeasured.

Borrowings are removed from the balance sheet when the obligation specified in the contract is discharged, cancelled or expired. The difference between the carrying amount of a financial liability that has been extinguished or transferred to another party and the consideration paid, including any non-cash assets transferred or liabilities assumed, is recognized in profit or loss as other gains/(losses).

Where the terms of the financial liability are renegotiated and the entity issues equity instruments to a creditor to extinguish all or part of the liability (debt for equity swap), a gain or loss is recognized in profit or loss, which is measured as the difference between the carrying amount of financial liability and the fair value of equity instruments issued.

Borrowings are classified as current liabilities unless the Proposed Trust Group has an unconditional right to defer settlement of the liability for at least 12 months after the reporting period. Where there is breach of a material provision of a long-term loan arrangement on or before the end of the reporting period with the effect that the liability becomes payable on demand on the reporting date, the entity does not classify the liability as current, if lender agreed, after the reporting period and before the approval of the financial statements for issue, not to demand payment as a consequence of the breach.

m) Borrowing costs

Borrowing costs include interest calculated using the effective interest method, amortization of ancillary costs and other costs the Trust Group incurs in connection with the borrowing of funds. General and specific borrowing costs that are directly attributable to the acquisition, construction or production of a qualifying assets are capitalized during the period of time that is required to complete and prepare the qualifying asset for its intended use or sale. Capitalization of borrowing costs is suspended and charged to the Special Purpose Combined Statement of Profit and Loss during extended periods when active development activity on the qualifying assets is interrupted.

Income earned on the temporary investment of specific borrowings pending their expenditure on qualifying asset is deducted from the borrowing costs eligible for capitalization.

Other borrowing costs are expensed in the period in which they are incurred.

n) Employee Benefits

Employee benefits includes provident fund, gratuity and compensated absences.

Short-term Employee Benefit

All employee benefits falling due wholly within twelve months of rendering the service are classified as short-term employee benefits. The benefits like salaries, wages, short-term compensated absences etc. and the expected cost of bonus, and ex-gratia are recognised in the period the related service is rendered at undiscounted amount of benefits expected to be paid in exchange for that service.

The cost of short-term compensated absences is accounted as under:
- in case of accumulated compensated absences, when employees render the services that increase their entitlement of future compensated absences; and
- in case of non-accumulating compensated absences, when the absences occur.

Post-employment benefits

(a) Defined contribution plans:

The Proposed Trust Group offers its employees State governed provident fund linked with employee pension scheme as defined contribution plans. The contribution paid/ payable under the scheme is recognised during the period in which the employee renders the related service.

(b) Defined benefit plans:

The SPVs operates an unfunded defined benefit gratuity plan other than two of the SPVs viz. DATRL and WUPTL, that makes contributions to a separately administered fund through annual contributions to Life Insurance Corporation of India under its Employee Gratuity Scheme. Proposed Trust Group's liability towards gratuity is determined at each period end.

For defined benefit gratuity plans, the cost of providing benefits is determined using the projected unit credit method, with actuarial valuations being carried out at the end of each annual reporting period. Re-measurement, comprising actuarial gains and losses, the effect of the changes to the asset ceiling (if applicable) and the return on plan assets (excluding net interest), is reflected immediately in the balance sheet with a charge or credit recognized in other comprehensive income in the period in which they occur. Remeasurement recognised in other comprehensive income is reflected immediately in retained earnings and will not be reclassified to profit or loss. Past service costs are recognised in profit or loss on the earlier of the date of the plan amendment or curtailment, and the date that the Proposed Trust Group recognises related restructuring costs.

Net interest is calculated by applying the discount rate at the beginning of the period to the net defined benefit liability or asset.

Defined benefit costs are categorized as follows:
- service cost (including current service cost, past service cost, as well as gains and losses on curtailments);

- net interest expense or income; and
- re-measurement

The Proposed Trust Group presents the first two components of defined benefit costs in Special Purpose Combined Statement of Profit and Loss in the line item 'Employee benefits expense'. Curtailment gains and losses are accounted for as past service costs.

The present value of the defined benefit liability is calculated using a discount rate which is determined by reference to market yields at the end of the reporting period on government bonds.

(c) Other long-term employee benefit
The obligation for other long-term employee benefits such as long-term compensated absences, are measured at the present value of the estimated future cash outflows expected to be made by the Proposed Trust Group in respect of services provided by employees up to the reporting date.

o) Inventories

Inventories are stated at the lower of cost and net realisable value. Cost of inventories include all costs incurred in bringing the inventories to their present location and condition. Costs are assigned to individual items of inventory based on first-in-first-out basis. Cost of purchased inventory are determined after deducting rebates and discounts. Net realisable value is the estimated selling price in the ordinary course of business less the estimated cost of completion and the estimated costs necessary to make the sales.

p) Insurance claims

Insurance claims are accounted for based on claims admitted / expected to be admitted and to the extent that the amount recoverable can be measured reliably and it is reasonable to expect ultimate collection.

q) Leases

The lease asset classes of the Proposed Trust Group primarily consist of leases for land and buildings. The Proposed Trust Group assesses whether a contract contains a lease, at inception of a contract. A contract is, or contains, a lease if the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration. To assess whether a contract conveys the right to control the use of an identified asset, the Proposed Trust Group assesses whether: (i) the contract involves the use of an identified asset (ii) the Proposed Trust Group has substantially all of the economic benefits from use of the asset through the period of the lease and (iii) the Proposed Trust Group has the right to direct the use of the asset

At the date of commencement of the lease, the Proposed Trust Group recognizes a right-of-use asset ("ROU") and a corresponding lease liability for all lease arrangements in which it is a lessee, except for leases with a term of twelve months or less (short-term leases) and low value leases, which are accounted for as under.

Short-term leases and leases of low-value assets
Short term leases are leases with a term of twelve months or less. For short-term and low value leases, the Proposed Trust Group recognises the lease payments as an operating expense on a straight-line basis over the term of the lease.

Currently, the Proposed Trust Group has lease contracts which are short-term leases or leases of low-value assets.

r) Provisions, contingent liabilities and contingent assets

Provisions are recognized when Proposed Trust Group have a present obligation (legal or constructive) as a result of a past event, it is probable that Proposed Trust Group will be required to settle the obligation, and a reliable estimate can be made of the amount of the obligation.

When some or all of the economic benefits required to settle a provision are expected to be recovered from a third party, a receivable is recognised as an asset if it is virtually certain that the reimbursement will be received and the amount of the receivable can be measured reliably.

Contingent liabilities are disclosed in notes in case of a present obligation arising from past events, when it is not probable that an outflow of resources will be required to settle the obligation or a present obligation arising from past events, when no reliable estimate is possible.

A contingent asset is a possible asset that arises from past events and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity. Contingent assets are not recognised but disclosed only when an inflow of economic benefits is probable.

s) Segment reporting

The Proposed Trust Group identifies primary segments based on the dominant source, nature of risks and returns and the internal organization and management structure. The operating segments are the segments for which separate financial information is available and for which operating profit / loss amounts are evaluated regularly by the chief operating decision maker in deciding how to allocate resources and in assessing performance. Operating segments are reported in a manner consistent with the internal reporting provided to the chief operating decision maker. Segment revenue, segment expenses, segment assets and segment liabilities have been identified to segments based on their relationship to the operating activities of the segment. The identification of operating segments and reporting of amounts is consistent with performance assessment and resource allocation by the management.

Inter-segment revenue is accounted based on transactions which are primarily determined based on market / fair value factors.

Revenue, expenses, assets and liabilities which relate to the Proposed Trust Group as a whole and are not allocable to segments on reasonable basis have been included under 'unallocated revenue / expenses / assets / liabilities'.

t) Taxation

Income tax

The income tax expense or credit for the year/period is the tax payable on current year's/period's taxable income based on the applicable income tax rate adjusted by changes in deferred tax assets and liabilities attributable to temporary differences and to unused tax losses. The current income tax charge is calculated based on tax laws enacted or substantively enacted at the end of the reporting period. Management periodically evaluates, positions taken in tax returns with respect to situations in which applicable tax regulation is subject to interpretation and provisions are established where appropriate based on amounts expected to be paid to the tax authorities.

Current tax items are recognized in correlation to the underlying transaction either in OCI or directly in equity. Management periodically evaluates positions taken in the tax returns with respect to situations in which applicable tax regulations are subject to interpretation and establishes provisions where appropriate.

Deferred Tax

Deferred tax is recognised on temporary differences, being the differences between the tax bases of assets and liabilities and their carrying amount in the financial statements. Deferred tax is measured using the tax rates and the tax laws enacted or substantively enacted as at the reporting date. Deferred tax liabilities are recognised for all temporary differences. Deferred tax assets are recognised for temporary differences of items other than unabsorbed depreciation and carry forward losses only to the extent that reasonable certainty exists that sufficient future taxable income will be available against which these can be realized. However, if there are unabsorbed depreciation and carry forward of losses and items relating to capital losses, deferred tax assets are recognised only if there is reasonable certainty supported by convincing evidence that there will be sufficient future taxable income available to realize the deferred tax assets. Deferred tax assets and liabilities are offset if such items relate to taxes on income levied by the same governing tax laws and the entity has a legally enforceable right for such set off. Deferred tax assets are reviewed at each reporting date for their realisability.

Minimum Alternate Tax (MAT) paid in accordance with the tax laws, which gives future economic benefits in the form of adjustment to future income tax liability, is considered as an asset if there is convincing evidence that the entity will pay normal income tax. Accordingly, MAT is recognised as a deferred tax asset in the

Special Purpose Combined Balance Sheet when it is highly probable that future economic benefit associated with it will flow to the Proposed Trust Group.

The Proposed Trust Group offsets deferred tax assets and deferred tax liabilities, and advance income tax and provision for tax, if it has a legally enforceable right and these relate to taxes in income levies by the same governing taxation laws.

Current and deferred tax relating to items directly recognised in other comprehensive income and reserves are recognised in other comprehensive income and reserves respectively and not in the Special Purpose Combined Statement of Profit and Loss.

u) Impairment of non-financial assets

The carrying values of assets / cash generating units at each reporting date are reviewed for impairment if any indication of impairment exists. The following intangible assets are tested for impairment each period end even if there is no indication that the asset is impaired:
(a) an intangible asset that is not yet available for use; and
(b) an intangible asset that is amortized over a period exceeding ten years from the date when the asset is available for use.

If the carrying amount of the assets exceed the estimated recoverable amount, an impairment is recognized for such excess amount. The impairment loss is recognized as an expense in the Special Purpose Combined Statement of Profit and Loss.

The recoverable amount is the higher of the fair value less costs of disposal and its value in use. In assessing value in use, the estimated future cash flows are discounted to their present value using a pre-tax discount rate that reflects the current market assessments of the time value of money and the risks specific to the asset for which the estimated future cash flows have not been adjusted.
When there is indication that an impairment loss recognized for an asset (other than a revalued asset) in earlier accounting periods no longer exists or may have decreased, such reversal of impairment loss is recognized in the Special Purpose Combined Statement of Profit and Loss, to the extent the amount was previously charged to the Special Purpose Combined Statement of Profit and Loss.

v) Provision for periodic maintenance / resurfacing obligations

The Proposed Trust Group estimates and provides for contractual obligations as per Service Concession Arrangement (SCA) with the Concessionaire to restore the infrastructure to a specified level of serviceability at periodic intervals or restore the infrastructure to a specified condition before it is handed over to the Concessionaire. Provisions are measured based on management's estimate required to settle the obligation at the balance sheet date and are discounted using a rate that reflects the time value of money. When discounting is used, the increase in the provision due to the passage of time is recognized as a finance cost. The same is reviewed at each balance sheet date and adjustments if any to the carrying amount is provided for accordingly.

w) Earnings before Interest, Tax, Depreciation, Amortization, Impairment and Exceptional Items

Earnings before Interest, Tax, Depreciation and Amortization and Exceptional Items disclosed in the Special Purpose Combined Statement of Profit and Loss is computed as under:
Total income less Proposed Trust Group's expenses other than finance costs, tax expenses, depreciation and amortization and exceptional items as appearing in the Special Purpose Combined Statement of Profit and Loss

x) Earnings per Unit

Basic earnings per unit are calculated by dividing the net profit / (loss) for the period attributable to unit holders of the Trust by the weighted average number of units outstanding during the period.

For the purpose of calculating diluted earnings per unit, the profit or loss for the period attributable to unit holders of the Trust and the weighted average number of units outstanding during the period are adjusted for the effects of all dilutive potential units.

Dilutive potential units are deemed converted as of the beginning of the reporting date, unless they have been issued at a later date. In computing diluted earnings per unit, only potential equity units that are dilutive and which either reduces earnings per unit or increase loss per units are included

y) Statement of net assets at fair value

The disclosure of Statement of Net Assets at Fair Value comprises of the fair values of the total assets and fair values of the total liabilities of individual SPV. The fair value of the assets are reviewed regularly by Management with reference to independent assets and market conditions existing at the reporting date, using generally accepted market practices. The independent valuers are leading independent appraisers with a recognized and relevant professional qualification and with recent experience in the location. Judgment is also applied in determining the extent and frequency of independent appraisals. Such independent appraisals and the assumptions used are reviewed at each balance sheet date.

z) Statement of Total Returns at Fair Value

The disclosure of total returns at fair value comprises of the total Comprehensive Income as per the Special Purpose Combined Statement of Profit and Loss and other changes in fair value of investment property, investment property under construction and borrowings where the cost model is followed which were not recognized in total Comprehensive Income.

aa) Recent pronouncements

Ministry of Corporate Affairs ("MCA") notifies new standards or amendments to the existing standards under Companies (Indian Accounting Standards) Rules as issued from time to time. During the seven month period ended October 31, 2022, MCA has not notified any new standards or amendments to the existing standards applicable to the Proposed Trust Group.

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
3 Property, plant and equipment				
Net carrying value	156.12	166.93	110.13	50.46
	156.12	**166.93**	**110.13**	**50.46**

Description	Office equipment	Computers	Furniture and fixtures	Plant and equipment	Vehicles	Building[(i)]	Total
Gross carrying value							
Balance as at April 01, 2019	**20.32**	**12.43**	**5.62**	**22.47**	**17.26**	**5.84**	**83.94**
Additions for the year	2.45	4.04	0.75	2.50	-	-	**9.74**
Disposals/adjustments for the year	(0.11)	-	-	-	-	-	**(0.11)**
Balance as at March 31, 2020	**22.66**	**16.47**	**6.37**	**24.97**	**17.26**	**5.84**	**93.57**
Additions for the year	25.92	21.19	8.20	21.69	3.68	0.44	**81.12**
Reclassified to assets held for sale	-	-	-	-	-	(5.84)	**(5.84)**
Disposals/adjustments for the year	(1.07)	(0.15)	(0.73)	(2.33)	(0.09)	-	**(4.37)**
Balance as at March 31, 2021	**47.51**	**37.51**	**13.84**	**44.33**	**20.85**	**0.44**	**164.48**
Additions for the year	27.58	17.46	5.06	35.33	0.68	-	**86.11**
Disposals/adjustments for the year	-	-	-	-	(0.85)	-	**(0.85)**
Balance as at March 31, 2022	**75.09**	**54.97**	**18.90**	**79.66**	**20.68**	**0.44**	**249.74**
Additions for the period	4.34	4.51	0.51	0.66	-	-	**10.02**
Disposals/adjustments for the period	(0.59)	-	-	(1.66)	-	-	**(2.25)**
Balance as at October 31, 2022	**78.84**	**59.48**	**19.41**	**78.66**	**20.68**	**0.44**	**257.51**
Accumulated depreciation							
Balance as at April 01, 2019	**9.05**	**7.20**	**2.15**	**5.50**	**6.25**	**0.76**	**30.91**
Charge for the year	3.77	2.80	0.64	2.51	2.18	0.34	**12.24**
Disposals/adjustments for the year	(0.04)	-	-	-	-	-	**(0.04)**
Balance as at March 31, 2020	**12.78**	**10.00**	**2.79**	**8.01**	**8.43**	**1.10**	**43.11**
Charge for the year	5.11	3.67	0.82	2.94	1.80	0.61	**14.95**
Reclassified to assets held for sale	-	-	-	-	-	(1.27)	**(1.27)**
Disposals/adjustments for the year	(0.92)	(0.13)	(0.53)	(0.84)	(0.02)	-	**(2.44)**
Balance as at March 31, 2021	**16.97**	**13.54**	**3.08**	**10.11**	**10.21**	**0.44**	**54.35**
Charge for the year	10.51	9.38	1.86	5.51	2.05	-	**29.31**
Disposals/adjustments for the year	-	-	-	-	(0.85)	-	**(0.85)**
Balance as at March 31, 2022	**27.48**	**22.92**	**4.94**	**15.62**	**11.41**	**0.44**	**82.81**
Charge for the period	6.97	7.13	1.17	4.35	1.09	-	**20.71**
Disposals/adjustments for the period	(0.56)	-	-	(1.57)	-	-	**(2.13)**
Balance as at October 31, 2022	**33.89**	**30.05**	**6.11**	**18.40**	**12.50**	**0.44**	**101.39**
Net carrying value:							
As at March 31, 2020	**9.88**	**6.47**	**3.58**	**16.96**	**8.83**	**4.74**	**50.46**
As at March 31, 2021	**30.54**	**23.97**	**10.76**	**34.22**	**10.64**	**0.00**	**110.13**
As at March 31, 2022	**47.61**	**32.05**	**13.96**	**64.04**	**9.27**	**0.00**	**166.93**
As at October 31, 2022	**44.95**	**29.43**	**13.30**	**60.26**	**8.18**	**0.00**	**156.12**

Notes:

(i) Includes cost of the freehold land which can not be segregated.

(ii) For details of property, plant and equipment pledged as security for borrowings refer note 22.

4. Capital work-in-progress	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Plant and equipment	3.71	3.10	11.60	0.58
Office Equipement	0.52	0.41	2.22	-
Computers	0.22	0.43	-	-
	4.45	**3.94**	**13.82**	**0.58**

Notes:
For details of capital work-in-progress pledged as security for borrowings refer note 22.

5. Investment properties	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Net carrying value	7.35	7.35	7.35	7.92
	7.35	**7.35**	**7.35**	**7.92**

Description	**Land-Freehold**	**Flat-Freehold**	**Total**
Gross carrying value			
Balance as at April 01, 2019	**7.95**	**1.38**	**9.33**
Movements during the year	-	-	**-**
Closing balance as at March 31, 2020	**7.95**	**1.38**	**9.33**
Transfer to assets held for sale	(0.10)	-	**(0.10)**
Closing balance as at March 31, 2021	**7.85**	**1.38**	**9.23**
Movements during the year	-	-	**-**
Closing balance as at March 31, 2022	**7.85**	**1.38**	**9.23**
Movements during the period	-	-	**-**
Closing balance as at October 31, 2022	**7.85**	**1.38**	**9.23**
Impairment charge:			
Balance as at April 01, 2019	**-**	-	**-**
Impairment charge during the year	1.41	-	**1.41**
Closing balance as at March 31, 2020	**1.41**	**-**	**1.41**
Impairment charge during the year	0.32	0.15	**0.47**
Closing balance as at March 31, 2021	**1.73**	0.15	**1.88**
Impairment charge during the year	-	-	**-**
Closing balance as at March 31, 2022	**1.73**	**0.15**	**1.88**
Impairment charge during the period	-	-	**-**
Closing balance as at October 31, 2022	**1.73**	**0.15**	**1.88**
Net carrying value:			
As at March 31, 2020	**6.54**	**1.38**	**7.92**
As at March 31, 2021	**6.12**	**1.23**	**7.35**
As at March 31, 2022	**6.12**	**1.23**	**7.35**
As at October 31, 2022	**6.12**	**1.23**	**7.35**

Details of the latest fair value of SPV wise investment properties are as under:

Entity	**Valuer [(i)]**	**Dated**	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
APEL	External valuer	March 23, 2022	0.68	0.68	0.68	0.68
DATRL	External valuer	June 1, 2021	1.23	1.23	1.23	1.23
FRHL	External valuer	December 26,2020	0.82	0.82	0.82	2.90
JMTL	External valuer	March 23, 2022	2.79	2.79	2.79	2.29
MBEL	External valuer	March 24, 2022	2.44	2.44	2.44	2.44
WVEPL	Management estimate	March 31, 2020	-	-	-	0.11

(i) External valuer is registered valuer as defined under rule 2 of Companies (Registered Valuers and Valuation) Rules, 2017.
(ii) The fair value was derived using the market comparable approach based on prevailing market prices without any significant adjustments being made to the market observable data. SPV obtains independent valuation for its respective investment property once in a block of three years. Management considers that the carrying amount of the investment property as reported above approximates its fair value.
(iii) For details of investment properties pledged as security for borrowings refer note 22.

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
6. Intangible assets				
Net carrying value	123,925.88	119,777.48	121,536.39	63,953.30
	123,925.88	**119,777.48**	**121,536.39**	**63,953.30**

Description	Rights under Service Concession Arrangements	Computer software	Total
Gross carrying value			
Balance as at April 01, 2019	**74,449.09**	**7.96**	**74,457.05**
Additions for the year [(ii)]	60.70	0.35	**61.05**
Balance as at March 31, 2020	**74,509.79**	**8.31**	**74,518.10**
Additions for the year [(ii) & (iii)]	64,496.45	1.50	**64,497.95**
Adjustment on NHAI settlement [Refer note 54 (iii)]	(2,984.38)	-	**(2,984.38)**
Balance as at March 31, 2021	**136,021.86**	**9.81**	**136,031.67**
Additions for the year	5,585.95	0.11	**5,586.06**
Adjustments for the year [Refer note 51 (b)]	(782.64)	-	**(782.64)**
Adjustment on NHAI Settlement [(iv)]	(1,367.60)	-	**(1,367.60)**
Balance as at March 31, 2022	**139,457.57**	**9.92**	**139,467.49**
Additions for the period	7,705.56	-	**7,705.56**
Adjustment for the period [Refer note 51 (b)]	(47.30)	-	**(47.30)**
Balance as at October 31, 2022	**147,115.83**	**9.92**	**147,125.75**
Accumulated amortisation and impairment			
Balance as at April 01, 2019	**7,162.80**	**2.42**	**7,165.22**
Charge for the year	3,241.74	1.75	**3,243.49**
Impairment loss for the year	156.09	-	**156.09**
Balance as at March 31, 2020	**10,560.63**	**4.17**	**10,564.80**
Charge for the year	3,761.28	1.80	**3,763.08**
Impairment loss for the year	167.40	-	**167.40**
Balance as at March 31, 2021	**14,489.31**	**5.97**	**14,495.28**
Charge for the year	5,461.79	1.61	**5,463.40**
Reversal of impairment loss for the year	(268.67)	-	**(268.67)**
Balance as at March 31, 2022	**19,682.43**	**7.58**	**19,690.01**
Charge for the period	3,513.92	0.78	**3,514.70**
Adjustments for the period	(4.84)	-	**(4.84)**
Balance as at October 31, 2022	**23,191.51**	**8.36**	**23,199.87**
Net carrying value:			
As at March 31, 2020	**63,949.16**	**4.14**	**63,953.30**
As at March 31, 2021	**121,532.55**	**3.84**	**121,536.39**
As at March 31, 2022	**119,775.14**	**2.34**	**119,777.48**
As at October 31, 2022	**123,924.32**	**1.56**	**123,925.88**

Notes:

(i) Please refer note 53 for information (including remaining amortisation period) related to Service Concession Arrangements.

(ii) Additions includes claims for compensation/concession extension with National Highways Authority of India (NHAI) towards compensation receivable for loss of revenue aggregating ₹ NIL (March 31, 2022: ₹ NIL, March 31, 2021: ₹ 576.30 million; March 31, 2020: ₹ 41.19 million) in terms of the concession agreement entered into with NHAI by certain SPVs (viz. FRHL, JMTL, WVEPL, MBEL and WUPTL) by way of extension of the concession agreement by certain number of days based on the losses incurred on account of suspension or less toll collection fee at toll plaza due to lockdowns imposed by Government of India as a remedial measure to COVID-19. The Proposed Trust Group has recognised the extension of the concession period by increasing the value of Toll collection rights and Claims for compensation/ concession extension under note 32 - 'Revenue from operations' in accordance with the accounting policy of the Proposed Trust Group as referred in note 2 II (f).

(iii) Additions of ₹ 64,496.45 million in Rights under Service Concession Arrangements for the year ended March 31, 2021 includes:
a) ₹ 50,110.00 million concession fee paid to NHAI and ₹ 10,014.40 million towards contractual obligations to be undertaken by certain SPVs (viz. HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL) within specified time from the Appointed Date in terms of the Concession Agreements entered with NHAI related to construction /improvements of the Project Highway granted to these SPVs.

b) ₹ 3,794.63 million towards Rights under Service Concession Arrangements -Toll Road Carriageway acquired by NDEPL comprising of (i) aggregate transaction consideration of ₹ 2,609.50 million, discharged by way of settlement of loans amounting ₹ 2,205.4 million of Lanco Devihalli Expressways Limited ('Previous concessionaire') and ₹ 404.10 million directly paid to the Previous concessionaire, and (ii) the estimated contractual liability as on January 11, 2021 of ₹ 558.66 million and upfront penalty due till January 11, 2021 of ₹ 626.47 million paid to NHAI, arising on account of NHAI "in- and principle" approval vide letter dated October 16, 2018 for substitution of Rights under Service Concession Arrangement from the previous concessionaire. During the seven month period ended October 31, 2022, reversal of ₹ 47.30 million on account of change in the estimated contractual liability on completion of work have been derecognized from the gross carrying value.

(iv) Refer note 59 for NHAI settlement of GAEPL.

(v) For details of Intangible Assets pledged as security for borrowings refer note 22.

7. Intangible assets under development (IAUD) - (Relating to Rights under Service Concession Arrangements)	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Opening balance	7,260.76	10,422.91	9,706.31	7,824.43
Adjustment on NHAI settlement [Refer note 54 (iii)]	-	-	(2,269.54)	(0.16)
Additions during the period/year [(i)]	860.92	1,723.51	2,987.52	1,901.55
Capitalised during the period/year [(ii)]	(7,705.56)	(4,885.66)	(1.38)	(19.51)
Closing balance	**416.12**	**7,260.76**	**10,422.91**	**9,706.31**

Notes:

(i) Includes construction costs aggregating ₹ 806.91 million (March 31, 2022: ₹ 1,436.82 million, March 31, 2021: ₹ 2,351.37 million; March 31, 2020: ₹ 1,326.65 million) and borrowing costs aggregating ₹ 54.01 million (March 31, 2022: ₹ 286.69 million, March 31, 2021: ₹ 636.15 million; March 31, 2020: ₹ 574.90 million).

(ii) During the seven month period ended October 31, 2022, DATRL has received Provisional Completion Certificate ('PCOD') from National Highway Authority of India ('NHAI') for Six-Laning of the Delhi-Agra Section (Km. 20.500 to Km. 200.00) of National Highway no. 2 which inlcudes SPV's third toll plaza at Gadpuri i.e. Km 46 to Km 94. The tolling as per revised toll fee notification from NHAI has commenced with effect from July 01, 2022.

(iii) For details of Intangible assets pledged as security for borrowings refer note 22.

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
8 Investments				
Non-current				
Investments in equity instruments (Unquoted) - at cost				
500 Equity shares of ₹10 each subscribed in Cube Highways Roots Foundation [(i)]	0.01	0.01	0.01	-
	0.01	**0.01**	**0.01**	**-**

(i) During the year ended March 31, 2021 AEPL, JMTL, MBEL and WUPTL each subscribed 100 shares of Cube Highways Root Foundation (CHRF), under Section 8 of the Companies Act, 2013 to carry out CSR activities in line with Schedule VII of the Companies Act, 2013 as amended time to time. As per Memorandum of Association of CHRF, upon a winding up or dissolution of CHRF, there remains, after the satisfaction of all the debts and liabilities, any property whatsoever, the same shall not be distributed amongst the members of the CHRF but shall be given or transferred to such other Company having objects similar to the Objects of CHRF, subject to such conditions as the concerned National Company Tribunal may impose, or may be sold and proceeds thereof credited to the Insolvency and Bankruptcy Fund formed under Section 224 of the Insolvency and Bankruptcy Code, 2016.

9 Other financial assets				
Non-current				
Unsecured, considered good				
Security deposits	15.15	12.87	12.54	8.81
Deposits with banks [(i)]	111.00	-	-	54.07
Receivable under service concession arrangements [(ii)]	586.05	880.90	1,568.96	2,215.42
Derivative financial assets (fair value through profit or loss) [Refer note 46(c)]	-	55.52	128.66	229.74
Other receivables	30.74	21.38	21.38	21.38
	742.94	**970.67**	**1,731.54**	**2,529.42**

Notes:

(i) Includes deposits towards Major Maintenance Reserve Account (MMRA) pursuant to covenant of the loan agreements of the SPVs with lenders is ₹111.00 million (March 31, 2022: Nil; March 31, 2021: Nil, March 31, 2020: Nil).

(ii) **Movement in receivables under service concession arrangements during the period/year:**				
Opening balance	**2,011.30**	**2,699.36**	**3,345.82**	**2,838.33**
Add: Interest income on annuity receivable from National Highway Authority of India ('NHAI') [Refer note 32]	110.86	245.23	296.23	273.26
Add: Recoverable for operation and maintenance income for the period/year [Refer note 32]	128.47	197.11	187.71	178.77
Add: Recoverable for renewal and overlay income for the period/year [Refer note 32]	31.03	-	-	1,185.86
Less: Annuity received from NHAI	565.21	1,130.40	1,130.40	1,130.40
Closing balance	**1,716.45**	**2,011.30**	**2,699.36**	**3,345.82**
- Non-current	586.05	880.90	1,568.96	2,215.42
- Current [Refer note 17]	1,130.40	1,130.40	1,130.40	1,130.40
	1,716.45	**2,011.30**	**2,699.36**	**3,345.82**

10 Current tax assets/(liabilities) (net)				
10.1 Current tax assets (net)				
Current tax assets				
- Non current	461.14	433.58	128.44	239.54
- Current	-	-	40.04	31.82
	461.14	**433.58**	**168.48**	**271.36**
10.2 Current tax liabilities (net)				
Current tax liabilities	-	-	1,039.64	-
	-	**-**	**1,039.64**	**-**

11 Other non-current assets				
Capital advances	758.53	126.18	50.92	25.83
Balance with government authorities	6.52	15.30	15.30	15.30
Unamortised financial guarantee charges and other assets	-	-	0.05	49.83
Prepayments	-	-	-	0.02
	765.05	**141.48**	**66.27**	**90.98**

12 Inventories				
Valued at lower of cost or net realisable value				
Stores and spares	119.75	41.84	23.02	12.98
	119.75	**41.84**	**23.02**	**12.98**

Note:

The cost of inventories recognised as an expense in the Special Purpose Combined Statement of Profit and Loss amounting to ₹325.12 million (March 31, 2022: ₹261.74 million; March 31, 2021: ₹71.89 million; March 31, 2020: ₹33.14 million).

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
13 Investments				
Current				
Investments at fair value through profit or loss (FVTPL): [(i)]				
315,684.49 (March 31, 2022: Nil, March 31, 2021: 175,553.62, March 31, 2020: Nil) units in SBI Liquid Fund - Growth Option	1,039.76	-	565.55	-
617,938.36 (March 31, 2022: Nil, March 31, 2021: 143,790.15, March 31, 2020: Nil) units in Axis Liquid Fund - Direct Plan - Growth Option	1,502.68	-	328.54	-
Nil (March 31, 2022: Nil, March 31, 2021: 590,356.27, March 31, 2020: 411,421.63) units in ICICI Prudential Liquid Fund - Direct Plan - Growth	-	-	179.89	120.87
Nil (March 31, 2022: Nil, March 31, 2021: 289,523.28, March 31, 2020: 88,026.26) units in ICICI Prudential Money Market Fund - Direct Plan - Growth	-	-	85.48	25.85
Nil (March 31, 2022: Nil, March 31, 2021: Nil, March 31, 2020: 19,899.99) units in HDFC Liquid Fund - Direct Plan - Growth Option	-	-	-	77.74
57,033.93 (March 31, 2022: Nil, March 31, 2021: Nil, March 31, 2020: Nil) units in SBI Overnight Fund Direct Growth	202.94	-	-	-
1,453,710.72 (March 31, 2022: Nil, March 31, 2021: Nil, March 31, 2020: Nil) units in SBI Saving Fund - Growth Option	53.00	-	-	-
Total	**2,798.38**	**-**	**1,159.46**	**224.46**

Notes:

(i)	Includes amount earmarked pursuant to loan covenant of common loan agreement and debenture trust deed of the SPVs towards:			
(a)	Debt Service Reserve Account (DSRA)	-	-	-	13.72
(b)	Major Maintenance Reserve Account (MMRA)	160.95	-	18.02	44.65
(ii)	Investments at FVTPL have carrying amount same as market value as these are quoted investments.				
(iii)	For details of investments pledged refer note 22.				

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
14 Trade receivables				
Current				
Trade receivables				
- Unsecured, considered good	798.08	751.21	755.54	658.89
- Unsecured, which have significant increase in credit risk	2.96	2.96	37.44	34.41
- Unsecured, credit impaired	69.05	69.05	1.00	4.47
Less: Impairment loss allowance [(i)]	(72.01)	(72.01)	(38.44)	(38.88)
	798.08	**751.21**	**755.54**	**658.89**

Note:
(i) Also refer note 46(ii) A for impairment loss allowance movement.

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
15 Cash and cash equivalents				
Cash on hand	17.83	15.54	35.02	11.38
Balances with banks: [(i) & (iii)]				
- current accounts	825.13	5,510.89	2,586.32	465.86
- deposits with original maturity of less than three months	9,875.83	12,963.68	6,230.55	1,947.12
	10,718.79	**18,490.11**	**8,851.89**	**2,424.36**

Notes:

(i)	Includes amount earmarked pursuant to loan covenant of common loan agreement and debenture trust deed of the SPVs towards:			
(a)	Debt Service Reserve Account (DSRA)	1,945.39	1,288.61	1,616.67	338.38
(b)	Major Maintenance Reserve Account (MMRA)	490.86	2,398.81	113.54	262.40
(ii)	For details of cash and cash equivalents pledged refer note 22.				
(iii)	Includes Nil (March 31, 2022 - ₹ 22.07 million, March 31, 2021 - ₹ 41.16 million ; March 31, 2020 - ₹ 41.16 million) against the pending punch list items to be carried out by APEL. Out of this Nil (March 31, 2022 - ₹ 6.48 million, March 31, 2021 - ₹ 6.48 million; March 31, 2020 - ₹ 6.48 million) has been kept in an escrow current account with the designated escrow banker and balance Nil (March 31, 2022 - ₹ 15.59 million, March 31, 2021 - ₹ 34.68 million ; March 31, 2020 - ₹ 34.68 million) in fixed deposits.			

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
16 Bank balances other than cash and cash equivalents				
Deposits with original maturity more than three months but less than twelve months	3,435.88	2,633.84	4,284.98	3,907.77
	3,435.88	**2,633.84**	**4,284.98**	**3,907.77**
Notes:				
(i) Includes amount earmarked pursuant to loan covenant of common loan agreement and debenture trust deed of the SPVs towards:				
(a) Debt Service Reserve Account (DSRA)	1,824.19	1,519.84	1,222.76	41.02
(b) Major Maintenance Reserve Account (MMRA)	828.83	371.50	1,665.86	371.75
(ii) For details of bank balances other than cash and cash equivalents pledged as security refer note 22.				
17 Other financial assets				
Current - Unsecured, considered good				
Interest accrued on fixed deposits with banks	49.64	39.77	33.12	13.60
Interest accrued on security deposits	-	-	0.25	0.25
Interest accrued - others	-	-	31.40	-
Security deposits	0.83	0.89	0.92	1.23
Claims receivable on NHAI settlement [Also Refer note 54 (iii) and 59]	-	1,501.24	8,535.40	0.33
Grant receivable [(i)]	96.16	96.16	96.16	199.41
Receivable under service concession arrangements [Refer note 9(ii)]	1,130.40	1,130.40	1,130.40	1,130.40
Receivable from related parties [Refer note 48]	-	7.95	-	30.06
Receivable from Reliance Infrastructure Limited [Refer note 54 (ii)]	898.57	346.66	365.00	-
Other receivables	12.31	12.67	45.69	16.85
	2,187.91	**3,135.74**	**10,238.34**	**1,392.13**
(i) Movement on grant receivable				
Particulars				
Opening Balance	**96.16**	**96.16**	**199.41**	**274.09**
Accrued interest during the period/year	-	-	-	18.36
Grant received during the period/year	-	-	(103.25)	(123.60)
Grant recognised during the period/year	-	-	-	30.56
Closing balance	**96.16**	**96.16**	**96.16**	**199.41**
18 Other current assets				
Unsecured, considered good				
Advance to suppliers	792.69	605.10	30.33	108.68
Advance to others	-	-	1.67	48.19
Advance to employees	3.19	0.60	0.12	4.91
Unbilled revenue related to construction	150.81	38.40	27.26	25.52
Prepaid expenses	184.05	188.56	190.02	63.46
Balance with government authorities	124.84	114.27	136.02	135.72
Other	162.19	38.90	-	4.95
Unsecured, considered doubtful				
Unbilled revenue related to construction	8.87	8.87	3.37	2.00
Less: Impairment loss allowance [(i)]	(8.87)	(8.87)	(3.37)	(2.00)
`	**1,417.77**	**985.83**	**385.42**	**391.43**
Note:				
(i) Also refer note 46(ii) A for impairment loss allowance movement.				
19 Assets held for sale				
Building [(i)]	4.57	4.57	4.57	-
Land	0.10	0.10	0.10	-
	4.67	**4.67**	**4.67**	-

(i) Includes cost of the freehold land which can not be segregated.

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
20 Capital				
Authorised				
A. Equity Shares				
4,500,000 (March 31, 2022: 4,500,000; March 31, 2021: 4,500,000; March 31, 2020: 4,500,000) equity shares of ₹10 each for JLTL	45.00	45.00	45.00	45.00
194,000,000 (March 31, 2022: 194,000,000; March 31, 2021: 194,000,000; March 31, 2020: 194,000,000) equity shares of ₹10 each for GAEPL	1,940.00	1,940.00	1,940.00	1,940.00
9,500,000 (March 31, 2022: 9,500,000; March 31, 2021: 9,500,000; March 31, 2020: 9,500,000) equity shares of ₹10 each for KMTL	95.00	95.00	95.00	95.00
9,900,000 (March 31, 2022: 9,900,000; March 31, 2021: 9,900,000; March 31, 2020: 9,900,000) equity shares of ₹10 each for NKTL	99.00	99.00	99.00	99.00
7,750,000 (March 31, 2022: 7,750,000; March 31, 2021: 7,750,000; March 31, 2020: 7,750,000) equity shares of ₹10 each for MKTL	77.50	77.50	77.50	77.50
5,500,000 (March 31, 2022: 5,500,000; March 31, 2021: 5,500,000; March 31, 2020: 5,500,000) equity shares of ₹10 each for LRTL	55.00	55.00	55.00	55.00
900,000 (March 31, 2022: 900,000; March 31, 2021: 900,000; March 31, 2020: 900,000) equity shares of ₹10 each for WVEPL	9.00	9.00	9.00	9.00
9,000,000 (March 31, 2022: 9,000,000; March 31, 2021: 9,000,000; March 31, 2020: 9,000,000) equity shares of ₹10 each for HTL	90.00	90.00	90.00	90.00
3,000,000 (March 31, 2022: 3,000,000; March 31, 2021: 3,000,000; March 31, 2020: 3,000,000) equity shares of ₹10 each for JVTL	30.00	30.00	30.00	30.00
7,500,000 (March 31, 2022: 7,500,000; March 31, 2021: 7,500,000; March 31, 2020: 7,500,000) equity shares of ₹10 each for KETL	75.00	75.00	75.00	75.00
7,000,000 (March 31, 2022: 7,000,000; March 31, 2021: 7,000,000; March 31, 2020: 7,000,000) equity shares of ₹10 each for SMTL	70.00	70.00	70.00	70.00
195,500,000 (March 31, 2022: 195,500,000; March 31, 2021: 195,500,000; March 31, 2020: 195,500,000) equity shares of ₹10 each for JMTL	1,955.00	1,955.00	1,955.00	1,955.00
260,000,000 (March 31, 2022: 260,000,000; March 31, 2021: 260,000,000; March 31, 2020: 260,000,000) equity shares of ₹10 each for FRHL	2,600.00	2,600.00	2,600.00	2,600.00
120,000,000 (March 31, 2022: 120,000,000; March 31, 2021: 45,500,000; March 31, 2020: 35,500,000) equity shares of ₹10 each for WUPTL	1,200.00	1,200.00	455.00	355.00
10,000,000 (March 31, 2022: 10,000,000; March 31, 2021: 10,000,000; March 31, 2020: 100,000) equity shares of ₹10 each for NDEPL	100.00	100.00	100.00	1.00
10,000,000 (March 31, 2022: 10,000,000; March 31, 2021: 10,000,000; March 31, 2020: 10,000,000) equity shares of ₹10 each for DATRL	100.00	100.00	100.00	100.00
50,000,000 (March 31, 2022: 50,000,000; March 31, 2021: 50,000,000; March 31, 2020: 50,000,000) equity shares of ₹10 each for APEL	500.00	500.00	500.00	500.00
100,000,000 (March 31, 2022: 100,000,000; March 31, 2021: 100,000,000; March 31, 2020: 100,000,000) equity shares of ₹10 each for MBEL	1,000.00	1,000.00	1,000.00	1,000.00
	10,040.50	**10,040.50**	**9,295.50**	**9,096.50**
B. Non Convertible, Non Cumulative Redeemable Preference Shares				
250,000,000 (March 31, 2022: 250,000,000; March 31, 2021: 250,000,000; March 31, 2020: 250,000,000) non convertible, non cumulative redeemable preference shares of ₹10 each for APEL	2,500.00	2,500.00	2,500.00	2,500.00
Issued, subscribed and fully paid:				
2,218,500 (March 31, 2022: 2,218,500; March 31, 2021: 2,218,500; March 31, 2020: 50,000) equity shares of ₹10 each for JLTL	22.18	22.18	22.18	0.50
194,000,000 (March 31, 2022: 194,000,000; March 31, 2021: 194,000,000; March 31, 2020: 194,000,000) equity shares of ₹10 each for GAEPL	1,940.00	1,940.00	1,940.00	1,940.00
4,760,500 (March 31, 2022: 4,760,500; March 31, 2021: 4,760,500; March 31, 2020: 50,000) equity shares of ₹10 each for KMTL	47.60	47.60	47.60	0.50
5,018,500 (March 31, 2022: 5,018,500; March 31, 2021: 5,018,500; March 31, 2020: 10,000) equity shares of ₹10 each for NKTL	50.18	50.18	50.18	0.10
3,825,500 (March 31, 2022: 3,825,500; March 31, 2021: 3,825,500; March 31, 2020: 50,000) equity shares of ₹10 each for MKTL	38.26	38.26	38.26	0.50
2,701,000 (March 31, 2022: 2,701,000; March 31, 2021: 2,701,000; March 31, 2020: 50,000) equity shares of ₹10 each for LRTL	27.01	27.01	27.01	0.50
900,000 (March 31, 2022: 900,000; March 31, 2021: 900,000; March 31, 2020: 900,000) equity shares of ₹10 each for WVEPL	9.00	9.00	9.00	9.00
4,505,000 (March 31, 2022: 4,505,000; March 31, 2021: 4,505,000; March 31, 2020: 50,000) equity shares of ₹10 each for HTL	45.05	45.05	45.05	0.50
1,452,000 (March 31, 2022: 1,452,000; March 31, 2021: 1,452,000; March 31, 2020: 10,000) equity shares of ₹10 each for JVTL	14.52	14.52	14.52	0.10
3,640,500 (March 31, 2022: 3,640,500; March 31, 2021: 3,640,500; March 31, 2020: 10,000) equity shares of ₹10 each for KETL	36.40	36.40	36.40	0.10
3,359,000 (March 31, 2022: 3,359,000; March 31, 2021: 3,359,000; March 31, 2020: 10,000) equity shares of ₹10 each for SMTL	33.59	33.59	33.59	0.10
131,051,026 (March 31, 2022: 131,051,026; March 31, 2021: 131,051,026; March 31, 2020: 140,141,936) equity shares of ₹10 each for JMTL	1,310.51	1,310.51	1,310.51	1,401.42
250,221,000 (March 31, 2022: 250,221,000; March 31, 2021: 250,221,000; March 31, 2020: 250,221,000) equity shares of ₹10 each for FRHL	2,502.21	2,502.21	2,502.21	2,502.21
114,875,204 (March 31, 2022: 114,875,204; March 31, 2021: 41,875,204; March 31, 2020: 27,875,204) equity shares of ₹10 each for WUPTL	1,148.75	1,148.75	418.75	278.75
9,482,986 (March 31, 2022: 9,482,986; March 31, 2021: 9,482,986; March 31, 2020: 10,000) equity shares of ₹10 each for NDEPL	94.83	94.83	94.83	0.10
9,018,000 (March 31, 2022: 9,018,000; March 31, 2021: 9,018,000; March 31, 2020: 9,018,000) equity shares of ₹10 each for DATRL	90.18	90.18	90.18	90.18
11,900,060 (March 31, 2022: 11,900,060; March 31, 2021: 11,900,060; March 31, 2020: 11,900,060) equity shares of ₹10 each for APEL	119.00	119.00	119.00	119.00
99,360,000 (March 31, 2022: 99,360,000; March 31, 2021: 99,360,000; March 31, 2020: 99,360,000) equity shares of ₹10 each for MBEL	993.60	993.60	993.60	993.60
	8,522.87	**8,522.87**	**7,792.87**	**7,337.16**

(i) 12 (March 31, 2022: 12; March 31, 2021: 12; March 31, 2020: 12) equity shares of ₹ 10 each issued by WUPTL but not subscribed by its shareholder
(ii) For details of equity shares pledged as security for borrowings refer note 22

		As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
21	**Other equity**				
i)	**Share application money pending allotment**				
	Opening Balance	**-**	**-**	**5.20**	**-**
	Share application money received	-	-	-	5.20
	Share application money transferred to capital	-	-	(5.20)	-
	Sub total (A)	**-**	**-**	**-**	**5.20**
ii)	**Equity component of compound financial instruments**				
a.	**Equity component of interest payable on NCD**				
	Opening Balance	**193.42**	**397.75**	**-**	**-**
	Equity component of interest accrued on non-convertible debentures of fellow subsidiary of WUPTL [Refer note 58]	-	-	397.75	-
	Adjustment to equity component of interest accrued on non-convertible debentures of fellow subsidiary [Refer note 58]	-	(204.33)	-	-
	Closing Balance	**193.42**	**193.42**	**397.75**	**-**
b.	**Equity component of non-cumulative, non-convertible redeemable preference shares**				
	Opening Balance	**400.48**	**400.48**	**400.48**	**400.48**
	Movement during the period/year	-	-	-	-
	Closing Balance	**400.48**	**400.48**	**400.48**	**400.48**
c.	**Equity component of optionally convertible debentures (net of tax)**				
	Opening Balance	**4,648.36**	**3,068.85**	-	**-**
	Equity component of optionally convertible debentures	931.92	1,579.51	3,068.85	-
	Closing Balance	**5,580.28**	**4,648.36**	**3,068.85**	**-**
d.	**Equity component of subordinate debt/seller loans**				
	Opening Balance	**338.17**	**338.17**	**8,414.20**	**8,414.20**
	Converted in to NCD - DATRL [Refer note 54 (ii)]	-	-	(4,449.10)	-
	Reclassifications to borrowings - WVEPL [Refer note 54 (i)]	-	-	(3,796.85)	-
	Effect of fair value of above borrowings - WVEPL [Refer note 54 (i)]	-	-	160.58	-
	Other - WVEPL [Refer note 54 (i)]	-	-	9.34	-
	Closing Balance	**338.17**	**338.17**	**338.17**	**8,414.20**
	Sub total (B)	**6,512.35**	**5,580.43**	**4,205.25**	**8,814.68**
iii)	**Deemed capital contribution**				
	Opening Balance	**5,522.07**	**2,448.54**	**1,351.81**	**563.46**
	Waiver of interest by the fellow subsidiary of WUPTL [Refer note 58]	198.52	338.60	338.60	339.52
	Deduction on cancellation of corporate guarantee	-	-	(49.77)	-
	Remission of shareholder loan liabilities of GAEPL [Refer note 54 (iv)]	-	1,898.80	-	-
	Waiver of interest on shareholder loans of GAEPL [Refer note 54 (iv)]	24.67	365.53	367.79	261.66
	Interest on interest free shareholder loans of GAEPL	61.26	470.60	440.11	187.17
	Sub total (C)	**5,806.52**	**5,522.07**	**2,448.54**	**1,351.81**

		As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
iv)	**Reserves and surplus**				
a.	**Securities premium**				
	Opening Balance	**7,761.59**	**7,761.59**	**1,649.99**	**1,649.99**
	Premium arising on issue of capital	-	-	6,111.60	-
	Closing Balance	**7,761.59**	**7,761.59**	**7,761.59**	**1,649.99**
b.	**Debenture redemption reserve**				
	Opening Balance	**490.43**	**490.43**	**490.43**	**490.43**
	Transferred from retained earnings	-	-	-	-
	Closing Balance	**490.43**	**490.43**	**490.43**	**490.43**
c.	**Capital reserve**				
	Opening Balance	**830.00**	**830.00**	**830.00**	**830.00**
	Movement during the period/year	-	-	-	-
	Closing Balance	**830.00**	**830.00**	**830.00**	**830.00**
d.	**Retained earnings**				
	Opening Balance	**(28,467.53)**	**(20,214.59)**	**(10,218.16)**	**(8,875.77)**
	Net loss for the period/year	(567.77)	(8,251.67)	(2,409.36)	(1,336.87)
	Other comprehensive income/(loss):				
	Re-measurement (losses)/gains on defined benefit obligations (net of tax)	(2.12)	(1.27)	14.29	(5.52)
	Settlement pursuant to Share Purchase Agreement (SPA) [Refer note 54 (ii) and 54 (iii)]	-	-	(7,092.27)	-
	Capital reduction during the year [(i)]	-	-	(509.09)	-
	Closing Balance	**(29,037.42)**	**(28,467.53)**	**(20,214.59)**	**(10,218.16)**
	Sub total (D)	**(19,955.40)**	**(19,385.51)**	**(11,132.57)**	**(7,247.74)**
	Total other equity (A+B+C+D)	**(7,636.53)**	**(8,283.01)**	**(4,478.78)**	**2,923.95**

Note:

(i) During the year ended March 31, 2021, National Company Law Tribunal ("NCLT") vide its letter dated September 24, 2020 approved reduction in issued, subscribed and fully paid up share capital of JMTL from 140,141,936 equity shares of ₹ 10 each to 131,051,026 equity shares of ₹ 10 each at a premium of ₹ 56 per share. Based thereon an amount of ₹ 600 million (including premium of ₹ 509.09 million) was paid to Cube Highways and Infrastructure Pte Ltd (holding company of JMTL) for reduction of 9,090,910 equity shares held by it.

Nature and purpose of components of Other Equity are as follows:

Equity Component of interest payable on NCD
This represents difference in interest payable on NCD less present value of the future cash flows of such interest payable.

Equity component of non-cumulative, non-convertible redeemable preference shares
This represents the equity component of non-cumulative, non-convertible redeemable preference shares ("Preference shares") being a compound financial instrument issued to the previous promoters of certain SPVs. These preference shares have been cancelled pursuant to Bombay High Court Order dated October 6, 2015.

Equity component of optionally convertible debentures
Equity component of compound financial instruments represents equity component of optionally convertible debenture issued during the period/year.

Equity component of subordinate debt/ seller loan
Subordinate debt/seller loan represents debt infused by the erstwhile promoters of certain SPVs for the project which is unsecured and interest free as per the loan agreement with the lender and subordinate to the secured loan.

Deemed capital contribution
Deemed capital contribution represents deemed contribution by erstwhile promoters of SPV's or holding companies/fellow subsidiaries of SPV's towards waiver of interest, remission of loan liabilities, interest on interest free loans and fair value of charges towards corporate guarantee provided to the SPV's.

Securities premium reserve
Securities premium reserve represents premium received on issue of shares. The reserve can be utilised in accordance with the provisions of the Companies Act, 2013.

Debenture redemption reserve
In terms of Section 71 of the Companies Act, 2013 the issuer SPV is required to create Debenture Redemption Reserve to the extent of 10% of the outstanding value of privately placed Debentures until such debentures are redeemed, to which amount shall be credited from out of its profits of the issuer SPV available for payment of dividend. The reserve can be utilised in accordance with the provisions of the Companies Act, 2013.
In the absence of distributable profits during the period/year, the issuer SPV has not created DRR. However, the issuer SPV is carrying DRR made during the previous years and is regular in redeeming matured debentures.

Capital reserve
Capital reserve has been created on cancellation of issued, subscribed and fully paid up 1% non-convertible, non-cumulative redeemable preference share capital of APEL in an earlier year pursuant to the application approved as per the Bombay High Court order dated October 6, 2016.

Retained earnings
Retained earnings represents accumulated earnings of the Proposed Trust Group, as adjusted for distributions to owners, transfers to other reserves, etc. Negative balance represents accumulated losses and other adjustments related to SPA.

22 **Borrowings - Non-current**	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
At amortised cost				
Secured:				
a) Term Loan [Refer note 22 (i) A]				
- from Banks	57,010.49	67,981.51	67,102.40	30,460.75
- from Financial institutions and NBFC's	5,664.96	-	6,324.48	6,546.86
- External commercial borrowings (ECB)	-	-	2,812.82	3,513.31
- from Others	-	-	487.92	487.92
Sub-total (A)	**62,675.45**	**67,981.51**	**76,727.62**	**41,008.84**
b) Non - convertible debentures (NCD) [Refer note 22 (ii) A]	11,684.89	12,528.43	4,327.11	6,150.35
Sub-total (B)	**11,684.89**	**12,528.43**	**4,327.11**	**6,150.35**
Unsecured:				
a) Optionally - convertible debentures (OCD) [Refer note 22 (ii) B]				
From related parties [Refer note 48]				
Cube Mobility Investment Pte. Ltd.	15,688.08	15,688.08	8,770.46	70.00
Cube Highways and Infrastructure I-D Pte Ltd	1,090.83	1,090.83	1,111.61	-
Cube Highways and Infrastructure III Pte. Ltd.	11,687.32	11,687.32	11,040.73	-
Cube Highways and Infrastructure II PTE Limited	6,041.02	6,041.02	3,715.23	-
Cube Highways and Infrastructure Pte Ltd	8,220.64	130.00	130.00	-
Sub-total (C)	**42,727.89**	**34,637.25**	**24,768.03**	**70.00**
b) Non - convertible debentures (NCD) [Refer note 22 (ii) C]				
From related parties [Refer note 48]				
Cube Infrastructure Investment Pte Ltd	4,410.11	4,499.24	5,504.24	5,504.24
From others				
HCC Concessions Limited	127.93	152.13	2,074.48	-
Reliance Infrastructure Ltd.	3,346.25	3,215.48	3,102.53	-
Sub-total (D)	**7,884.29**	**7,866.85**	**10,681.25**	**5,504.24**
c) Term loans [Refer note 22 (i) B]				
From related parties [Refer note 48]				
HCC Concessions Limited	-	-	-	733.12
Galfar Engineering and Contracting India Pvt Ltd	-	487.92	-	-
Bharat Road Network Limited	-	-	481.89	481.89
From others				
KNR Constructions Limited	280.33	274.43	422.82	-
Revenue shortfall loan from NHAI	-	1,250.00	-	-
SREI Equipment Finance Limited (Term Loan 1)	-	799.59	731.04	731.05
SREI Equipment Finance Limited (Term Loan 2)	-	880.81	880.81	880.81
Sub-total (E)	**280.33**	**3,692.75**	**2,516.56**	**2,826.87**
Less: Current maturities of borrowings (Current borrowings)				
Secured:				
a) Term loan				
- from Banks	2,106.24	9,932.85	4,447.30	4,010.55
- from Financial institutions	32.65	-	303.61	190.70
- External commercial borrowings (ECB)	-	-	633.98	491.82
b) Non - convertible debentures	358.25	229.86	876.40	360.78
Unsecured:				
a) Non - convertible debentures - from others	3,474.18	4,054.69	2,312.19	37.07
b) Term loans - from others	150.99	150.99	308.89	-
Total current maturities of borrowings (F)	**6,122.31**	**14,368.39**	**8,882.37**	**5,090.92**
Total non-current borrowings (A+B+C+D+E-F)	**119,130.54**	**112,338.40**	**110,138.20**	**50,469.38**

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
1	Term loans from banks	Hazaribagh Tollway Limited	State Bank of India	6,525.10	6,597.15	6,717.12	-	**Interest rate:** Interest rate is linked to one year SBI MCLR plus Spread (based on external credit rating). For seven month period ended October 31, 2022: ranging from 7.75% to 8.70% p.a. For year ended March 31, 2022: 7.75% p.a. For year ended March 31, 2021: 8% p.a. **Repayment terms as on October 31, 2022:** Maturity date - September 30, 2040 Remaining 72 structured quarterly installments. Last installment due on September 30, 2040	Secured by pari-passu charge over: (i) all present and future tangible/intangible movable assets of the SPV (as more particularly stipulated under the Deed of Hypothecation). (ii) all the rights, title, interest, benefits, claims and demands of the SPV, inter alia, in the project documents, concession agreement, letter of credits, guarantees the clearances insurance contracts, insurance policies. (as more particularly stipulated under Deed of Hypothecation) (iii) all the bank accounts including but not limited to the escrow account and any other reserves or bank accounts of the SPV including all monies deposited/ to be deposited in such accounts (as more particularly stipulated under Deed of Hypothecation), (iv) all present and future receivables in relation to Project, (v) all the current assets of the SPV as per the Deed of Hypothecation (vi) all other assets of the borrower, both present and future [other than the property referred to in (i) to (v) above] 51% Equity shares and Optionally Convertible Debentures (OCD) of the SPVs have been pledged with the secured lenders. All the borrowers have entered into Intercompany guarantee agreement to secure the Loan aggregating to ₹ 35,000 million from State Bank of India. As per Intercompany guarantee agreement, in the event of the failure of any of the Borrower to pay and discharge any of its Guaranteed Obligations till their respective Final Settlement Date, each of the all Borrowers* hereby irrevocably, unconditionally and absolutely guarantee that it shall, immediately on demand will make payments of the amount demanded out of the monies available with such Other Borrowers in its Surplus Accounts determined as per "Intercompany guarantee agreement". * all borrowers as mentioned above consist of the following SPVs : Hazaribagh Tollway Limited, Jhansi-Lalitpur Tollway Limited, Jhansi-Vigakhet Tollway Limited, Kanyakumari-Etturavattam Tollway Limited, Kotwa-Muzaffarpur Tollway Limited, Lucknow-Raebareli Tollway Limited, Madurai Kanyakumari Tollway Limited, Nanguneri-Kanyakumari Tollway Limited, Salaipudhur- Madurai Tollway Limited
2	Term loans from banks	Jhansi-Lalitpur Tollway Limited	State Bank of India	3,197.39	3,199.25	3,207.75	-		
3	Term loans from banks	Jhansi-Vigakhet Tollway Limited	State Bank of India	1,904.38	1,917.80	1,935.22	-		
4	Term loans from banks	Kanyakumari-Etturavattam Tollway Limited	State Bank of India	3,175.15	3,177.18	3,178.49	-		
5	Term loans from banks	Kotwa-Muzaffarpur Tollway Limited	State Bank of India	4,769.56	4,815.84	4,872.42	-		
6	Term loans from banks	Lucknow-Raebareli Tollway Limited	State Bank of India	3,001.62	3,022.78	3,050.37	-		
7	Term loans from banks	Madurai Kanyakumari Tollway Limited	State Bank of India	4,561.97	4,636.54	4,720.84	-		
8	Term loans from banks	Nanguneri-Kanyakumari Tollway Limited	State Bank of India	3,538.09	3,537.74	3,535.97	-		
9	Term loans from banks	Salaipudhur- Madurai Tollway Limited	State Bank of India	3,303.74	3,308.31	3,319.86	-		

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
10	Term loans from banks	Nelamangala Devihalli Expressway Private Limited	State Bank of India	2,620.36	2,620.87	2,292.84	-	Interest rate - 6 months MCLR plus 1.05% For seven months period ended October 31, 2022: ranging from 8% to 8.70% p.a. For year ended March 31, 2022: 8% p.a. For year ended March 31, 2021: 8% p.a. Repayment terms as on October 31, 2022: Remaining 33 structured quarterly installments. Last installment due on December 31, 2030.	Secured by a first mortgage and charge in favour of SBI CAP Trustee Company Limited on: (i) all rights, title, interests and benefits, fixed assets and tangible movable assets of the borrowers, both present and future (except the project assets) including without limitation all plant and machinery, current assets and all intangible assets of the borrower including but not limited to intellectual property rights and goodwill of the borrower, any uncalled capital of the Issuer and Sponsor Contribution received by the issuer and all other movable assets, estate, benefit, property whatsoever of the borrower unto and upon the same, both present and future. (ii) all rights, title, interests and benefits, claim and demands both present and future except project assets in a) project documents and all assignments and concession thereunder b) all clearances obtained by the borrower to the extent permitted under applicable laws c) all letters of credit and guarantees, contracts, liquidated damages and performance bonds provided by any project participant and all claims of the borrower unto and upon the same, both present and future d) all insurance contracts and policies together with all proceeds, monies, revenues and receivables in relation thereto or arising thereunder, both present and future (iii) all rights, title, interests and benefits whatsoever of the borrowers in and to all the bank accounts of the borrower, both present and future including all monies, securities, instruments, investments, other properties, funding and/or financing commitments received, deposited or credited in such accounts including book debts, commissions, investments, operating cash flows, assets and securities except the project assets. (iv) all monies, revenue, receivables and amount owing to or received by or receivable by the borrower, both present and future(whether under any Project documents including termination payments) or in the nature of Insurance proceeds or contractual damage or otherwise, whether such monies receivable are retained in the Escrow account or otherwise (except the project assets) and all the estate, property, rights, title, interest, benefits, claims and demands whatsoever of the Borrower in to or in respect of all the aforesaid amounts, both present and future. (v) all rights, title, interests, benefits, claims and demand whatsoever of the Borrower in all the other movable assets of the borrower(except the project assets) both present and future including the borrower's cash in hand, all investments in and of the borrower and also including without limitation, the borrowers right, title and interest and in the moveable undertakings of the borrower, which description shall include all assets of the above description of the borrower whether presently in existence, constructed or acquired hereafter all the estate, benefit, property, rights, title and demands whatsoever of the borrower in, to or in respect of all the aforesaid amounts , both present and future. (vi) Pledge of 51% present and future shareholding in the SPV and pledge in equitable assignment of 51% of the OCD's/NCD's as applicable, by the promoter.
11	Term loans from banks and NBFC's	Western UP Tollway Limited (WUPTL)	State Bank of India- TL (A) State Bank of India- TL (B) L&T Infrastructure Finance Ltd-Facility (B) Tata Cleantech Capital Limited-TL (A) Tata Cleantech Capital Limited-TL (B)	-	-	1,274.23	1,504.99	**During the year ended March 31, 2022, the SPV has repaid its term loan from banks & financial institutions.** **Interest rate:** Benchmark rate of Secured Term Loan is Prime Lending Rate minus agreed Spread Rate. (i) For the year ended March 31, 2021- ranging from 8.75% to 11.35% p.a. (ii) For the year ended March 31, 2020 - ranging from 10.70% to 11.35% p.a.	Term Loans from State Bank of India, L&T Infrastructure Finance Company Limited, Tata Cleantech Capital Limited and Debentures issued to L&T Infra Debt Fund Limited and L&T Infrastructure Finance Company Limited are secured by : (i) Pari-passu charge in favour of Catalyst Trustship Limited formerly known as GDA Trusteeship Limited (Security Trustee) of all the SPV's immovable properties, present and future except project assets. (ii) Pari-passu charge by way of hypothecation of all the SPVs movables, including movable plant and machinery, machinery spares, tools and accessories, furniture, fixtures, vehicles and all other movable assets, present and future, except the project assets. (iii) Pari-passu charge on operating cash flows, book debts and receivables and any other revenues of whatsoever nature and wherever arising, present and future. (iv) Pari-passu charge on all intangibles including but not limited to goodwill, uncalled capital, present and future. (v) Subject to the provisions of the Concession Agreement, a first charge on the Escrow Account, Debt service reserve, Major Maintenance Reserve and other reserves. (vi) A pari passu pledge of 26% of paid up capital of the SPV held by the promoter during the currency of the loan. (vii) Cube Highways and Transportation Assets Advisors Private Limited (fellow subsidiary) has provided an absolute, irrevocable and unconditional bank guarantee in favour of security trustee for meeting debt service reserve and cash reserve requirement of the SPV as per the common loan agreement and debenture trust deed for years ended March 31, 2021 and March 31, 2020 amounting ₹ 310 million.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
12	Term loans from banks	Western UP Tollway Limited (WUPTL)	Axis Bank Ltd.	826.54	1,030.73	-	-	Interest rate: Secured Term Loan interest rate is linked to 1 year MCLR (Axis Bank). Rate of interest: For seven months period ended October 31, 2022 is 8.2% p.a. and year ended March 31, 2022 is 7.80% p.a. Repayment terms as on October 31, 2022: Remaining 6 structured quarterly installments. Last instalment due on February 2024. During the year ended March 31, 2022, the SPV has repaid its old debt i.e. term loan from banks & financial institutions and Non Convertible Debentures from the financial institutions. Borrowings include unamortized borrowing cost of ₹ 4.76 million (March 31, 2022: ₹ 9.28 million).	Secured by first charge on following securities held by security trustee on behalf of Lender : (i)all the movable assets of the SPV, both present and future (except the Project Assets), including without limitation all plant and machinery, current assets including (the SPV stocks of raw materials, semi-finished and finished goods, consumable stores and inventory), furniture, fixtures, instruments, machinery spares, steam andwater systems, storage tanks, electrical systems, hardware, computer software, wiring, pipelines, electronics spares, movable civil works, tools, meters, vehicles, accessories and all other equipment and movable assets of the SPV, whether in the possession or under the control of the SPV or not, whether affixed to the earth or not, (ii) all the bank accounts of the SPV, both present and future, including the Existing Account, Escrow Account and all sub-accounts including the Debt Service Reserve Account (or any account in substitution thereof) and all rights, title, interest, benefit, claims and demands whatsoever of the SPV in, to, under and in respect of all such bank accounts (including the Escrow Account, the Debt Service Reserve Account and all sub-accounts thereof) or any replacement thereof, including all monies, securities, instruments, investments, and other properties deposited in, credited to and/or required to be deposited in or credited to or lying to the credit of such accounts or liable to be credited to such accounts, (iii) all rights, title, interests, benefits, claims and demands whatsoever of the SPV, both present and future (except the Project Assets), in: a. The Project Documents, each as amended, varied or supplemented from time to time, and all assignments and concessions thereunder, both present and future; b. all Clearances obtained by the SPV, to the extent permitted under Applicable Laws, both present and future; c. all letters of credit, guarantees (including contractor guarantees), liquidated damages (including Contractual Damages) and performance bonds provided by any Project Participant and all claims of the SPV under or in any proceedings against any such Person, both present and future; and d. all Insurance Contracts together with all proceeds, monies, revenues and receivables in relation thereto or arising thereunder, both present and future; and all the estate, benefit, property whatsoever of the SPV unto and upon the same, both present and future (the "Third Hypothecated Assets") (iv) all monies and amounts owing to or received by or receivable by the SPV, both present and future (whether under any Project Documents (including Termination Payments) or in the nature of Insurance Proceeds or Contractual Damages or otherwise, whether such monies receivable are retained in the Escrow Account or otherwise) (except the Project Assets) and all estate, property, rights, title, interests, benefits, claims and demands whatsoever of the SPV in, to or in respect of all the aforesaid amounts, both present and future. (v) all the other movable assets of the SPV (except the Project Assets), both present and future (other than the assets effectively charged pursuant to the provisions of Section 3.1 (a) through (d)), including, the SPV cash in hand, all investments of the SPV and also including without limitation, the SPV's rights, title and interests in the movable undertakings of the SPV, which description shall include all assets of the above description of the SPV whether presently in existence, constructed or acquired hereafter and all estate, benefit, property, rights, title, interests, benefits, claims and demands whatsoever of the SPV in, to or in respect of all the aforesaid amounts, both present and future (collectively, the "General Assets"). (vi) A pari passu pledge of 26% of paid up capital of the SPV held by the promoter during the currency of the loan. (vii) Cube Highways and Transportation Assets Advisors Private Limited (fellow subsidiary) has provided an absolute, irrevocable and unconditional bank guarantee in favour of security trustee for meeting debt service reserve and cash reserve requirement of the SPV as per the common loan agreement and debenture trust deed for ₹ 130 million.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
13	Term loans from banks	Jaipur Mahua Tollway Limited	ICICI Bank	2,053.32	2,203.85	2,461.21	1,152.77	Interest rate: ICICI Loan - I Secured Term Loan interest rate is "I-MCLR-1Y+ Spread per annum". October 31, 2022 : 7.60% p.a March 31, 2022 : 7.65% p.a March 31, 2021: 7.65%- 9.25% p.a. March 31, 2020 : 9.25% p.a ICICI Loan - II Secured Term Loan interest rate is "I-MCLR-1Y+ Spread per annum". October 31, 2022 : 7.60% p.a March 31, 2022 : 7.65% p.a March 31, 2021 : 7.65% - 9.25% p.a Repayment terms as on October' 31, 2022: Remaining 65 structured monthly instalments. Last instalment due on March 2028.	Secured by a first charge in favour of Catalyst Trustship Limited formerly known as GDA Trusteeship Limited (Security trustee) on all the immovable properties of the SPV and by way of hypothecation of movable properties, book debts, receivables of the SPV (both present and future), rights and interests in project documents, first charge on all intangible assets, intellectual property rights and uncalled capital of the SPV and Pledge of 26% of equity shares issued by the SPV to the shareholder i.e. Cube Highways and Infrastructure Pte Limited. Cube Highways and Transportation Assets Advisors Private Limited (fellow subsidiary) has provided an absolute, irrevocable and unconditional bank guarantee (fully backed by standby letter of credit from Cube Infrastructure Investments Pte Ltd) in favour of security trustee for meeting debt service reserve and cash reserve requirement of the SPV as per the common loan agreement and debenture trust deed for ₹ 180 million (₹ 180 million as at March 31, 2022, ₹ 170 million as at March 31, 2021, ₹ 170 million as at March 31, 2020).
14	Term loans from banks	Walayar Vadakkencherry Expressways Private Limited	Axis Bank Ltd	1,907.41	1,924.56	1,230.53	-	Interest rate: Interest rate (Tranch-A, B & C): 1 year Axis MCLR plus spread (based on external credit rating). October 31, 2022 : 7.50% to 7.60% p.a March 31, 2022 : 7.50% to 7.60% p.a March 31, 2021 : 7.60% p.a Repayment terms as on October 31, 2022: Repayment (Tranche-A): Remaining 34 structured quarterly instalments. Last instalment due on March 2031 Repayment (Tranche-B): Remaining 34 structured quarterly instalments. Last instalment due on March 2031. Repayment (Tranche-C): Remaining 10 structured quarterly instalments. Last instalment due on March 2025. During the year ended March 31, 2021, the WVEPL has got the existing term loans from banks and financial institution refinanced from Axis Bank Limited.	Secured by : (i) first pari-passu mortgage and charge on the SPV's immovable properties, tangible moveable assets and intangible assets (other than Project Assets specified in the Concession Agreement), including without limitation, all moveable plant and machinery, machinery spares, tools and accessories, furniture, fixtures, vehicles and other movable assets both present and future, goodwill, rights, undertaking trademarks and uncalled capital, present and future and the accounts including the escrow and sub-accounts and all funds from time to time deposited therein, the receivables and all the other movable assets both present and future and all authorized investments or other securities. (ii) first pari-passu charge-cum-assignment over the SPV's rights, titles, interest, benefits, claims and demands under each of the (a) the Project Documents (including right to be substituted as borrower in case of substitution of concessionaire in accordance with the Substitution Agreement); (b) the Government Approvals; (c) any letter of credit, guarantee and performance bond provided by any party to the Project Documents and (d) Insurance Contracts. (iii) 51% Equity shares of the SPV have been pledged with secured lenders.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
15	Term loans from banks	Walayar Vadakkencherry Expressways Private Limited	Central Bank of India (Lead Bank) Bank of India Corporation Bank Vijaya Bank Canara Bank	-	-	-	1,380.90	During the year ended March 31, 2021, the SPV has got the existing term loans from banks and financial institution refinanced with Axis Bank Limited as per the facility agreement. Interest Rate: Lead bank 1 year MCLR rate + 0.10% Term loan I: For year ended March 31, 2020 - 10.75% p.a Term loan II: For year ended March 31, 2020 - 11% p.a..	Secured by : (i) A first mortgage on all immovable assets (if any) and first charge by way of hypothecation on all moveable assets (including but not limited to all current/non-current assets)both present and future ,ranking Pari-Passu with other lenders save and except assets forming part of the project assets as defined in the Concession Agreement (ii) First-charge /assignment on all intangible assets (other than Project Assets as defined in the concession agreement) including but not limited to the goodwill, rights, undertakings and uncalled capital both present and future, ranking pari-passu with other lenders to be availed in the manner and to the extent permissible under the Concession Agreement save and except assets forming part of the Project Assets as defined in the Concession Agreement (iii) First-charge on all bank accounts including ,without limitation ,TRA/Escrow Account, and any other bank account to be established by SPV and each of the other accounts required to created by the SPV. Provided that the charge on the retention account and other bank accounts as mentioned above shall always be subject to and the payments from the accounts shall always be in the manner and only to the extent of order of priorities of payments as permitted under the Escrow Agreement (iv) A first Charge over all rights ,title and interest of the SPV related to the project from all contracts, insurances, licenses in to and under all project agreement (including the Concession Agreement) to which the borrower is party to including contractor guarantees, liquidated damages and all other contracts relating to the project ,provided such charge shall be limited to and to arise to the extent provided under Substitution agreement. (v) A pledge of 51% (fifty one percent) of the total issued, paid up and voting equity share capital of the SPV held by the Sponsor till final settlement date.
16	Term loans from banks	Farakka Raiganj Tollway Limited	State Bank of India	8,798.96	8,842.87	-	-	Interest Rate: SBI 6 month MCLR plus spread (based on external credit rating). Term loan I: For seven month period ended October 31, 2022 - Ranging from 7.90% - 8.15 p.a (March 31, 2022 - Ranging from 7.70% - 8.00% p.a.). Term loan II: For seven month period ended October 31, 2022 - Ranging from 7.90% - 8.15 p.a (March 31, 2022 - Ranging from 7.95% - 8.25% p.a.). Repayment terms as on October 31, 2022: Rupee Term Loan I & II: Remaining 54 structured quarterly instalments. Last instalment due on March 2036. During the year ended March 31, 2022, FRHL has got the existing term loans from banks and financial institution refinanced with State Bank of India as per the facility agreement.	**Rupee Term Loan I is secured by :** (i) first pari-passu mortgage and charge on the SPV's movable assets (current and non-current) and intangible assets (other than Project Assets specified in the Concession Agreement), including without limitation, all moveable plant and machinery, machinery spares, tools and accessories, furniture, fixtures, vehicles and other movable assets both present and future, all Intellectual Property Rights, goodwill and uncalled capital, both present and future. (ii) first pari-passu charge over the SPV's rights, titles, interest, benefits, claims and demands under each of (a) the Concession Agreement and all other Project Documents and Clearances (including right to be substituted as borrower in case of substitution of concessionaire in accordance with the Substitution Agreement); (b) letter of credit, guarantees including contractors guarantees, liquidated damages and performance bonds provided by any party to the Project Documents; (c) Insurance contracts, policies and insurance proceeds; (d) the accounts including the escrow and sub-accounts including any other account opened in terms of Facility Agreement and Financing Documents, and all funds from time to time deposited therein. (iii) first pari-passu charge over all current assets and all amounts, book debts, receivables and revenues owing to or received by or receivables by the SPV. **Rupee Term Loan II is secured by:** The facility together with interest, fees, commission, costs, expenses and all other monies whatsoever shall be secured by second pari-passu charge over the above mentioned security of Rupee Term Loan - I Rupee Term Loan I and II are also secured by : (i) the land as investment property is under lien by way of mortgage to SBICap Trustee Company Limited by way of charge. (ii) 51% of equity share capital and 51% by the Optionally Convertible Debentures by the holding company.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
17	Term loans from banks and NBFC's	Farakka Raiganj Tollway Limited	Corporation bank, Dena bank, Vijaya bank, OBC bank, Indian bank, Allahabad bank , Yes Bank and IIFCH	-	-	8,990.90	9,090.36	During the year ended March 31, 2022, the SPV has got the existing term loans from banks and financial institution refinanced with State Bank of India as per the facility agreement. Term loan I: Interest Rate: March 31, 2021 : 10.75% March 31, 2020 : 9.75%- 10.75% Term loan II: Interest Rate: March 31, 2021 : 11.00% March 31, 2020 : 9.75%- 11.00% Overdues in respect of interest/principal repayment: Default in repayment of interest amounting ₹ 270.30 million as on August 31, 2020. Default has been rectified subsequently in September 2020.	Secured by : a) first pari-passu mortgage and charge on the SPV's immovable properties, tangible moveable assets and intangible assets (other than Project Assets specified in the Concession Agreement), including without limitation, all moveable plant and machinery, machinery spares, tools and accessories, furniture, fixtures, vehicles and other movable assets both present and future, goodwill, rights, undertaking trademarks and uncalled capital, present and future and the accounts including the escrow and sub-accounts and all funds from time to time deposited therein, the receivables and all authorized investments or other securities. b) first pari-passu charge-cum-assignment over the SPV's rights, titles, interest, benefits, claims and demands under each of the (i) the Project Documents (including right to be substituted as borrower in case of substitution of concessionaire in accordance with the Substitution Agreement); (ii) the Government Approvals; (iii) any letter of credit, guarantee and performance bond provided by any party to the Project Documents and (iii) Insurance Contracts. c) pledge of 51% shareholding of the promoters. (d) the land as investment property is under lien by way of mortgage to SBICap Trustee Company Limited by way of charge.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
18	Term loans from banks, financial institutions and NBFC's	DA Toll Road Private Limited	1) Andhra Bank 2) Bank Of Baroda 3) Indian Bank 4) IFCI Limited 5) India Infrastructure Finance Company Limited 6) State Bank of India 7) SBI (Mauritius) Ltd. 8) Union Bank of India 9) Intesa Sanpaolo SpA	-	4,854.99	17,894.99	19,061.71	During the year ended March 31, 2022, the SPV has refinanced existing term loans with Rupee Term Loans from Axis Bank Ltd as per the facility agreement dated March 25, 2022 and proceeds from NCDs. Existing term loans (other than loan from State Bank of India of ₹ 4,840.67 million and loan from Indian Bank to the extent of ₹ 14.32 million) were repaid during year ended March 31, 2022. Outstanding Term loans from SBI and Indian Bank have been repaid during seven months period ended October 31, 2022. Interest rate: Term Loan : March 31, 2021 & March 31, 2020 : 11.50% to 13.50% p.a ECB : March 31, 2021 & March 31, 2020 : 3 month Libor + 4.44%/ 4.62% Borrowing includes amortised cost as under: a) From Banks (i) Term Loan - March 31, 2021 : ₹ 29.65 million (March 31, 2020 : ₹ 33.69 million) (ii) External Commercial Borrowings - March 31, 2021 :₹ 53.86 million (March 31, 2020 : ₹ 80.77 million) b) From financial Institutions (i) Term Loan - March 31, 2021 :₹ 15.81 million (March 31, 2020 : ₹ 17.71 million) Overdues in respect of interest/principal repayment: Default of principal & interest amounting ₹ 676.380 million and ₹ 2692.88 million respectively and hedging cost of ₹ 26.48 million as on December 31, 2020. Default has been rectified subsequently in the month of January 2021.	A. Secured by : (i) a first ranking pari passu mortgage/charge over all the Borrower's immoveable and movable properties, both present and future, except the Project Assets ; (ii) a first ranking pari passu charge on all the Borrower's bank accounts including, but not limited to the Escrow Account/ its Sub-Accounts where all revenues, Disbursements, receivables shall be deposited and in all funds from time to time deposited therein and in all Permitted Investments or other securities representing all amounts credited to the Escrow Account. (iii) a first ranking pari passu charge on all movable tangible and intangible assets of the Borrower (other than those specified in paragraphs (ii) above and (iv) below) including but not limited to its goodwill, undertaking and uncalled capital, both present and future, except the Project Assets.; (iv) a first ranking pari passu charge over / assignment by way of security in all the right, title, interest, benefits, claims and demands whatsoever of the borrower: a. in the project documents. b. in any letter of credit, guarantee including Contractors guarantees and liquidated damages and performance bond provided by any party to the project documents c. under all insurance contracts. B. Pledge of 51% of the issued and paid up equity share capital of the SPV. C. The flat at Boisar in Thane district is under pledge as security with SBI Cap Trustee Company Limited
19	Term Loans from Banks	DA Toll Road Private Limited	Axis Bank	4,839.29	7,580.95	-	-	**Interest rate:** (Facility A & B): Axis Bank 3 month MCLR plus spread (based on external credit rating). The applicable interest rate as at October 31, 2022 is 8.25% p.a. and for the year ended March 31, 2022 is 7.50% p.a. **Repayment terms as on October 31, 2022** Repayment (Facility A & B): Remaining 50 structured quarterly instalments. Last date of repayment March, 2035. Facility - C for ₹ 2400 million is undrawn as at October 31, 2022 Borrowing includes amortised cost of ₹ 32.19 million (March 31, 2022: ₹ 53.80 million). During the year ended March 31, 2022, the SPV has refinanced Rupee Term Loans from Axis Bank Ltd as per the facility agreement dated March 25, 2022 During the seven months ended October 31, 2022, Axis bank entered into a novation and assignment agreement with Aseem infrastructure Finance Limited where in Axis Bank assigned ₹ 2,692.90 millions. The new lender is bound by the same terms and conditions of the financing documents as if it had been party to such documents in the capacity of lender	Facility A is secured by way of a first ranking pari passu charge and facility B and C is secured by way of second ranking pari passu charge on:- (i) all rights, title, interests and benefits, fixed assets and tangible movable assets of the borrowers, both present and future (except the project assets) including without limitation all plant and machinery, current assets and all intangible assets of the borrower including but not limited to intellectual property rights and goodwill of the borrower, any uncalled capital of the Issuer and Sponsor Contribution received by the issuer and all other movable assets, estate, benefit, property whatsoever of the borrower unto and upon the same, both present and future. (ii) all rights, title, interests and benefits whatsoever of the borrowers in and to all the bank accounts of the borrower (including the withheld amount account subject to the terms of the settlement agreement, but excluding the DATRPL Distribution Sub- Account), both present and future including all monies, securities, instruments, investments, other properties, funding and/or financing commitments received deposited or credited in such accounts including book debts, commissions, investments, operating cash flows, assets and securities except the project assets (iii) all rights, title, interests and benefits, claim and demands both present and future except project assets in a) project documents and all assignments and concession thereunder b) all clearances obtained by the borrower to the extent permitted under applicable laws c) all letters of credit and guarantees, contracts, liquidated damages and performance bonds provided by any project participant and all claims of the borrower unto and upon the same, both present and future d) all insurance contracts and policies together with all proceeds, monies, revenues and receivables in relation thereto or arising thereunder, both present and future

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020	Interest and repayment terms	Security terms
									(iv) all monies, revenue, receivables and amount owing to or received by or receivable by the borrower, both present and future(weather under any Project documents including termination payments) or in the nature of Insurance proceeds or contractual damage or otherwise, weather such monies receivable are retained in the Escrow account or otherwise(except the project assets) and all the estate, property,rights,title, interest, benefits, claims and demands whatsoever of the Borrower in to or in respect of all the aforesaid amounts, both present and future (v) all rights,title,interests,benefits,claims and demand whatsoever of the Borrower in all the other movable assets of the borrower(except the project assets) both present and future including the borrower's cash in hand, all investments in and of the borrower and also including without limitation, the borrowers right, title and interest and in the moveable undertakings of the borrower, which description shall include all assets of the above description of the borrower weather presently in existence, constructed or acquired hereafter all the estate, benefit, property, rights, title and demands whatsoever of the borrower in, to or in respect of all the aforesaid amounts , both present and future. (vi) The facility shall be secured by a second ranking pari-passu charge over security interest over the above mentioned security of facility A and pari passu charge on 51% Equity shares of the SPV and 100% of Optionally Convertible Debentures of the SPV.
20	Term loans from NBFC's	DA Toll Road Private Limited	Aseem Infrastructure Finance Limited	2,683.58	-	-	-	Interest rate: Axis Bank 3 month MCLR plus spread (based on external credit rating). The applicable interest rate as at October 31, 2022 is 8.25% p.a. and for the period ended September 30, 2022 is 8.10% . Repayment terms as on October 31, 2022. Repayment (Facility A & B): Remaining 50 Structured quarterly instalments. Last date of repayment March, 2035. Facility - C for ₹ 2400 million is undrawn as at October 31, 2022 Borrowing includes amortised cost of ₹ 18.09 million. During the seven months ended October 31, 2022, Axis bank entered into a novation and assignment agreement with Aseem infrastructure Finance Limited where in Axis Bank assigned ₹ 2,692.90 millions.	The new lender (Assem Infrastructure Finance Limited) is bound by the same terms and conditions of the financing documents as if it had been party to such documents in the capacity of lender. For security terms refer S. N. 19 above.

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
21	Term Loan from Banks	Ghaziabad Aligarh Expressway Private Limited	1) Allahabad Bank 2) Axis Bank 3) Bank of Baroda 4) Bank of India 5) Canara Bank 6) Dena Bank 7) Indian Overseas Bank 8) Oriental Bank of Commerce 9) Punjab National Bank 10) South Indian Bank 11) State Bank of Travancore 12) Syndicate Bank 13) Union Bank of India 14) Vijaya Bank	11.93	4,710.10	7,556.96	8,330.19	During the seven month period ended October 31, 2022, the SPV has got the existing term loans from banks and financial institution refinanced with Axis Bank and L & T Finance Limited. Remaining amount of ₹ 11.93 million is repaid in November 2022. Interest rate For year ended March 31, 2022 ranges from 8.65% p.a. to 9.95% p.a. For year ended March 31, 2021 ranges from 8.95% to 15.00% p.a. For year ended March 31, 2020 - ranges from 9.95% to 11.45% p.a. Overdues in respect of interest/principal repayment: Default of principal & interest as on March 31, 2022 amounting ₹ 609.16 million (March 31, 2021- ₹ 586.68 million; March 31, 2020- ₹ 569.18 million) and ₹ 34.67 million (March 31, 2021- ₹ 175.01 million; March 31, 2020- ₹ 209.73 million) respectively. These defaults have been rectified subsequent to the respective year ends.	Secured by first charge in favour of Security Trustee: (a) Immovable Properties both present and future, save and except the Project Assets. (b) Moveable Properties of the SPV including but not limited to current and non-current assets, plant and machinery, furniture and fixtures, vehicles and all other movable assets both present and future, salve and except the Project Assets (c) All the Receivables, Bank Accounts including without limitation, the Escrow Account, the DSRA, MMRA, the Retention Account and such other bank account that may be opened in terms of the project document. (d) All Insurance Contracts/ Insurance proceeds. (e) Intangible Assets of the SPV including but not limited to the Goodwill, Rights, Undertakings and un called capital present and future. (f) Pledge of 51% of the issued and paid up equity share capital of the SPV.
22	Term loans from NBFC's	Ghaziabad Aligarh Expressway Private Limited	L & T Finance Limited	2,981.38	-	-	-	Interest rate: (Facility A, B & C): L&T Finance Ltd. 1 year PLR plus spread (based on external credit rating). The applicable interest rate for the period ended October 31, 2022 is 8.90% p.a. Repayment terms as on October 31, 2022 Repayment (Facility A, B & C): Remaining 58 structured quarterly installments. Last date of repayment March, 2037. During the period ended October 31, 2022, GAEPL has got the existing term loans from banks and financial institution refinanced with Axis Bank and L & T Finance Limited.	Term Loans of GAEPL from L&T Finance Ltd. & Axis Bank are secured by first ranking charge in favour of the Security Trustee: i) all rights, title, interest, claims, demands and benefit of the SPV in the present and future tangible moveable assets and in particular including without limitation all its plants, machinery, contstructions and structures.All intangible assets and in particular including, without limitation, goodwill, patents, trademarks and intellectual property, uncalled capital undertaking (as more particularly stipulated under Deed of Hypothecation) ii) all the rights, title, interest, benefits, claims and demands of the SPV, inter alia, under the project documents, concession agreement, insurance policies and reinsurance policies (as more particularly stipulated under Deed of Hypothecation) (iii) all the rights, title, interest, benefits, claims and demands of the SPV over all the bank accounts and all amounts in such other bank accounts and all monies, securities, instruments, investments, fixed deposits and other properties deposited in, credited to or required to be deposited in or credited to or lying to the credit of or created from such bank accounts of the SPV or libale to be credited to such bank accounts of the SPV and proceeds of all such securities, investments and fixed deposits, which description shall include all properties of the above description whether presently in existence or acquired thereafter (iv) all the current assets both present and future (excluding the project assets) of the SPV as per the Deed of Hypothecation
23	Term Loan from Banks	Ghaziabad Aligarh Expressway Private Limited	Axis Bank Limited	1,975.68	-	-	-	Interest rate: (Facility A, B & C):Axis Bank 6 month MCLR plus spread (based on external credit rating). The applicable interest rate for the period ended October 31, 2022 is 8.90% p.a. Repayment terms as on October 31, 2022 Repayment (Facility A, B & C): Remaining 58 structured quarterly installments. Last date of repayment March, 2037. During the period ended October 31, 2022, GAEPL has got the existing term loans from banks and financial institution refinanced with Axis Bank and L & T Finance Limited.	

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below: [(i)]

A **Secured Loan:**

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
24	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	SREI Equipment Finance Limited	-	-	487.92	487.92	Galfar Engineering and Contracting India Pvt Ltd (GECIPL) being the Sponsor and Guarantor of the loan from SREI Equipment Finance Limited (SEFL) has met the obligations related to loan of SEFL as on March 31, 2022 as per confirmation received from SEFL, thus became the beneficiary of the said loan vide their letter dated May 6, 2022 and loan has been transferred to GECIPL. **Interest Rate** For the year ended March 31, 2021 and March 31, 2020 shall be SREI Benchmark Rate (SBR) - 1.75% Per annum i.e. 16% p.a linked to SBR. Interest will be monthly compounding payable quarterly in arrear.	Secured by : a) 10.65% fully paid equity share of the SPV, i.e. 20,660,803 in favour of lenders as security held by Galfar Engineering and Contracting India Pvt. Ltd. (GECIPL), in favor of the lender and in such form and manner as may be required by the lender. b) 13.26%, fully paid equity share of SPV i.e. 25,724,400, in favour of lenders as security held by GECIPL ranking subservient to Existing Senior Lenders along with all the beneficial rights and interest, including ownership in favour of lender and in such form and manner as may be required by lender. c) Exclusive charge on all loan(s) and/ or investment of GECIPL in the Borrower, in any form whatsoever, present and future in such form and manner as may be required by lender d) Charge on cash flows of the Borrower ranking subservient to its Existing Senior Lenders in such form and manner as may be required by lender; e) Demand Promissory Note for the Principal and the Interest repayment in such a form and manner as may be required by lender.
	Term loan include balance taken from bank, financial institution, external commercial borrowings, related parties and others			**62,675.45**	**67,981.51**	**76,727.62**	**41,008.84**		

(i) All numbers are net of transaction / processing fees

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings refer the table below:

B Unsecured Loan:

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Significant terms and conditions of the loan (including interest and repayment terms)
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020	
1	Term Loan - Others	Walayar Vadakkencherry Expressways Private Limited	KNR Constructions Limited	280.33	274.43	422.82	-	Refer note 54 (i) of Share Purchase agreement between Walayar Vadakkencherry Expressways Private Limited and KNRCL. Loan carries nil rate of interest.
2	Term Loan - related party	Farakka Raiganj Tollway Limited	HCC Concessions Limited	-	-	-	733.12	Subordinate loan from HCC Concession Limited carry rate of Interest of 10.75% p.a. and repayable after Senior debt. Subordinate loan along with accrued interest was converted to NCD as on September 21, 2020. Refer note 54 (iii).
3	Term Loan - related party	Ghaziabad Aligarh Expressway Private Limited	Bharat Road Network Limited	-	-	481.89	481.89	GAEPL had earlier issued share warrants to the lender, which was converted into subordinate debt on March 12, 2020. Interest shall accrue and will be payable annually at 14% p.a. from the date of agreement (i.e. from the date when warrants have been converted into subordinate debt) and only when the SPV has distributable profits after paying all the expenses, statutory dues and payment to senior secured lenders. During the year ended March 31, 2022 the SPV has written back the loan liability of ₹ 481.89 million obtained from Bharat Road Network Limited. Refer note 54 (iv)
4	Term Loan - related party	Ghaziabad Aligarh Expressway Private Limited	Galfar Engineering and Contracting India Pvt Ltd	-	487.92	-	-	Being the Sponsor and Guarantor of the loan (₹ 487.92 million), Galfar Engineering has met the obligations of the GAEPL - SREI Infrastructure Finance Ltd. (SIFL) facility to SIFL directly over a period of time and as on March 31, 2022 as per confirmation received from SIFL , there is no outstanding amount under the said facility. Hence GECIPL has become the beneficiary of the said loan vide their letter dated May 06, 2022. Interest Rate applicable shall be SREI Benchmark Rate (SBR) - 1.75% Per annum i.e. 16% p.a linked to SBR. Current SBR is 17.75%. Interest will be monthly compounding payable quarterly in arrear. The loan has been repaid in full on May 26, 2022.
5	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	SREI Equipment Finance Limited (Term Loan 1)	-	799.59	731.04	731.05	The Obligation of the Borrower shall be secured by way of :- a) Exclusive charge by way of pledge of the entire issued, subscribed and fully paid up unencumbered equity shares of the Borrower in demat form held by BRNL, not less than 19.11% of the fully paid up equity share capital of the Borrower; b) Second charge by way of pledge of the issued, subscribed and fully paid up encumbered equity shares of the Borrower held by BRNL not less than 19.89% of the issued, subscribed and fully paid up equity shares of the Borrower; c) Exclusive charge on all investments (except investment in the form of shares) including but not limited to optionally convertible participative interest bearing debentures ("OCPID's) and share warrants made by BRNL in the Borrower. Applicable interest rate on loan facility is 1% p.a. fixed and interest shall be payable quarterly in arrears on interest payment date with yield on exit at 15%. The loan has been repaid in full on May 26, 2022.
6	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	SREI Equipment Finance Limited (Term Loan 2)	-	880.81	880.81	880.81	GAEPL had earlier issued share warrants to the lender, which was converted to subordinate debt on March 12, 2020. The applicable interest rate on loan facility is 14% p.a. (compounded annually) till date of actual payment. The loan has been repaid in full on May 26, 2022.
7	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	National Highway Authority of India (NHAI)	-	1,250.00	-	-	NHAI provided revenue shortfall loan to GAEPL at an interest rate equal to 2% above the Bank rate. As per the terms of the agreement, a sum equal to 50% of the 'profit before tax' of GAEPL shall be earmarked for repayment of the Revenue Shortfall Loan and interest thereon, and paid by GAEPL to the NHAI within 90 (ninety) days of the close of the Accounting Year in which such profits have been made; provided that GAEPL shall repay the entire Revenue Shortfall Loan and interest thereon not later than one year prior to the expiry of the Concession Period. Refer note 59. The loan has been settled in full on May 26, 2022.
	Total Unsecured Non Current Borrowings from others and related parties			**280.33**	**3,692.75**	**2,516.56**	**2,826.87**	

22 (i) Borrowing footnote term loans

For repayment terms and security details of the outstanding non-current borrowings refer the table below:

C Unsecured Loan (Current borrowing):

Sl. No.	Nature of borrowing	Name of SPV	Lender	As at				Significant terms and conditions of the loan (including interest and repayment terms)
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020	
1	Term Loan - Others	DA Toll Road Private Limited	Reliance Infrastructure Ltd.	-	-	-	180.50	This loan has been converted into NCD. Refer note 54 (ii)
2	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	PNC Infratech Ltd. , Galfar Engineering and Contracting India Pvt Ltd	-	2,617.24	3,407.28	3,395.80	The SPV has written back the loan liability ₹ 1,086.10 million obtained from PNC Infratech Ltd., Galfar Engineering and Contracting India Pvt Ltd. Further during the current year the SPV has adjusted debit balance of ₹ 1.74 million from loan liability pertaining to Galfar Engineering and Contracting India Pvt. Ltd. The loans are interest free loans and repayable when the SPV has residual cash flows available for distribution after payment of all expenses, statutory dues. The lender shall have the right to recall the facility at any point of time during the term of the deposit by giving prior notice of 3 working days. The loan has been repaid in full on May 26, 2022.
3	Term Loan - Others	Ghaziabad Aligarh Expressway Private Limited	Bharat Road Network Limited	-	517.00	866.36	866.36	Interest shall be accrued and payable when there us residual cash flow in GAEPL to provide minimum annual yield of 12% p.a. The loan is repayable on demand by the lender at any point of time by giving prior notice of 3 days subject to availability of free cash flow. Further, the SPV has written back the loan liability ₹ 330.81 million obtained from Bharat Road Network Limited during the year ended March 31, 2022. The loan has been repaid in full on May 26, 2022.
	Total Unsecured Current Borrowings			**-**	**3,134.24**	**4,273.64**	**4,442.66**	

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

A **Secured NCD's:**

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
1	Non Convertible Debentures	Andhra Pradesh Expressway Limited	Listed NCD	562.93	1,248.28	1,882.96	1,933.54	567 (March 31, 2022 - 1,254; March 31, 2021 - 1,892; March 31, 2020 - 1,947) secured, rated, listed and redeemable NCD of ₹ 1 million each fully paid up in seven series E to G carrying a yield to maturity of 10.00% p.a. compounded semi-annually on private placement basis. **Repayment terms as on October 31, 2022:** These NCD are redeemable in 3 structured instalments ending in October 2025. The SPV has the right to re-purchase such debentures at any time at the price available in the Debt market in accordance with the applicable laws. Series A to D were redeemed as per stipulated terms by October 31, 2022.	Secured by : - First and exclusive charge on all the following assets of the SPV in favour of the Debenture Trustee, acting for the benefit of the debenture holders; - immovable property of the SPV: - all tangible movable assets; - the escrow account and Its sub-accounts, monies standing to their credit and permitted Investments; - ail receivables (including annuity receivables from NHAI) - rights of the SPV under the project documents (other than the concession agreement) - Rights under the substitution agreement.
2	Non Convertible Debentures	Mahua Bharatpur Expressways Limited	Listed NCD's	1,526.72	1,580.15	1,682.46	1,769.53	1,540 (March 31, 2022 - 1,650; March 31, 2021 - 1,750; March 31, 2020 - 1,855) secured, rated, listed and redeemable Non-convertible debentures (NCDs) of ₹ 1 each fully paid up in two series A and B carrying a yield to maturity of 8.40% p.a. compounded semi-annually on private placement basis. **Repayment terms as on October 31, 2022:** These NCD are redeemable in 15 half yearly structured instalments and ending on March 2030. Series B was redeemed as per stipulated terms by March 31, 2021.	NCD are secured against: Except project assets as specified in the concession agreement, first pari passu charge on the following in favour of the Debenture Trustee: - All tangible movable assets and intangible assets both present and future. - All bank accounts (excluding the Distribution Account and the DRR Investments), permitted investments and all receivables along with monies received/ receivable by the SPV both present and future; - The SPV rights, titles, interest, benefits, claims and demands under the insurance contracts together with any receivables or proceeds thereunder, the Concession Agreement (in accordance with the substitution agreement) and the Project Documents along with rights thereunder.

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

A <u>Secured NCD's:</u>

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
3	Non Convertible Debentures "Series D"	Western UP Tollway Limited	L&T Infra Debt Fund Limited	-	-	598.65	763.57	**During the year ended March 31, 2022, the SPV has repaid its existing Non Convertible Debentures from the financial institutions.**	Secured by a pari-passu charge in favour of Catalyst Trustship Limited formerly known as GDA Trusteeship Limited (Security Trustee). For details refer S. No.11 of note 22(i) - Borrowing foot note term loans.
4	Non Convertible Debentures "Series B"	Western UP Tollway Limited	L&T Infrastructure Finance Co. Limited	-	-	163.04	176.21	Interest rate: (i) NCD Series B- L&T Infrastructure Finance Co.: Limited is Prime Lending Rate minus agreed Spread Rate. (ii) Benchmark rate of Secured NCD Series D- L&T Infra Debt Fund Limited is based on Credit rating. Currently SPV has Credit Rating of "A-category" as on March 31, 2021. Series B- L&T Infrastructure Finance Co.: Interest rate for the year ended March 31, 2021 and March 31, 2020 varies from - 11.20% to 11.40% p.a. Series D- L&T Infra Debt Fund Limited: Interest rate for the year ended March 31, 2021 and March 31, 2020- 9.70% p.a.	
5	Non Convertible Debentures	Jaipur Mahua Tollway Limited	India Infradebt Limited	-	-	-	1,507.50	**During the year ended March 31, 2021, SPV has redeemed the debenture issued to India Infradebt Limited from proceeds of additional disbursements of term loan from ICICI Bank Limited.** **Interest rate**: Interest Rate during the year was 9.30% per annum. Interest Payout Frequency – Payable quarterly subject to the requirements with respect to restricted payment conditions as per the common loan agreement.	Secured by a pari-passu charge in favour of Catalyst Trustship Limited formerly known as GDA Trusteeship Limited (Security Trustee). For details refer S. No.13 of note 22(i) - Borrowing foot note term loans.

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

A Secured NCD's:

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Interest and repayment terms	Security terms
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
6	Non Convertible Debentures	DA Toll Road Private Limited	Axis Bank, Morgan & Stanley & SBI Magnum	9,595.24	9,700.00	-	-	2,100 Series A Debentures and 7,600 Series B Debentures of face value ₹ 10,00,000 each issued on March 30, 2022 which got listed on April 01, 2022. The terms and conditions of the listed securities are as follows: **Interest rate:** From July 06, 2022 till October 31, 2022 is 6.6839 % per annum. From April 01, 2022 till July 05, 2022 is 6.8139 % per annum. For the year ended March 31, 2022 is 6.8139 % per annum **Repayment terms as on October 31, 2022:** Maturity date (Series A & B): March 31, 2035 Series A & B: Structured quarterly instalments with a door to door tenor of 13 years from June 30, 2022 and ending on March 31, 2035. Remaining 50 structured quarterly instalments. Last installment due on March 31, 2035.	Series A debenture is secured by way of a first ranking pari passu charge and series B is secured by way of second ranking pari passu charge on:- (i) all rights, title, interests and benefits, fixed assets and tangible movable assets of the borrowers, both present and future (except the project assets) including without limitation all plant and machinery, current assets and all intangible assets of the borrower including but not limited to intellectual property rights and goodwill of the borrower, any uncalled capital of the Issuer and Sponsor Contribution received by the issuer and all other movable assets, estate, benefit, property whatsoever of the borrower unto and upon the same, both present and future. (ii) all rights, title, interests and benefits whatsoever of the borrowers in and to all the bank accounts of the borrower (including the withheld amount account subject to the terms of the settlement agreement, but excluding the DATRL Distribution Sub- Account), both present and future including all monies, securities, instruments, investments, other properties, funding and/or financing commitments received deposited or credited in such accounts including book debts, commissions, investments, operating cash flows, assets and securities except the project assets (iii) all rights, title, interests and benefits, claim and demands both present and future except project assets in a) project documents and all assignments and concession thereunder b) all clearances obtained by the borrower to the extent permitted under applicable laws c) all letters of credit and guarantees, contracts, liquidated damages and performance bonds provided by any project participant and all claims of the borrower unto and upon the same, both present and future d) all insurance contracts and policies together with all proceeds, monies, revenues and receivables in relation thereto or arising thereunder, both present and future. (iv) all monies, revenue, receivables and amount owing to or received by or receivable by the borrower, both present and future(weather under any Project documents including termination payments) or in the nature of Insurance proceeds or contractual damage or otherwise, weather such monies receivable are retained in the Escrow account or otherwise(except the project assets) and all the estate, property,rights,title, interest, benefits, claims and demands whatsoever of the Borrower in to or in respect of all the aforesaid amounts, both present and future (v) all rights,title,interests,benefits,claims and demand whatsoever of the Borrower in all the other movable assets of the borrower(except the project assets) both present and future including the borrower's cash in hand, all investments in and of the borrower and also including without limitation, the borrowers right, title and interest and in the moveable undertakings of the borrower, which description shall include all assets of the above description of the borrower weather presently in existence, constructed or acquired hereafter all the estate, benefit, property, rights, title and demands whatsoever of the borrower in, to or in respect of all the aforesaid amounts , both present and future. The series B shall be secured by a second ranking charge over security interest over the above mentioned security of series A Further, Series A and B are secured by pari passu charge on 51% Equity shares of the DATRL and 100% of Optionally Convertible Debentures of DATRL.
	Total Secured NCD's			**11,684.89**	**12,528.43**	**4,327.11**	**6,150.35**		

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

B Unsecured OCD's:

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD/ NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
1	Optionally convertible debentures	Hazaribagh Tollway Limited	Cube Mobility Investment Pte. Ltd.	2,789.44	2,789.44	2,037.44	-	13,947,200 (March 31, 2022 - 13,947,200 ; March 31, 2021 - 10,187,200 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	Redemption: OCDs shall be redeemable on or before October 19, 2050. Premature redemption: Subject to the SPV having met all the restricted payment conditions under the senior loan agreements, the Subscriber shall have the right to seek premature redemption of the OCDs at face value with any accrued but unpaid interest on the OCDs, at any time prior to the Final Redemption Date. Coupon: Subject to the SPV having met all the restricted payment conditions as defined in the loan agreements entered with senior lenders (Secured term loan lenders), the Subscriber will be paid on quarterly basis at an annual interest rate which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter ("Coupon"). Conversion: (i) Jhansi-Lalitpur Tollway Limited : Where redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the SPV on 1:1 basis such that the face value of each equity share is ₹ 10 and security premium is ₹ 90 on 700,000 OCDs and security premium is ₹ 190 on 6,676,358 OCDs. (ii) For other SPVs: If the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the SPV on 1:1 basis.
2	Optionally convertible debentures	Jhansi-Lalitpur Tollway Limited	Cube Mobility Investment Pte. Ltd.	1,405.27	1,405.27	1,035.57	70.00	7,376,358 (March 31, 2022 - 7,376,358 ; March 31, 2021 - 5,527,850 ; March 31, 2020 - 700,000) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200/₹ 100 (March 31, 2022 - ₹ 200/₹ 100, March 31, 2021 - ₹ 200/₹ 100, March 31, 2020 - ₹ 100) each at par.	
3	Optionally convertible debentures	Jhansi-Vigakhet Tollway Limited	Cube Mobility Investment Pte. Ltd.	926.13	926.13	598.33	-	4,630,667 (March 31, 2022 - 4,630,667 ; March 31, 2021 - 2,991,650 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
4	Optionally convertible debentures	Kanyakumari-Etturavattam Tollway Limited	Cube Mobility Investment Pte. Ltd.	2,298.25	2,298.25	946.89	-	11,491,241 (March 31, 2022 - 11,491,241 ; March 31, 2021 - 4,734,450 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
5	Optionally convertible debentures	Kotwa-Muzaffarpur Tollway Limited	Cube Mobility Investment Pte. Ltd.	2,987.19	2,987.19	1,369.67	-	14,935,952 (March 31, 2022 - 14,935,952; March 31, 2021 - 6,848,350 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
6	Optionally convertible debentures	Lucknow-Raebareli Tollway Limited	Cube Mobility Investment Pte. Ltd.	957.07	957.07	897.59	-	4,785,342 (March 31, 2022 - 4,785,342; March 31, 2021 - 4,487,950 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
7	Optionally convertible debentures	Madurai Kanyakumari Tollway Limited	Cube Mobility Investment Pte. Ltd.	2,436.95	2,436.95	1,424.19	-	12,184,753 (March 31, 2022 - 12,184,753; March 31, 2021 - 7,120,950 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
8	Optionally convertible debentures	Nanguneri-Kanyakumari Tollway Limited	Cube Mobility Investment Pte. Ltd.	3,043.59	3,043.59	1,864.93	-	15,217,960 (March 31, 2022 - 15,217,960; March 31, 2021 - 9,324,650 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	
9	Optionally convertible debentures	Salaipudhur-Madurai Tollway Limited	Cube Mobility Investment Pte. Ltd.	2,146.16	2,146.16	1,033.44	-	10,730,775 (March 31, 2022 - 10,730,775; March 31, 2021 - 5,167,200 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 200 each at par.	

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

B Unsecured OCD's:

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD/ NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
10	Optionally convertible debentures	Nelamangala Devihalli Expressway Private Limited	Cube Highways and Infrastructure I-D Pte Ltd	1,151.76	1,151.76	1,151.76	-	11,517,583 (March 31, 2022 - 11,517,583; March 31, 2021 - 11,517,583 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 100 each at par.	Redemption: OCDs shall be redeemable on or before March 12, 2033. Premature redemption: The subscriber shall have the right to seek premature redemption of the OCDs at face value along with any accrued but unpaid interest on the OCDs. Premature redemption is subject to the SPV having met all the restricted payment conditions as defined under the loan agreement with senior lenders or the debenture trust deed. Coupon: Subject to the SPV having met all the restricted payment conditions as defined in the senior loan agreements, the Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter. Conversion: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the SPV at par on a 1:1 basis.
11	Optionally Convertible Debentures	Walayar Vadakkencherry Expressways Private Limited	Cube Highways and Infrastructure III Pte. Ltd.	3,033.78	3,033.78	3,033.78	-	27,579,800 (March 31, 2022 - 27,579,800; March 31, 2021 - 27,579,800 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 110 each at par.	Redemption: OCDs shall be redeemable on or before May 18, 2033 Premature Redemption: Subject to the SPV having met all the restricted payment conditions under the senior loan agreements, the Subscriber shall have the right to seek premature redemption of the part/entire OCDs at face value with any accrued but unpaid interest on the OCDs, at any time prior to the Final Redemption Date. Coupon: Subject to met all the restricted payment conditions as defined in the senior loan agreements, the Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter (“Coupon”). Conversion: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the SPV on 2:1 basis. such that the face value of each equity share is ₹ 10 (Rupees Ten) and each equity share is issued with a securities premium of ₹ 45 (Rupees forty five).

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

B Unsecured OCD's:

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD/ NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
12	Optionally Convertible Debentures	Farakka Raiganj Tollway Limited	Cube Highways and Infrastructure II PTE Limited	6,531.05	6,531.05	3,886.05	-	65,310,502 (March 31, 2022 - 65,310,502; March 31, 2021 - 38,860,502 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 100 each at par.	Redemption: OCDs shall be redeemable on or before May 4, 2041. Coupon: Subject to the SPV having met all the restricted payment conditions as defined in the senior loan agreements, the Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter (“Coupon”). Premature redemption: Subject to the SPV having met all the restricted payment conditions under the senior loan agreements, the Subscriber shall have the right to seek premature redemption of the part/entire OCDs at face value with any accrued but unpaid interest on the OCDs, at any time prior to the Final Redemption Date. Conversion: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares at par of the SPV on 1:10 basis.

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

B Unsecured OCD's:

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD/ NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
13	Optional Convertible Debentures	DA Toll Road Private Limited	Cube Highways and Infrastructure III Pte Ltd.	11,222.66	11,222.66	9,688.65	-	112,226,545 (March 31, 2022 - 112,226,545; March 31, 2021 - 96,886,545 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 100 each at par.	Redemption: OCDs shall be redeemable on or before October 16, 2038. Premature redemption: The subscriber shall have the right to seek premature redemption of the OCDs at face value along with any accrued but unpaid interest on the OCDs. Premature redemption is subject to the SPV having met all the restricted payment conditions as defined under the loan agreement with senior lenders or the debenture trust deed. Coupon: For OCD 1: Subject to the SPV having met all the restricted payment conditions as defined in the senior loan agreements, the first coupon shall be accrue on March 31, 2022 and Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter (“Coupon”). For OCD 2: Subject to the SPV having met all the restricted payment conditions as defined in the senior loan agreements, the first coupon shall be accrue on June 30, 2023 and Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and payable on December 31, March 31, June 30 and September 30 of the relevant quarter (“Coupon”). Conversion: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares of the SPV at par on a 1:10 basis.
14	Optionally convertible debentures	Andhra Pradesh Expressway Limited	Cube Highways and Infrastructure Pte Ltd	130.00	130.00	130.00	-	1,300,000 (March 31, 2022 - 1,300,000 ; March 31, 2021 - 1,300,000 ; March 31, 2020 - Nil) Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 10 each at par.	Redemption: OCDs shall be redeemable on or before September 30, 2026 by bullet repayment. Premature Redemption: The subscriber shall have the right to seek premature redemption of the OCDs at face value along with any accrued but unpaid interest on the OCDs. Premature Redemption is subject to the SPV having met all the Restricted Payment Conditions as defined under the Debenture Trust Deed for listed NCDs entered with debenture trustee read with Escrow Agreement entered with the Escrow banker. Coupon: Interest rate - 13.00 % Quarterly. However, the subscriber/ holder of the OCDs right to receive the interest is subject to the SPV having met all the Restricted Payment Conditions as defined under the Debenture Trust Deed for listed NCDs entered with debenture trustee read with Escrow Agreement entered with the Escrow banker. Conversion terms: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares at par on a 1:2 basis.

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

B **Unsecured OCD's:**

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD/ NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
15	Optionally Convertible Debentures	Ghaziabad Aligarh Expressway Private Limited	Cube Highways and Infrastructure Pte Ltd	9,350.00	-	-	-	9,35,00,000 Unsecured, Optionally convertible debentures (OCDs) having face value of ₹ 100 each at par.	Redemption date : OCDs shall be redeemable on or before March 31, 2039. Premature redemption is subject to the SPV having met all the restricted payment conditions as defined under the loan agreement with senior lenders or the debenture trust deed. The subscriber shall have the right to seek premature redemption of the OCDs at face value along with any accrued but unpaid interest on the OCDs. Coupon: Subject to the SPV having met all the restricted payment conditions as defined in the senior loan agreements, the first coupon shall accrue on June 30, 2023 with a moratorium of one year from the effective date of respective Optionally Convertible Debenture Subscription Agreement and Subscriber will be paid on quarterly basis at an annual interest rate of 13% which shall accrue and be payable on June 30, September 30, December 31, and March 31 of the relevant quarter ("Coupon") Interest payout frequency – quarterly subject to the requirements with respect to restricted payment conditions as per the common loan agreement. Conversion terms: In case where the redemption rights as mentioned above are not exercised by the Subscriber, then on the Final Redemption Date such OCDs will be, at the option of the Subscriber, convertible into equity shares at par on a 1:10 basis.
	Total OCD's			**50,409.29**	**41,059.30**	**29,098.29**	**70.00**		
	Total equity component of OCD's			**7,681.40**	**6,422.05**	**4,330.26**	**-**		
	Total debt component of OCD's			**42,727.89**	**34,637.25**	**24,768.03**	**70.00**		

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

C Unsecured NCD's

S.No.	Nature of borrowing	Name of SPV	Lender	As at				Description of OCD's / NCD's	Significant term with respect to repayment schedule and interest
				October 31, 2022	March 31, 2022	March 31, 2021	March 31, 2020		
1	Non Convertible Debentures	Andhra Pradesh Expressway Limited	Cube Infrastructure Investment Company Pte Ltd	1,250.00	1,250.00	1,250.00	1,250.00	125,00,000 Unsecured, Non convertible debentures (NCDs) having face value of ₹ 100 each at par.	Redemption: NCDs shall be redeemable on or before September 24, 2026 by bullet repayment. Premature redemption: The subscriber shall have the right to seek premature redemption of the NCDs at face value along with any accrued but unpaid interest on the NCDs. Premature Redemption is subject to the SPV having met all the Restricted Payment Conditions as defined under the Debenture Trust Deed for listed NCDs entered with debenture trustee read with Escrow Agreement entered with the Escrow banker. Coupon: Interest rate - 14.25 % (mutually agreed however the coupon rate shall not exceed SBI PLR + 500 basis points) semi-annually. Interest pay-out frequency – Semi-annually. However, the subscriber/ holder of the NCD right to receive the interest is subject to the SPV having met all the Restricted Payment Conditions as defined under the Debenture Trust Deed for listed NCDs entered with debenture trustee read with Escrow Agreement entered with the Escrow banker.
2	Non Convertible Debentures	Western UP Tollway Limited	Cube Infrastructure Investment Company Pte. Limited	2,367.81	2,367.81	2,367.81	2,367.81	23,678,101 unsecured NCDs unsecured, Redeemable Non-Convertible Debentures (“NCDs”) of ₹ 100 each fully paid up.	Redemption: NCDs are redeemable in full on February 28, 2026. Premature Redemption: The Subscriber shall have the right to seek premature redemption of the NCDs at face value along with any accrued but unpaid interest on the NCDs. Premature Redemption subject to the SPV having met all the Restricted Payment Conditions as defined under the Common Loan Agreement or the Debenture Trust Deed. Coupon: 14.30 % (Mutually agreed however the Coupon Rate shall not exceed SBI base rate + 500 basis points) Interest Payout Frequency – Payable quarterly subject to the requirements with respect to restricted payment conditions as per the common loan agreement. However, subscriber/ holder of the NCDs right to receive the interest is subject to the SPV having met all the Restricted Payment Condition as defined under the Seller subordinate loan.
3	Non Convertible Debentures	Jaipur Mahua Tollway Limited	Cube Infrastructure Investment Company Pte. Limited	19.35	88.69	1,093.69	1,093.69	193,533 (March 2022: 886,900 ; March 2021: 1,09,36,900 ; March 2020: 1,09,36,900) unsecured, Non-convertible debentures (NCDs) having face value of ₹ 100 each at par.	Redemption: NCDs are redeemable in full on May 22, 2031. Premature Redemption: The subscriber shall have the right to seek premature redemption of the NCDs at face value along with any accrued but unpaid interest on the NCDs. Premature redemption is subject to the SPV having met all the restricted payment conditions as defined under the common loan agreement or the debenture trust deed. Coupon: Interest on the NCDs will be chargeable at an annual interest rate of SBI Base + 500 bps, or lower as mutually agreed, (payable annually) from the date of issuance of such NCDs. Present rate of interest is 14.30%. However, subscriber/ holder of the NCDs right to receive the interest is subject to the SPV having met all the Restricted Payment Condition as defined under the Seller subordinate loan.

22 (ii) Borrowing footnote OCD/NCD

For repayment terms and security details of the outstanding non-current borrowings (including current maturities) refer the table below:

4	Non Convertible Debentures	DA Toll Road Private Limited	Reliance Infrastructure Ltd.	3,346.25	3,215.48	3,102.54	-	5,252,059,146 Unsecured, NCDs of ₹ 1 each fully paid up on private placement basis to Reliance Infrastructure Limited ("RIL"). For other details and status of various tranche - refer Note 54 (ii).	Redemption: The estimated redemption date of the various tranches of these NCDs are from December 31, 2020 to September 30, 2022. Refer note 54 (ii) Coupon: The NCDs carry coupon rate of 0% per annum on the maturity amount including redemption premium payable while redeeming relevant tranche of NCDs.
5	Non Convertible Debentures	Mahua Bharatpur Expressways Limited	Cube Infrastructure Investment Company Pte Ltd	772.95	792.74	792.74	792.74	7,927,379 Un-secured, Non-convertible debentures (NCDs) having face value of ₹ 100 each at par.	Redemption: NCDs are redeemable in full on April 28, 2031. These Non Convertible Debentures are subordinate to the listed secured Non Convertible Debentures Premature Redemption: The Subscriber shall have the right to seek premature redemption of the NCD at face value along with any accrued but unpaid interest on the NCD. Premature Redemption subject to the SPV having met all the Restricted Payment Conditions as defined under the Debenture Trust Deed entered with the listed secured NCD. Coupon: Interest on the NCD will be chargeable at an annual Interest Rate of SBI Base + 500 bps, or lower as mutually agreed, (Payable annually) from the date of issuance of such NCD. Present rates of interest ranges from 14.25% to 14.30%. However, the subscriber/ holder of the NCD right to receive the interest is subject to the SPV having met all the Restricted Payment Condition as defined under the Debenture Trust deed entered with the listed secured NCD.
6	Non Convertible Debentures	Farakka Raiganj Tollway Limited	HCC Concessions Limited	127.93	152.13	2,074.47	-	121,055,946 debentures of ₹ 1 each fully paid up. Also refer note 54 (iii) for further details.	Redemption: The original estimated redemption date of the various tranches of these NCDs are from March 31, 2021 to September 30, 2025 . Coupon: 10% per annum on the maturity amount including redemption premium payable while redeeming relevant tranche of NCDs. Redemption premium: FRHL will pay the redemption premium amount when the respective redemption event is met and while redeeming relevant tranche of NCDs. Also refer note 54 (iii) for further details.
	Total NCD's			**7,884.29**	**7,866.85**	**10,681.25**	**5,504.24**		
	Total equity component of NCD's			**-**	**-**	**-**	**-**		
	Total debt component of NCD's			**7,884.29**	**7,866.85**	**10,681.25**	**5,504.24**		

23 Other non-current financial liabilities

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Interest accrued but not due on debentures	4,777.49	3,335.10	1,615.73	809.51
	4,777.49	**3,335.10**	**1,615.73**	**809.51**

24 Non-current trade payables

Total outstanding dues of micro enterprises and small enterprises [Refer note 52]	0.41	6.04	1.65	0.96
Total outstanding dues to creditors other than micro enterprises and small enterprises	32.73	6.52	8.66	23.15
	33.14	**12.56**	**10.31**	**24.11**

Credit period varies as per the contractual terms of various suppliers/vendors. The Proposed Trust Group has appropriate policy in place to ensure that all dues are paid within the credit terms agreed with the parties. Also, refer note 46 (ii) A for Proposed Trust Groups credit risk management policy.

25 Non-current provisions

Provision for employee benefits				
- Gratuity [Refer note 42]	18.18	16.84	11.39	15.87
- Compensated absences	11.73	11.61	6.76	10.03
Provisions for infrastructure upgrade work, etc [Refer note 51 (b)]	488.03	466.60	430.71	-
Provision for periodic major maintenance works [Refer note 51 (a)]	3,041.89	2,808.42	2,952.48	3,901.20
	3,559.83	**3,303.47**	**3,401.34**	**3,927.10**

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
26 Deferred Tax Asset/Liabilities				
26A Deferred tax liabilities (net)				
Deferred tax liability arising on account of :				
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	5,960.04	5,075.36	2,939.75	1,762.74
Unamortised processing fees on borrowings	302.80	333.48	220.36	-
Income taxable on receipt basis	7.19	39.25	40.86	-
Equity component of optionally convertible debentures	2,101.03	1,773.61	1,261.42	-
Deferred tax asset arising on account of :				
Unused tax losses carried forward	(72.64)	-	(319.32)	-
Interest disallowed u/s 94B of Income-tax Act, 1961 carried forward	(137.00)	(76.94)	(9.58)	-
Expense allowed in tax on payment basis	(1,256.69)	(1,097.80)	(298.65)	-
Unabsorbed depreciation carried forward	(5,920.25)	(4,986.97)	(2,568.29)	(1,198.46)
MAT credit entitlement	(373.98)	(282.88)	(194.82)	(95.51)
Deferred tax liabilities (net)	**610.50**	**777.11**	**1,071.73**	**468.77**
26B Deferred tax assets (net)				
Deferred tax liabilities arising on account of :				
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	(310.03)	(363.49)	(489.19)	(489.93)
Unamortised processing fees on borrowings	(1.02)	(1.46)	(2.35)	(44.78)
Income taxable on receipt basis	-	-	-	(26.06)
Deferred tax assets arising on account of :				
Unused tax losses carried forward	502.55	542.69	674.50	1,052.57
Interest disallowed u/s 94B of Income-tax Act, 1961 carried forward	44.40	36.94	14.76	-
Expense allowed in tax on payment basis	21.14	1.02	1.22	2.49
MAT credit entitlement		-	-	-
Deferred tax assets (net)	**257.04**	**215.70**	**198.94**	**494.29**

Movement in deferred tax liabilities (net)

Particulars	Balance as at April 01, 2022	Recognised in Special Purpose Combined Statement of Profit and Loss	Recognised in other comprehensive income/ equity	Balance as at October 31, 2022
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	(5,438.86)	(831.21)	-	(6,270.07)
Unamortised processing fees on borrowings	(334.94)	31.12	-	(303.82)
Income taxable on receipt basis	(39.25)	32.06	-	(7.19)
Equity component of optionally convertible debentures	(1,773.61)	-	(327.42)	(2,101.03)
Unused tax losses carried forward	542.70	32.49	-	575.19
Interest disallowed u/s 94B of Income-tax Act, 1961 carried forward	113.88	67.52	-	181.40
Expense allowed in tax on payment basis	1,098.82	178.26	0.75	1,277.83
Unabsorbed depreciation carried forward	4,986.97	933.28	-	5,920.25
MAT credit entitlement	282.88	91.10	-	373.98
Total deferred tax assets/(liabilities)	**(561.41)**	**534.62**	**(326.67)**	**(353.46)**

Particulars	Balance as at April 01, 2021	Recognised in Special Purpose Combined Statement of Profit and Loss	Recognised in other comprehensive income/ equity	Balance as at March 31, 2022
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	(3,428.93)	(2,009.93)	-	(5,438.86)
Unamortised processing fees on borrowings	(222.71)	(112.23)	-	(334.94)
Income taxable on receipt basis	(40.86)	1.61	-	(39.25)
Equity component of optionally convertible debentures	(1,261.42)	-	(512.19)	(1,773.61)
Unused tax losses carried forward	993.82	(451.12)	-	542.70
Interest disallowed u/s 94B of Income-tax Act, 1961 carried forward	24.33	89.55	-	113.88
Expense allowed in tax on payment basis	299.86	798.63	0.32	1,098.82
Unabsorbed depreciation carried forward	2,568.29	2,418.68	-	4,986.97
MAT credit entitlement	194.82	88.06	-	282.88
Total deferred tax assets/(liabilities)	**(872.80)**	**823.25**	**(511.87)**	**(561.41)**

Particulars	Balance as at April 01, 2020	Recognised in Special Purpose Combined Statement of Profit and Loss	Recognised in other comprehensive income/ equity	Balance as at March 31, 2021
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	(2,252.66)	(1,176.27)	-	(3,428.93)
Unamortised processing fees on borrowings	(44.78)	(177.93)	-	(222.71)
Income taxable on receipt basis	(26.06)	(14.80)	-	(40.86)
Equity component of optionally convertible debentures	-	-	(1,261.42)	(1,261.42)
Unused tax losses carried forward	1,052.57	(58.75)	-	993.82
Interest disallowed u/s 94B of Income-tax Act, 1961 carried forward	-	24.33	-	24.33
Expense allowed in tax on payment basis	2.49	302.02	(4.65)	299.86
Unabsorbed depreciation carried forward	1,198.46	1,369.83	-	2,568.29
MAT credit entitlement	95.51	99.31	-	194.82
Total deferred tax assets/(liabilities)	**25.53**	**367.74**	**(1,266.07)**	**(872.80)**

Particulars	Balance as at April 01, 2019	Recognised in Special Purpose Combined Statement of Profit and Loss	Recognised in other comprehensive income/ equity	Balance as at March 31, 2020
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	(194.49)	(2,058.17)	-	(2,252.66)
Unamortised processing fees on borrowings	(52.09)	7.31	-	(44.78)
Income taxable on receipt basis	(49.36)	23.30	-	(26.06)
Unused tax losses carried forward	32.93	1,019.64	-	1,052.57
Expense allowed in tax on payment basis	4.00	(3.46)	1.95	2.49
MAT credit entitlement	50.99	44.52	-	95.51
Total deferred tax assets/(liabilities)	**(208.02)**	**231.60**	**1.95**	**25.53**

Also, refer note 41 (ii) for unrecognised deferred tax.

27 Current borrowings	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Current maturities of long term borrowings [Refer note 22]	6,122.31	14,368.39	8,882.37	5,090.92
Short term loans [Refer note 22(i) C]				
- Loan from erstwhile shareholder	-	-	-	180.50
- Loan repayble on demand	-	3,134.23	4,273.64	4,262.16
	6,122.31	**17,502.62**	**13,156.01**	**9,533.58**

28 Trade payables

Current

Total outstanding dues of micro enterprises and small enterprises [Refer note 52]	143.31	144.75	148.88	57.86
Total outstanding dues to creditors other than micro enterprises and small enterprises	2,490.04	1,876.01	2,465.72	1,687.61
	2,633.35	**2,020.76**	**2,614.60**	**1,745.47**

Credit period varies as per the contractual terms of various suppliers/vendors. The Proposed Trust Group has appropriate policy in place to ensure that all dues are paid within the credit terms agreed with the parties. Also, refer Proposed Trust Group's credit risk management policy.

29 Other financial liabilities

Current

Interest accrued and due on borrowings	50.35	63.64	194.52	1,512.24
Interest accrued but not due on retention money	-	-	8.15	-
Interest accrued but not due on borrowings	-	26.70	12.05	79.95
Interest accrued but not due on debentures	3,650.87	3,031.79	1,578.08	2,568.91
Security deposits	4.15	1.81	5.29	4.17
Payable for punch list items	-	37.79	41.16	41.16
Payable pursuant to share purchase agreement [Refer note 54 (iii)]	-	-	7,740.91	-
Payable to NHAI	33.83	573.28	50.86	-
Creditors for capital supplies and services	470.87	270.37	616.60	4,472.92
Payable to related party [Refer note 48]	-	0.19	0.23	-
Other payable	29.58	187.57	90.03	111.89
	4,239.65	**4,193.14**	**10,337.88**	**8,791.24**

30 Other current liabilities

Statutory dues payable	70.20	226.30	294.48	78.53
Advance from customers	-	-	0.19	2.47
	70.20	**226.30**	**294.67**	**81.00**

31 Provisions

Current

Provision for employee benefits				
- Gratuity [Refer note 42]	1.68	4.27	2.68	3.84
- Compensated absences	1.80	1.17	1.76	0.83
Provisions for infrastructure upgrade work, etc [Refer note 51 (b)]	2,886.40	3,310.54	10,050.42	-
Provision for periodic major maintenance works [Refer note 51 (a)]	3,264.10	7,755.84	2,868.49	0.70
Provision for damages [Refer note 44]	-	-	41.61	-
	6,153.98	**11,071.82**	**12,964.96**	**5.37**

		For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
32	**Revenue from operations**				
	Revenue from toll fee collections	13,103.69	18,685.58	12,884.98	10,474.47
	Construction income	806.91	1,415.52	2,337.09	1,083.29
	Operation and maintenance income	128.47	197.11	187.71	178.77
	Finance Income on annutiy receivables	110.86	245.23	296.23	273.26
	Revenue from additional work (net of related cost)	-	6.96	2.88	34.08
	Renewals and overlay income	31.03	-	-	1,185.86
	Claims for compensation/ concession extension [Refer note 6 (ii)]	-	-	576.30	41.19
		14,180.96	**20,550.40**	**16,285.19**	**13,270.92**
33	**Other income**				
	Interest on financial assets carried at amortised cost:				
	- bank deposits	305.94	399.32	240.68	141.98
	- electricty deposits	-	-	0.07	0.01
	- other financial assets	-	0.16	0.18	18.83
	Interest on income tax refund	1.39	4.53	12.62	22.30
	Interest on others - SPA transaction [Refer note 54 (iii)]	-	16.58	31.40	-
	Sale of scrap	1.17	1.72	4.59	1.79
	Insurance claim received	1.18	6.68	24.44	11.08
	Net gain on sale of mutual funds	1.99	95.49	11.12	7.11
	Net gain on investments measured at fair value through profit and loss	11.84	-	8.27	1.12
	Gain on cash flows changes on non - convertible debentures (net)	-	-	19.38	-
	Net foreign exchange gain	-	-	101.50	-
	Profit on sale/write off of property, plant and equipment (net)	0.15	2.12	-	-
	Liabilities no longer required written back / Remission in loan liability	44.43	220.68	55.80	125.32
	Claim receivable on NHAI settlement [Refer note 59]	-	132.40	-	-
	Deferred share warrant income	-	-	-	287.62
	Miscellaneous income	10.27	142.23	3.35	5.10
		378.36	**1,021.91**	**513.40**	**622.26**
34	**Cost of construction**				
	Construction cost	799.02	1,387.77	2,308.40	1,073.05
		799.02	**1,387.77**	**2,308.40**	**1,073.05**
35	**Operation and maintenance expenses**				
	Periodic major maintenance expense [Refer note 51]	471.93	5,123.47	1,919.57	2,192.74
	Repair and maintenance of carriageway	1,018.57	1,691.42	820.94	397.88
	Toll operation expenses	522.07	917.46	614.77	622.99
	Security charges	73.31	157.73	125.49	93.48
	Change of scope expenses	5.54	-	-	-
	Vehicle hire charges	158.58	206.80	58.55	27.50
	Power and fuel	133.33	168.70	106.59	89.74
	Route patrolling expenses	37.82	65.56	69.72	43.68
	Professional charges - site	56.29	73.66	75.17	62.58
	Miscellaneous expenses	0.08	0.02	8.66	1.47
		2,477.52	**8,404.82**	**3,799.46**	**3,532.06**
36	**Employee benefits expense**				
	Salary and wages	168.09	266.40	179.48	180.05
	Gratuity expenses [Refer note 42]	4.56	5.57	5.14	5.93
	Contribution to provident and other funds	9.92	18.50	14.75	14.86
	Staff welfare expenses	9.29	15.94	11.28	10.48
		191.86	**306.41**	**210.65**	**211.32**

		For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
37	**Other expenses**				
	Rent [(i)]	3.10	5.41	5.40	8.22
	Management service charges	281.31	446.28	215.03	92.47
	Rates and taxes	14.31	22.59	6.75	14.68
	Advertising expenses	1.02	1.24	0.88	1.40
	Insurance expense	144.12	246.47	167.81	89.98
	Legal and professional fees	61.43	130.90	131.75	60.74
	Payments to auditors (including indirect taxes):				
	- As auditors	14.09	23.82	15.87	7.25
	- Other services	0.24	1.09	1.20	1.11
	- Out of pocket expenses	0.56	0.17	0.26	0.14
	Travelling and conveyance	13.68	23.24	12.34	15.70
	Printing and stationary	2.89	4.14	2.93	1.83
	Communication expenses	5.77	11.14	5.25	2.66
	Provision for damages [Refer note 44]	-	-	41.61	-
	Penalty to NHAI for delay in execution of major Maintenance expenses	-	94.99	26.82	-
	Impairment on investment property	-	-	0.47	1.41
	Impairment loss allowance on trade receivables/unbilled revenues	-	39.11	4.35	13.40
	Doubtful advance/balances written off	1.08	1.73	37.99	0.06
	Bad debts written off (net of adjustments from impairment loss allowance on trade receivables)	-	3.98	3.85	3.77
	Information Technology related cost	12.76	10.92	5.52	13.05
	Royalty expenses [Refer note 54 (iii)]	40.95	150.28	282.83	-
	Net loss on foreign currency transaction	0.30	26.86	-	-
	Corporate social responsibility expense	15.51	22.24	7.63	5.77
	Loss on write-off of property, plant and equipment	-	-	0.44	0.06
	Miscellaneous expenses	16.82	31.68	38.13	17.41
	Total	**629.94**	**1,298.28**	**1,015.11**	**351.11**

(i) The Proposed Trust Group has taken office premises on lease for which average lease term is 11 months (Short Term Leases).

38	**Finance costs**				
	Interest for financial liabilities classified at amortised cost:				
	- term loans	2,898.28	6,487.79	6,138.88	4,265.27
	- other secured loans	10.67	92.70	92.70	89.70
	- unsecured loans	94.52	924.41	863.62	422.90
	- non-convertible debentures	1,060.14	1,348.70	1,449.48	1,403.33
	- optionally convertible debentures	3,574.87	4,029.71	1,225.81	1.14
	Interest on delayed payment of statutory dues	0.20	45.60	53.90	0.30
	Interest on delayed payment to MSME vendors	13.42	1.42	0.53	0.70
	Interest others	46.05	1.42	8.15	0.49
	Unwinding of interest:				
	- on processing fees	57.75	203.03	87.21	58.42
	- on major maintenance / infrastructure upgrade	95.22	589.23	342.36	244.45
	- on unsecured loan	5.91	9.51	4.50	294.71
	- on interest accrued for non-convertible debentures	37.81	112.73	16.54	-
	- on financial guarantee	-	-	4.95	4.94
	- on security deposit	-	0.01	0.01	0.15
	Derivative hedging cost	12.17	29.64	101.08	40.20
	Other borrowing costs	27.10	64.34	27.74	11.05
		7,934.11	**13,940.24**	**10,417.46**	**6,837.75**

39	**Depreciation and amortisation expense**				
	Depreciation of property, plant and equipment	20.71	29.31	14.95	12.24
	Amortisation of intangible assets	3,514.70	5,463.40	3,763.08	3,243.49
		3,535.41	**5,492.71**	**3,778.03**	**3,255.73**

40 Earnings Per Unit (EPU)

The number of units that Cube Highways Trust will issue to investors in connection with the proposed private placement is not presently ascertainable. Hence, the disclosures in respect of Earnings per Unit have not been given.

41 Tax expense

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
(i) Income tax expense recognised in Special Purpose Combined Statement of Profit and Loss				
Current tax	93.85	92.46	1,102.03	44.52
Tax for earlier years	-	(6.79)	20.91	-
Deferred tax	(534.62)	(823.25)	(367.76)	(231.58)
	(440.77)	**(737.58)**	**755.18**	**(187.06)**

The major components of income tax expense and the reconciliation of expense based on the respective effective tax rate and the reported tax expense in profit or loss are as follows :

Particulars				
Loss before tax	(1,008.54)	(8,989.25)	(1,654.18)	(1,523.93)
Blended Tax Rate [(i)]	24.65%	27.38%	27.96%	29.24%
Expected tax expense [A]	**(248.65)**	**(2,461.16)**	**(462.50)**	**(445.51)**
Tax effect of adjustment to reconcile expected income tax expense to reported income tax expense:				
Effect of transactions that are not considered in determining taxable income	21.13	114.66	80.26	18.58
Tax effect of amounts directly credited to other equity and considered for determining taxable income	-	-	128.06	-
Impact due to change in estimates relating to tax adjustments arising on filling of income tax return, adoption of new tax regime u/s 115BAA/ holiday period, etc.	-	(189.74)	(188.20)	(54.40)
Effect due to change in tax rate	-	9.78	29.90	-
Effect of income that is exempt from taxation u/s 80 IA of the Income-tax Act, 1961	(194.19)	(237.14)	(71.06)	-
Effects of unrecognised deferred tax on deductible temporary differences and tax losses including those reversing or originating and reversing during tax holiday period u/s 80IA of the Income tax act, 1961				
Difference between carrying value of property, plant and equipment, intangible assets and receivable under service concession arrangement as per books and tax	42.84	(98.13)	(141.00)	(263.50)
Income taxable on receipt basis	-	-	(0.60)	(0.08)
Expense allowed in tax on payment basis	(33.08)	733.41	249.34	(170.94)
Unamortised processing fees on borrowings	-	321.83	3.32	1.32
Unabsorbed depreciation and carry forward losses	(181.78)	721.88	1,065.94	720.91
Interest disallowed u/s 94B of the Income-tax Act, 1961 carried forward	152.96	369.82	24.81	6.56
MAT credit entitlement	-	(16.00)	16.00	-
Total adjustments [B]	**(192.12)**	**1,730.37**	**1,196.77**	**258.45**
Tax Related to earlier years [C]	**-**	**(6.79)**	**20.91**	**-**
Actual tax expense [D=A+B+C]	**(440.77)**	**(737.58)**	**755.18**	**(187.06)**

Note:
(i) Applicable SPV wise tax rate ranges between 25.17% - 31.20%. Blended tax rate has been considered for effective tax rate reconciliation.

(ii) Unrecognised deferred tax:

Deferred tax assets/(liability) has not been recognised in respect of following items because the said temporary differences, business losses etc. will reverse during the holiday period u/s 80IA of the Income-tax Act, 1961 and deferred tax assets are not recognised in the absence of reasonable certainty that future taxable amounts will be available to utilize these temporary differences and business losses:

Particulars				
Business losses and unabsorbed depreciation	20,681.78	20,613.35	19,337.89	16,505.39
Interest disallowed under section 94B of the Income Tax Act, 1961	2,345.91	1,937.04	489.45	399.33
Minimum Alternate Tax (MAT) credits	-	-	748.94	732.94
Reversal of Minimum Alternate Tax (MAT) Credits	-	(16.00)	-	-
Difference between tax written down value (WDV) and book WDV of intangible assets	(2,684.21)	(2,815.19)	(2,762.69)	(2,936.81)
Expense allowed in tax on payment basis	1,918.96	4,787.68	1,772.06	1,069.06
Total	**22,262.44**	**24,506.88**	**19,585.65**	**15,769.91**

(iii) Unused business loss can be carried forward based on the year of origination as follows:

Financial year/period of origination	Financial year of expiry	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
March 31, 2021	March 31, 2029	767.72	382.03	420.91	-
March 31, 2022	March 31, 2030	1,916.63	950.27	-	-
March 31, 2023	March 31, 2031	341.96			

(iv) Minimum alternate tax (MAT):

Tax credits have been recognised on the basis that recovery is probable in the foreseeable future. This recognised MAT credit expires, if unused, based on the year of origination as follows:

Financial year/period of origination	Financial year of expiry	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
March 31, 2021	March 31, 2036	-	-	16.00	-

42 Disclosure relating to employee benefits pursuant to Ind AS 19 - Employee Benefits

(a) Defined contribution plan

The Proposed Trust Group's contribution to Provident Fund amounts to ₹9.62 million (March 31, 2022: ₹17.42 million; March 31, 2021: ₹13.35 million; March 31, 2020: ₹12.58 million) has been recognised in the Special Purpose Combined Statement of Profit and Loss under the head Employee benefit expenses.

(b) Defined benefit plans

The Proposed Trust Group provides for gratuity for employees in India as per The Payment of Gratuity Act, 1972. Employees who are in continuous service for 5 years are eligible for gratuity. The amount of gratuity payable on retirement/termination is the employees last drawn basic salary per month completed proportionately for 15 days salary multiplied for number of completed years of service. The gratuity plan is funded plan for 2 SPVs viz. DATRL and WUPTL, these 2 SPVs makes contribution to recognised funds with Life Insurance Corporation of India (pension and group schemes department). For other SPVs, the Proposed Trust Group operates the unfunded gratuity scheme.

The gratuity scheme covers substantially all regular employees. Commitments are actuarially determined at year-end. The actuarial valuation is done based on "Projected Unit Credit" method. Gains and losses of changed actuarial assumptions are charged to Special Purpose Combined Statement of Profit and Loss.

Gratuity

(i) **Amount recognised in the Special Purpose Combined Statement of Profit and Loss is as under:**

Description	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
Current Service Cost	4.22	5.44	3.84	5.19
Past Service Cost including curtailment (gain)/losses	-	-	-	-
Total Service Cost	**4.22**	**5.44**	**3.84**	**5.19**

(ii) **Net Interest Cost**

Description				
Interest cost on defined benefit obligations	0.93	1.05	2.00	1.64
Interest income on plan assets	(0.59)	(0.92)	(0.70)	(0.90)
Net Interest Cost	**0.34**	**0.13**	**1.30**	**0.74**

(iii) **Bifurcation of Actuarial (loss)/gain on obligations:**

Description				
Actuarial (loss)/gain on arising from change in demographic assumption	0.23	-	(0.01)	(0.73)
Actuarial (loss)/gain on arising from change in financial assumption	0.33	(3.00)	3.10	(0.74)
Actuarial (loss)/gain on arising from experience adjustment	(3.43)	1.41	15.65	(5.95)
Actuarial (loss)/gain on for the period/year on obligations	**(2.87)**	**(1.59)**	**18.74**	**(7.42)**

(iv) **Actuarial (loss)/gain on plan asset**

Description				
Actual income on plan asset	0.59	0.92	0.90	0.85
Expected interest income	(0.59)	(0.92)	(0.70)	(0.90)
Actuarial (loss)/gain for the period/year on plan asset	**-**	**-**	**0.20**	**(0.05)**

(v) **Other Comprehensive Income (OCI)**

Description				
Actuarial (loss)/gain for the period/year on DBO	(2.87)	(1.59)	18.74	(7.42)
Actuarial (loss)/gain for the period/year on plan asset	-	-	0.20	(0.05)
Unrecognized actuarial (loss)/gain for the period/year	**(2.87)**	**(1.59)**	**18.94**	**(7.47)**

(vi) **Change in plan assets**

Description				
Fair value of plan assets at the beginning of the period/year	14.56	13.64	12.74	11.89
Actual return on plan assets	0.59	0.92	0.90	0.85
Employer contribution	-	-	-	-
Benefit paid	-	-	-	-
Fair value of plan assets at the end of the period/year	**15.15**	**14.56**	**13.64**	**12.74**

(vii) **Change in defined benefit obligations**

Description	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Defined benefit liability at the start of the period/year	23.00	15.19	32.45	21.94
Adjustments related to employees transferred to/from fellow subsidiaries	(0.24)	-	(0.29)	0.01
Interest Cost	0.93	1.05	2.00	1.64
Current service cost	4.22	5.44	3.84	5.19
Re-measurements (gain)/loss for the period/year	2.87	1.59	(18.74)	7.42
Benefit paid directly by the Proposed Trust Group	(7.96)	(0.27)	(4.07)	(3.75)
Defined benefit liability at the end of the period/year	**22.82**	**23.00**	**15.19**	**32.45**

(viii) **The amount included in the special purpose combined balance sheet arising in respect of its defined benefit obligations/plans**

Description				
Present value of defined benefit obligations/ plans	22.82	23.00	15.19	32.45
Fair value of plan assets [(i)]	(15.15)	(14.56)	(13.64)	(12.74)
Net defined benefit obligations	**7.67**	**8.44**	**1.55**	**19.71**

Bifurcation of Present Benefit Obligations (PBO) and Plan Assets at the end of period/year in current and non current

Description				
Current provision (Amount due within one year)	1.68	4.27	2.68	3.84
Non-Current provision (Amount due after one year)	18.18	16.84	11.39	15.87
Total PBO at the end of period/year	**19.86**	**21.11**	**14.07**	**19.71**
Net plan assets at the end of period/year	12.19	12.67	12.52	-
Net PBO at the end of period/year	**7.67**	**8.44**	**1.55**	**19.71**

(x) **Sensitivity analysis for gratuity liability:**

Description				
Impact of change in discount rate				
Present value of obligations at the end of the period/year	**22.82**	**23.00**	**15.19**	**32.45**
- Impact due to decrease of 0.50%	1.31	1.59	0.73	1.37
- Impact due to increase of 0.50%	(1.20)	(0.85)	(0.71)	(1.32)
Impact of change in salary increase				
Present value of obligations at the end of the period/year	**22.82**	**23.00**	**15.19**	**32.45**
- Impact due to decrease of 0.50%	(1.16)	(0.53)	(0.59)	(1.55)
- Impact due to increase of 0.50%	1.24	1.23	0.61	1.59

The above sensitivity analysis is based on a change an assumption while holding all other assumptions constant. In practice, this is unlikely to occur and changes in some of the assumptions may be correlated. When calculating the sensitivity of the defined benefit obligations to significant actuarial assumptions the same method (present value of the defined benefit obligations calculated with the projected unit credit method at the end of the reporting period) has been applied which was applied while calculating the defined benefit obligations liability recognised in the Special Purpose Combined Balance Sheet.

Sensitivities due to mortality and withdrawals are not material and hence impact of change due to these not calculated.
Sensitivities as rate of increase of pensions in payment, rate of increase of pensions before retirement and life expectancy are not applicable.

The methods and types of assumptions used in preparing the sensitivity analysis did not change compared to previous periods.

(xi) **Actuarial assumptions:**

Description				
Discount rate range	7.25% - 7.30%	6.95% - 7.25%	6.76% - 7.00%	5.45% - 7.00%
Rate of increase in compensation levels range	5.00% - 10.00%	5.00% - 10.00%	5.00% - 7.50%	3.00% - 10.00%
Retirement age	58 years	58 years	58 years	58 - 60 years
Mortality rate	100% of IALM (2012-14)	100% of IALM (2012-14)	100% of IALM (2012-14)	100% of IALM (2012-14)
Attrition at age (Withdrawal rate %)				
Up to 30 Years	5.00% - 9.00%	5.00% - 9.00%	5.00% - 9.00%	5.00% - 20.00%
From 31 to 44 years	5.00% - 9.00%	5.00% - 9.00%	5.00% - 9.00%	5.00% - 20.00%
Above 44 years	5.00% - 9.00%	5.00% - 9.00%	5.00% - 9.00%	1.00% - 20.00%

Notes:

(i) The plan assets are maintained with LIC of India Gratuity scheme. The details of investment maintained by LIC are not available and therefore not been disclosed.

(This space has been intentionally left blank)

43 Capital and other commitments

Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Estimated amount of contracts remaining to be executed on capital account not provided for (Net of Advance) towards:				
- Property, plant and equipment	7.83	2.23	0.82	472.59
- Intangible assets- Rights under Service Concession Arrangements	4,986.85	264.22	1,331.92	132.97

The Proposed Trust Group has other commitments for purchase orders which are issued after considering requirements per operating cycle for purchase of goods and services in normal course of business. The Proposed Trust Group does not have any other long term commitments or material non-cancellable contractual commitments/contracts, which might have material impact on the Special Purpose Combined Financial Statements.

44 Contingent liabilities and claims

i) Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Claims against the Proposed Trust Group not acknowledged as debt				
a) In respect of Income-tax matters, disputed by SPVs	53.39	59.84	35.78	67.64
b) In respect of Indirect tax matters (VAT/Entry tax/Service tax/GST) disputed by SPVs	319.83	321.87	1.39	1.39
c) **Project related claims in FRHL [(i)]:**				
(i) Project related claims by EPC contractor, payable on receipt from NHAI	-	-	-	10,959.27
(ii) Project related claims (Including negative change of scope and collection of toll on overloaded vehicles) from NHAI.	-	-	-	1,874.05
d) Damages/penalties etc. claimed by NHAI for non fulfilment of certain conditions of the concession agreement by certain Companies (net).	53.27	42.14	42.14	-
e) Differences in balance as per bank loan confirmations and books of accounts mainly on account of interest rate resetting are under reconciliation with the banks. The Proposed Trust Group expect to settle these soon and do not anticipate any further liability on account of interest [(ii)]	-	-	-	7.82

f) WVEPL received an Award dated January 28, 2019 from the Arbitral Tribunal in the matter of adjudication of disputes between SPV and NHAI in connection with the work for Project referred to in note 54 (i). SPV had raised various claims on NHAI inter-alia towards cost increase due to delay in issuance of Letter of Award, Loss incurred due to the extension of Bank Guarantee, construction of minor bridge and approached at Km 182 to 236, Loss of Revenue due to non-completion of adjoining packages, Loss due to difference in length of Project Highway, Interest etc., in respect of which the Arbitral Tribunal awarded ₹ 1,706.00 million (including interest of ₹ 344.6 million). Further in terms of the Award, in case NHAI fails to pay the aforesaid sum of ₹ 1,706.00 million to SPV within three months from the date of Award, NHAI is required to pay Simple interest at 12% per annum to SPV on the said sum on expiry of three months until the date of payment. NHAI has filed case in the High Court of Delhi in 2019 against the aforesaid Award which is pending before the Court.

In term of undertaking reached with the EPC contractor (i.e. KNR), the awarded amount will be passed on to KNR only on receipt of the same from NHAI (Also refer note 54 (i) regarding Claims Management Agreement dated January 9, 2020 as amended)

g) i. The office of the Registration and Stamps Department, Government of Telangana has issued notices for shortfall in stamp duty amounting ₹ 225 million to APEL and KMC Constructions Limited ("KMC") in relation to the inadequate stamping of the EPC contract entered into between APEL and KMC.

ii. 2 of SPVs viz. GAEPL and WUPTL have received notices for stamp duty amounting ₹ 456.40 million and ₹ 251.30 million respectively from the office of the Collector, Aligarh and the office of the Additional District Magistrate (Finance Revenue), Meerut, respectively, in relation to the stamping of the concession agreements entered into by such SPVs. The Collector, Aligarh has passed an order in this regard. While these matters are currently pending, in accordance with the share purchase agreement signed by these SPVs with their current and erstwhile shareholders, the erstwhile shareholders are obligated to indemnify, defend and hold harmless the SPVs in relation to any payment of deficient stamp duty on the concession agreements.

The relevant SPVs are contesting the aforesaid notices /order before various authorities and are confident that the matters will be decided in favor of the SPVs and ultimately no liability is likely to be devolved on the respective SPVs.

h) In an earlier year, Commercial suit was filed by a contractor before the High Court of Judicature at Bombay against DATRL seeking direction against DATRL to pay an amount of ₹ 4,193.21 million (including towards loss of profit of ₹ 351.51 million) plus taxes for the works of utility shifting performed by it for DATRL. Further as an interim measure, the aforesaid contractor has sought a direction against DATRL to deposit a sum of ₹ 277 million with the Court. DATRL is contesting the matter and final outcome of the matter is unascertainable.

As per the SPA referred to in note 54 (ii), in the event Reliance Infrastructure Limited ("RIL" or "erstwhile promoter") is unable to settle all the disputes existing between DATRL and contractor by the earlier of (i) December 30, 2021; or (ii) such date when an insolvency petition filed by the contractor is admitted against DATRL, DATRL has the right to settle the matter and set off such amount from the balance amount payable to RIL.

Pursuant to the Settlement Agreement dated December 19, 2022 with the Contractor, DATRL has agreed and paid ₹ 590 million (including GST) to the contractor towards full and final settlement of all the pending dues/ disputes/ issues. Out of the aforesaid amount (i) RIL has agreed to DATRPL that Rs.400 million to be recovered by DATRPL from the amount payable by it to RIL under the SPA and/or any other Transaction Document (as defined in the SPA) referred to in note 54(ii), which is included under "Receivable from Reliance Infrastructure Limited" has been disclosed under note 17 "Other financial assets"; and (ii) remaining amount of ₹ 115.36 million (net off amount already recognised in earlier years) has been included under note 35 "Operation and maintenance expenses".

Notes:

(i) The above matters have been settled during the year ended March 31, 2021 (Refer note 54 (iii))

(ii) During the year ended March 31, 2021, DATRL approached lenders and obtained confirmation for outstanding obligations as on December 31, 2020 under the provisions of and arising out of the Facility Agreements and financing documents executed in relation thereto. Based on the confirmations received, DATRL paid interest overdues till December 31, 2020 and also paid ₹ 272.38 million towards total penalty, additional interest or any other charges as levied by the lenders.

(iii) 9 SPVs (HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL) have entered into intercompany guarantee agreement to secure the loans aggregating ₹ 35,000 million from State Bank of India. As per intercompany guarantee agreement, in the event of the failure of any of the SPV to pay and discharge any of its Guaranteed Obligations till their respective Final Settlement Date, each of the other SPVs (8 fellow SPVs) hereby irrevocably, unconditionally and absolutely guarantee that it shall, immediately on demand will make payments of the amount demanded out of the monies available with such Other SPVs in its Surplus Accounts determined as per Intercompany guarantee agreement. As at October 31, 2022 loans outstanding – ₹ 34,372.32 million (March 31, 2022 ₹ 34,631.86 million, March 31, 2021 ₹ 34,998.64 million), in respect of which above guarantee has been given.(Refer note 22 (i))

Based on information available with the Proposed Trust Group, respective fellow subsidiaries, have not defaulted in repayment of aforesaid loans as per scheduled instalments. Further, based on the assessment made by the Proposed Trust Group, no liability is likely to devolve on the SPVs.

(iv) Future ultimate outflow of resources embodying economic benefits in respect of the above matters are uncertain as it depends on the final outcome of the matter involved.

45 Fair value disclosures

i) Fair values hierarchy

Financial assets and financial liabilities measured at fair value in the Special Purpose Combined Balance Sheet are divided into three levels of fair value hierarchy. The three levels are defined based on the observability of significant inputs to the measurement, as follows:

Level 1: Quoted prices (unadjusted) in active markets for financial instruments.
Level 2: The fair value of financial instruments that are not traded in an active market is determined using valuation techniques which maximise the use of observable market data rely as little as possible on entity specific estimates.
Level 3: If one or more of the significant inputs is not based on observable market data, the instrument is included in level 3.

Financial assets/(liabilities) measured at fair value - recurring fair value measurements:

As at October 31, 2022	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets at fair value				
Investments measured at fair value through profit or loss	2,798.38	-	-	**2,798.38**
Derivative financial assets	-	-	-	**-**
As at March 31, 2022	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets at fair value				
Investments measured at fair value through profit or loss	-	-	-	-
Derivative financial assets	-	55.52	-	**55.52**
As at March 31, 2021	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets at fair value				
Investments measured at fair value through profit or loss	1,159.46	-	-	**1,159.46**
Derivative financial assets	-	128.66	-	**128.66**
As at March 31, 2020	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets at fair value				
Investments measured at fair value through profit or loss	224.46	-	-	**224.46**
Derivative financial assets	-	229.74	-	**229.74**

Valuation process and technique used to determine fair value

The fair value of investments in mutual fund units are based on the net asset value ('NAV') as stated by the issuers of these mutual fund units in the published statements as at each reported balance sheet dates. NAV represents the price at which the issuer will issue further units of mutual fund and the price at which issuers will redeem such units from the investors.

(ii) Fair value of instruments measured at amortised cost

Fair value of instruments measured at amortised cost for which fair value is disclosed as follows using Level 3 inputs:

Particulars	**As at October 31, 2022**		**As at March 31, 2022**		**As at March 31, 2021**		**As at March 31, 2020**	
	Carrying value	**Fair value**	**Carrying value**	**Fair value**	**Carrying value**	**Fair value**	**Carrying value**	**Fair value**
Financial assets measured at amortised cost:								
Trade receivables	798.08	798.08	751.21	751.21	755.54	755.54	658.89	658.89
Cash and cash equivalents	10,718.79	10,718.79	18,490.11	18,490.11	8,851.89	8,851.89	2,424.36	2,424.36
Bank balance other than cash and cash equivalents	3,435.88	3,435.88	2,633.84	2,633.84	4,284.98	4,284.98	3,907.77	3,907.77
Other financial assets	2,930.85	2,930.85	4,050.89	4,050.89	11,841.22	11,841.22	3,691.81	3,691.81
Total financial assets	**17,883.60**	**17,883.60**	**25,926.05**	**25,926.05**	**25,733.63**	**25,733.63**	**10,682.83**	**10,682.83**
Financial liabilities (excluding equity component)								
Borrowings	125,252.85	125,252.85	129,841.02	129,841.02	123,294.21	123,294.21	60,002.96	60,002.96
Trade payables	2,666.49	2,666.49	2,033.32	2,033.32	2,624.91	2,624.91	1,769.58	1,769.58
Other financial liabilities	9,017.14	9,017.14	7,528.24	7,528.24	11,953.61	11,953.61	9,600.75	9,600.75
Total financial liabilities	**136,936.48**	**136,936.48**	**139,402.58**	**139,402.58**	**137,872.73**	**137,872.73**	**71,373.29**	**71,373.29**

The management assessed that cash and cash equivalents, bank balances other than cash and cash equivalents, trade receivables, other financial assets, trade payables, borrowings and other financial liabilities are approximate to their carrying amounts largely due to the short-term maturities of these instruments. The fair value of the financial assets and liabilities is included at the amount at which the instrument could be exchanged in a current transaction between willing parties, other than in a forced or liquidation sale.

46 Financial risk management

i) Financial instruments by category

Particulars	As at October 31, 2022			As at March 31, 2022			As at March 31, 2021			As at March 31, 2020		
	FVTPL	FVOCI	Amortised cost	FVTPL	FVOCI	Amortised cost	FVTPL	FVOCI	Amortised cost	FVTPL	FVOCI	Amortised cost
Financial assets												
Investments	2,798.38	-	0.01	-	-	0.01	1,159.46	-	0.01	224.46	-	-
Derivative financial assets	-	-	-	55.52	-	-	128.66	-	-	229.74	-	-
Other financial assets	-	-	2,930.85	-	-	4,050.89	-	-	11,841.22	-	-	3,691.81
Trade receivables	-	-	798.08	-	-	751.21	-	-	755.54	-	-	658.89
Cash and cash equivalents	-	-	10,718.79	-	-	18,490.11	-	-	8,851.89	-	-	2,424.36
Bank balances other than cash and cash equivalents	-	-	3,435.88	-	-	2,633.84	-	-	4,284.98	-	-	3,907.77
Total	**2,798.38**	**-**	**17,883.61**	**55.52**	**-**	**25,926.06**	**1,288.12**	**-**	**25,733.64**	**454.20**	**-**	**10,682.83**
Financial liabilities (excluding equity component)												
Borrowings	-	-	125,252.85	-	-	129,841.02	-	-	123,294.21	-	-	60,002.96
Trade payables	-	-	2,666.49	-	-	2,033.32	-	-	2,624.91	-	-	1,769.58
Other financial liabilities	-	-	9,017.14	-	-	7,528.24	-	-	11,953.61	-	-	9,600.75
Total	**-**	**-**	**136,936.48**	**-**	**-**	**139,402.58**	**-**	**-**	**137,872.73**	**-**	**-**	**71,373.29**

ii) Risk Management

The Proposed Trust Group's activities expose it to variety of financial risks : credit risk, liquidity risk and market risk. Proposed Trust Group's focus is to foresee the unpredictability of financial markets and seek to minimize potential adverse effects on its financial performance. The Board of Directors of the Investment Manager have overall responsibility for the establishment and oversight of Proposed Trust Group's risk management framework. The Board of Directors of the Investment Manager have established a risk management policy to identify and analyse the risks faced by the Proposed Trust Group, to set appropriate risk limits and controls, and to monitor risks and adherence to limits. Risk management systems are reviewed periodically to reflect changes in market conditions and Proposed Trust Group's activities. The Board of Directors of the Investment Manager oversee compliance with Proposed Trust Group's risk management policies and procedures, and reviews the risk management framework.

A) Credit risk management

Credit risk is the risk of financial loss to Proposed Trust Group if a customer or counterparty to a financial instrument fails to meet its contractual obligations, and arises principally from Proposed Trust Group's receivables from customers. Proposed Trust Group's maximum exposure to credit risk is limited to the carrying amount of following types of financial assets:

- cash and cash equivalents,
- trade receivables,
- other financial assets, and
- deposits with banks

The Proposed Trust Group has credit risk on trade receivables related change of scope and other claims from NHAI and ETC receivable. The Proposed Trust Group continuously reviews these claims and provides for the expected credit losses based on each claim.

Reconciliation of loss allowance for trade receivable and unbilled revenue from beginning to end of reporting period:

Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Opening Balance	80.88	41.81	40.88	27.48
Movement in expected credit loss allowance on trade receivables calculated at lifetime expected credit losses	-	39.11	4.35	13.40
Adjustment against bad debts written off	-	(0.04)	(3.42)	-
Closing Balance	**80.88**	**80.88**	**41.81**	**40.88**
Management has considered the unsecured receivables of WVEPL from Kerala and Tamilnadu State Road Transportation Corporation, where WVEPL has received a high court order in its favour to collect the Toll as good and recoverable. Accordingly, no ECL provisioning is considered necessary in these special purpose combined financial statements.	131.34	131.34	131.34	131.46

In case of majority of Trade Receivable, the counter party being the Government Undertaking as such does not have significant credit risk. However, Proposed Trust Group estimates the expected credit loss based on specific identified basis.

Other financial assets measured at amortised cost

Other financial assets measured at amortised cost includes security deposits, annuity receivable, receivable from related parties and other Credit risk related to these other financial assets is managed by monitoring the recoverability of such amounts continuously, while at the same time internal control system in place ensure the amounts are within defined limits.

B) Liquidity risk

Liquidity risk is the risk that the Proposed Trust Group may encounter difficulty in meeting its present and future obligations associated with financial liabilities that are required to be settled by delivering cash or another financial asset. Proposed Trust Group is exposed to liquidity risk due to borrowings and trade and other payables. Proposed Trust Group measures risk by forecasting cash flows. The Proposed Trust Group's approach to managing liquidity is to ensure, as far as possible, that it will always have sufficient liquidity to meet its liabilities when due without incurring unacceptable losses or risking damage to the Proposed Trust Group's reputation. The Proposed Trust Group ensures that it has sufficient fund to meet expected operational expenses, servicing of financial obligations.

(a) Financing arrangements

The Proposed Trust Group has access to the following undrawn borrowing facilities at the end of the reporting periods:

Floating rate	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
- Expiring within one year	1,485.30	3,485.78	3,463.28	3,180.82
- Expiring beyond one year	2,895.30	3,624.33	4,093.69	5,149.38
	4,380.60	**7,110.11**	**7,556.97**	**8,330.20**

(b) Maturities of financial liabilities

The tables below analyse the Proposed Trust Group's financial liabilities into relevant maturity categories based on their contractual maturities for all non-derivative financial liabilities:
The amounts disclosed in the table are the contractual undiscounted cash flows net of processing fees.

As at October 31, 2022	**Less than 1 year**	**1-2 year**	**2-5 year**	**More than 5 years**	**Total**
Borrowings	6,556.57	8,071.98	27,838.63	90,467.07	**132,934.25**
Trade payables	2,633.35	33.14	-	-	**2,666.49**
Other financial liabilities	6,403.49	374.96	-	2,880.15	**9,658.60**
Total	**15,593.41**	**8,480.08**	**27,838.63**	**93,347.22**	**145,259.34**

As at March 31, 2022	**Less than 1 year**	**1-2 year**	**2-5 year**	**More than 5 years**	**Total**
Borrowings	19,240.42	7,023.27	23,893.66	86,105.71	**136,263.06**
Trade payables	2,030.30	3.02	-	-	**2,033.32**
Other financial liabilities	6,071.18	488.61	-	1,635.74	**8,195.53**
Total	**27,341.90**	**7,514.90**	**23,893.66**	**87,741.45**	**146,491.91**

As at March 31, 2021	**Less than 1 year**	**1-2 year**	**2-5 year**	**More than 5 years**	**Total**
Borrowings	14,124.96	11,873.97	23,103.33	78,522.21	**127,624.47**
Trade payables	2,614.60	10.31	-	-	**2,624.91**
Other financial liabilities	10,079.24	671.55	5,010.40	4.47	**15,765.66**
Total	**26,818.80**	**12,555.83**	**28,113.73**	**78,526.68**	**146,015.04**

As at March 31, 2020	**Less than 1 year**	**1-2 year**	**2-5 year**	**More than 5 years**	**Total**
Borrowings	10,503.40	6,311.39	12,030.27	31,157.90	**60,002.96**
Trade payables	1,748.88	20.70	-	-	**1,769.58**
Other financial liabilities	8,508.51	580.80	-	511.44	**9,600.75**
Total	**20,760.79**	**6,912.89**	**12,030.27**	**31,669.34**	**71,373.29**

C) Market risk

(a) Interest rate risk

i) Liabilities

The Proposed Trust Group's policy is to minimise interest rate cash flow risk exposures on long-term financing. At the reporting periods end, the Proposed Trust Group is exposed to changes in market interest rates through bank borrowings at variable interest rates.

Interest rate risk exposure

Below is the overall exposure of the Proposed Trust Group to interest rate risk:

Particulars	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Variable rate borrowing	72,270.70	77,770.22	78,095.10	40,377.96
Fixed rate borrowing	52,982.15	52,070.80	45,199.11	19,625.00
Total borrowings	**125,252.85**	**129,841.02**	**123,294.21**	**60,002.96**

Sensitivity

Below is the sensitivity of profit or loss and equity changes in interest rates.

Particulars	**For the seven month ended October 31, 2022**	**For the year ended March 31, 2022**	**For the year ended March 31, 2021**	**For the year ended March 31, 2020**
Interest sensitivity*				
Interest rates – increase by 50 bps [(i)]	(365.63)	(450.01)	(316.40)	(158.70)
Interest rates – decrease by 50 bps [(i)]	365.63	450.01	316.40	158.70

(i) Holding all other variables constant

ii) Assets

The Proposed Trust Group's fixed deposits are carried at amortised costs and are fixed rate deposits. They are therefore not subject to interest rate risk as defined in Ind AS 107 'Financial Instruments Disclosures', since neither the carrying amount nor the future cash flows will fluctuate because of a change in market interest rates.

(b) Price risk

i) Exposure

The Proposed Trust Group requires for implementation (construction, operation and maintenance) of the projects various commodities such as cement, bitumen, steel and other construction materials which are exposed to price risk. The Proposed Trust Group are able to manage its exposure to price increases through bulk purchases and negotiations. Hence, the sensitivity analysis is not required to be provided.

The Proposed Trust Group's exposure to price risk arises from investments held and classified at fair value through profit or loss. To manage the price risk arising from investments, the Proposed Trust Group diversifies its portfolio of assets through fixed rate investment like deposit with bank and investment in mutual funds (Growth Scheme).

ii) Sensitivity

The table below summarises the impact of increase/decrease of the index on the Proposed Trust Group's profit for the period/year :

Impact on loss before tax

Particulars	**As at October 31, 2022**	**As at March 31, 2022**	**As at March 31, 2021**	**As at March 31, 2020**
Mutual Funds				
Net assets value – increase by 100 bps	16.32	-	11.59	2.24
Net assets value – decrease by 100 bps	(16.32)	-	(11.59)	(2.24)

(c) Foreign currency risk

Foreign currency risk is the risk that the fair value or future cash flows of an exposure will fluctuate because of changes in foreign exchange rates. The Proposed Trust Group has no significant exposure to the risk of changes in foreign exchange rates except related to DATRL's foreign currency loan i.e. External Commercial Borrowings (ECB). DATRL has an aggregate exposure of Nil as at October 31, 2022 (March 31, 2022: USD Nil, March 31, 2021: USD 50 million) relating to ECBs.

i) Exposure

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
a) Financial liabilities				
Interest Accrued on foreign borrowings	-	-	0.68	186.31
External commercial borrowings	-	-	2,866.69	3,594.08

Sensitivity

The following tables demonstrate the sensitivity to a reasonably possible change in USD exchange rates, with all other variables held constant. The impact on Proposed Trust Group's profit / loss is impacted due to changes in the fair value of monetary liabilities.

Impact on loss before tax

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
INR/USD closing exchange rate	-	-	73.50	75.67
INR/USD (increase) by 6%	-	-	(172.04)	(226.82)
INR/USD decrease by 6%	-	-	172.04	226.82

b) Particulars of derivative Instruments

Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Principal currency swap	-	6.37	22.56	28.85
No of instruments	-	3.00	4.00	4.00

c) Foreign currency exposures not hedged by derivative instrument or otherwise:

Particulars				
Borrowings (including interest accrued but not due) in USD in millions	-	-	16.45	21.11
Borrowings (including interest accrued but not due) in INR in millions	-	-	1,209.16	1,597.31

47 Capital management

The primary objective of the Proposed Trust Group's capital management is to ensure Proposed Trust Group's ability to continue as going concern and to provide an adequate return to unitholders through optimisation of debts and equity balance.

The Proposed Trust Group monitors capital using a gearing ratio, which is net debt divided by total equity. The Proposed Trust Group's policy is to keep the gearing ratio optimum. Net debt includes borrowings (including interest accrued less cash and cash equivalents and other bank deposits (net of restricted deposits)).

Debt equity ratio

Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Debts	133,731.56	136,298.25	126,694.59	64,973.57
Less : Cash & cash equivalents, Bank balances other than cash and cash equivalents net of restricted deposits and deposits with banks*	(12,834.98)	(18,315.85)	(11,316.31)	(5,710.89)
Net Debt	**120,896.58**	**117,982.40**	**115,378.28**	**59,262.68**
Total equity	886.34	239.86	3,314.09	10,261.11
Net debt to equity ratio (in times)	**136.40**	**491.89**	**34.81**	**5.78**

*Cash and cash equivalents has been considered after excluding deposits maintained in MMR account amounting ₹1,430.69 million (March 31, 2022: ₹2,770.31 million; March 31, 2021: ₹1,779.40 million; March 31, 2020: ₹634.15 million) and restricted deposits of Nil (March 31, 2022: ₹37.79 million; March 31, 2021: ₹41.16 million; March 31, 2020: ₹41.16 million).

48 Information on related party transactions

The name of the related parties and nature of relationship are as identified by the management with reference to the Trust and its proposed subsidiaries which are considered for the Special Purpose Combined Financial Statements pursuant to SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended and are disclosed only with whom the Proposed Trust Group had transactions during the reported years.

a) List of related parties

i)	**Sponsor**	Cube Highways and Infrastructure Pte. Limited Cube Highways and Infrastructure III Pte. Limited
ii)	**Investment manager**	Cube Highways Funds Advisors Private Limited
iii)	**List of additional related parties as per Regulation 2(1) (zv) of the SEBI InvIT Regulations Parties to the Trust**	Axis Trustee Services Limited (Trustee of the Trust)

iv)	**Ultimate Holding Company (SPV wise)**	**SPVs where relationship exists**
	ISQ Asia Infrastructure Holdings II Pte. Limited	HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL
	Hindustan Construction Company Limited (control exists upto September 22, 2020)	FRHL

v) **Immediate Holding Company (SPV wise)**

Name of related parties	**SPVs where relationship exists**
Cube Mobility Investment Pte Limited	HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL
Cube Highways and Infrastructure Pte. Limited- Singapore	APEL, MBEL, JMTL, WUPTL
Cube Highways and Infrastructure I-D Pte. Limited	NDEPL
Cube Highways and Infrastructure II Pte. Ltd - Singapore (control exists w.e.f. September 23, 2020)	FRHL
Cube Highways and Infrastructure III Pte. Limited (control exists w.e.f. September 28, 2020)	WVEPL
Cube Highways and Infrastructure-III Pte. Limited-Singapore (control exists w.e.f. December 31, 2020)	DATR
Cube Highways and Infrastructure Pte Ltd (control exists w.e.f. May 26, 2022)	GAEPL
HCC Concessions Limited (control exists upto September 22, 2020)	FRHL
HCC Infrastructure Company Limited (Intermediatory Holding company control exists upto September 22, 2020)	FRHL
KNR Constructions Limited (control exists upto September 28, 2020)	KNR
Reliance Infrastructure Limited (control exists upto December 30, 2020)	DATR

b) Other related parties with whom the Proposed Trust Group have transactions during the reported years/period

vi) **Fellow subsidiaries (SPV wise)**

Name of related parties	**SPVs where relationship exists**
Highbar Technologies Limited (upto September 22, 2020)	FRHL
Highbar Technocrat Limited (upto September 22, 2020)	FRHL
HCC Operations and maintenance Limited (upto September 22, 2020)	FRHL
Baharampore Highways Limited (upto September 22, 2020)	FRHL
Cube Infrastructure Investment Company Pte Limited	JMTL, APEL, MBEL, WUPTL, GAEPL
Cube Highways and Transportation Assets Advisors Private Limited	JMTL, APEL, MBEL, WUPTL, GAEPL
Cube Highways Operations Management Private Limited	HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL

48 Information on related party transactions

vii) **Entities having Significant Influence over GAEPL:**

Name of related parties	**SPVs where relationship exists**
Bharat Road Network Limited (Upto May 25, 2022)	GAEPL
PNC Infratech Limited (Upto May 25, 2022)	GAEPL
Galfar Engineering and Contracting India Private Limited (Upto May 25, 2022)	GAEPL

viii) **Key managerial personnel (SPV wise)**

	SPVs where relationship exists
Mr. Shreedhar Narayan (Director)	WUPTL
Mr. Velusamy Vasu (Director) (Upto November 03, 2022)	WUPTL, APEL, MBEL, DATRL, NDEPL
Mr. Velusamy Vasu (Director) (Upto November 09, 2022)	JMTL, FRHL
Mr. Akhil Kumar Jain (Director)	WUPTL, APEL, JMTL, MBEL
Mr . C. P. Jain (Director) (Upto October 18, 2019)	APEL, MBEL, NDEPL, WUPTL
Mr. Pujari Bala Ganesh (Director)	APEL
Mr. Ashok Kumar Tyagi (Director)	APEL, MBEL
Mrs. Vasundhara Peddapalle (Director upto August 24, 2020)	JMTL
Mr. Andrew Lewis, Director	MBEL
Mr. Manish Khanna (Director upto September 22, 2020)	FRHL
Mr. Chandrahas Zaveri (Director upto September 22, 2020)	FRHL
Mr. Ashok Kumar Sharma (Director w.e.f May 26, 2022)	GAEPL
Mr. Ankit Jain (Director w.e.f May 26, 2022)	GAEPL
Mrs. Pragya Gupta (Director w.e.f May 26, 2022)	GAEPL

ix) **Entities in which persons covered above can exercise significant influence**

Name of related parties	**SPV's where relationship exist**
Cube Highways and Transportation Assets Advisors Private Limited	FRHL, DATR, WVEPL, HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL, SMTL, NDEPL
Cube Highways Root Foundation	All SPVs

48 Information on related party transactions

	For the seven month period ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
c) Transactions during the period/year				
Issue of Capital (including securities premium)				
Cube Highways and Infrastructure Pte. Ltd.	-	730.00	140.00	178.00
Cube Highways and Infrastructure I-D Pte. Ltd.	-	-	378.92	-
Cube Mobility Investment Pte Limited	-	-	6,139.30	2.90
Share Application Pending Allotment				
Cube Mobility Investment Pte Limited	-	-	-	5.20
Payment for capital reduction				
Cube Highways and Infrastructure Pte. Ltd.	-	-	600.00	-
Issue of optionally convertible debentures (including equity component)				
Cube Mobility Investment Pte Limited	-	7,782.00	11,138.05	70.00
Cube Highways and Infrastructure III Pte Limited	-	1,534.00	12,722.43	-
Cube Highways and Infrastructure II Pte Limited	-	2,645.00	3,886.05	-
Cube Highways and Infrastructure Pte. Limited	9,350.00	-	130.00	-
Cube Highways and Infrastructure I-D Pte Limited	-	-	1,151.76	-
Issue of non-convertible debentures (including redemption premium)				
Reliance Infrastructure Limited [Refer note 54(ii)]	-	-	5,252.06	-
HCC Concessions Limited [Refer note 54(iii)]	-	-	2,170.63	-
Inter-corporate deposit converted into non-convertible debentures				
Reliance Infrastructure Limited [Refer note 54(ii)]	-	-	180.50	-
Term loans received				
Bharat Road Network Limited	-	-	-	877.54
PNC Infratech Limited	-	297.80	11.48	1,705.42
Galfar Engineering and Contracting India Private Limited	-	-	-	536.12
Term loan taken over from lender				
Galfar Engineering and Contracting India Private Limited [Refer note 54(iv)]	-	487.90	-	-
Waiver of term loans				
Bharat Road Network Limited [Refer note 54(iv)]	-	812.70	-	-
PNC Infratech Limited [Refer note 54(iv)]	-	694.26	-	-
Galfar Engineering and Contracting India Private Limited [Refer note 54(iv)]	-	391.84	-	-
KNR Constructions Limited [Refer note 54(i)]	-	-	168.24	-
Waiver of interest on borrowings				
Cube Infrastructure Investment Company Pte Limited [Refer note 58]	198.52	338.60	338.60	339.52
Bharat Road Network Limited [Refer note 54(iv)]	24.67	365.53	367.79	261.66
Subordinate debt (including interest accrued) converted to non-convertible debentures				
HCC Concessions Limited [Refer note 54(iii)]	-	-	1,058.78	37.00
Reliance Infrastructure Limited	-	-	4,449.10	-
Warrants converted into unsecured loan				
Bharat Road Network Limited	-	-	-	481.89
PNC Infratech Limited	-	-	-	1,180.50
Galfar Engineering and Contracting India Private Limited	-	-	-	387.79
Interest on optionally convertible debentures				
Cube Mobility Investment Pte Limited	1,426.69	1,514.69	521.64	1.14
Cube Highways and Infrastructure Pte. Ltd.	448.68	16.90	0.32	-
Cube Highways and Infrastructure I-D Pte Ltd	97.36	146.04	44.10	-
Cube Highways and Infrastructure II Pte Limited	533.16	742.06	251.41	-
Cube Highways and Infrastructure III Pte. Ltd.	1,068.98	1,607.65	463.00	-

48 Information on related party transactions

	For the seven month period ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
c) Transactions during the period/year				
Interest on non - convertible debentures				
Cube Highways and Infrastructure Pte. Ltd.	-	-	-	-
Cube Infrastructure Investment Company Pte. Ltd.	374.86	409.94	464.40	449.09
HCC Concessions Limited	-	-	29.81	103.60
Investment in Equity Shares				
Cube Highways Roots Foundation	-	-	0.01	-
Reimbursement of expenses				
Cube Highways and Transportation Assets Advisors Private Limited	-	0.72	1.30	1.63
Mr . Shreedhar Narayan- Director	-	-	0.01	0.05
HCC Concessions Limited	-	-	0.15	0.60
KNR Constructions Limited	-	-	8.67	22.15
Reliance Infrastructure Limited	-	-	0.48	1.30
HCC Operations & Maintenance Limited	-	-	3.36	1.74
Management service charges				
Cube Highways and Transportation Assets Advisors Private Limited	276.85	435.07	212.85	92.47
Cube Highways Operations Management Private Limited	4.46	11.18	2.21	-
Operation and maintenance expense				
KNR Constructions Limited	-	-	40.25	77.45
HCC Operations & Maintenance Limited	-	-	127.74	267.37
Rent				
Cube Highways and Transportation Assets Advisors Private Limited	0.54	1.02	1.01	0.04
Contribution from employees deducted from salary and paid to the related party				
Cube Highways Roots Foundation	-	0.00	0.07	-
Cube Highways and Transportation Assets Advisors Private Limited	-	-	0.06	-
Payable on account of employees transferred to/from fellow subsidiaries				
Cube Highways Operations Management Private Limited	-	-	0.43	-
Cube Highways and Transportation Assets Advisors Private Limited	-	-	0.03	0.02
Donations (including corporate social responsibility)				
Cube Highways Roots Foundation	15.51	8.61	5.69	-
Corporate guarantee commission				
Cube Highways and Transportation Assets Advisors Private Limited	-	-	-	0.71
Amortisation of Corporate Guarantee				
HCC Concessions Limited	-	-	4.95	4.94
Information Technology related cost				
Highbar Technologies Limited	-	-	0.30	0.58
Highbar Technocrat Limited	-	-	0.05	0.06
Construction cost				
Hindustan Construction Company Limited	-	-	19.45	390.12
KNR Constructions Limited	-	-	-	1.22
PNC Infratech Limited	-	-	-	436.79
Recovery for negative change in scope [Refer note 59]				
PNC Infratech Limited	-	489.40	-	-
Galfar Engineering and Contracting India Private Limited	-	6.00	-	-
Managerial remuneration[(i) & (ii)]				
Mr . Shreedhar Narayan	-	-	1.50	-
Mr. Pujari Bala Ganesh	0.55	3.07	2.65	5.65
Mrs. Vasundhara Peddapalle	-	-	1.67	3.46
Mr. Andrew Lewis	-	-	-	2.21
Sitting fees				
Mr. Ashok Kumar Tyagi	0.40	0.55	0.55	0.15
Mr. Akhil Kumar Jain	0.54	1.07	0.72	1.40
Mr. C.P Jain	-	-	-	0.91
Mr. Manish Khanna	-	-	0.14	0.14
Mr. Chandrahas Zaveri	-	-	0.14	0.14
Payment of interest				
Cube Infrastructure Investment Company Pte. Ltd	657.48	-	-	-
Cube Highways and Infrastructure III PTE Limited	797.78	-	-	-
Repayment of non-convertible debentures				
Cube Infrastructure Investment Company Pte. Ltd	89.13	-	-	-
Term loan repaid				
Galfar Engineering and Contracting India Private Limited	924.96	-	-	-
Bharat Road Network Limited	517.00	-	-	-
PNC Infratech Limited	2,180.20	-	-	-

48 Information on related party transactions

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
d) Balances outstanding at the end of the period/year				
Unsecured long term borrowings				
Cube Mobility Investment Pte Limited	18,990.05	18,990.05	11,208.05	70.00
Cube Highways and Infrastructure Pte. Limited	9,480.00	130.00	130.00	-
Cube Highways and Infrastructure I-D Pte. Limited	1,151.76	1,151.76	1,151.76	-
Cube Highways and Infrastructure II Pte Limited	6,531.05	6,531.05	3,886.05	-
Cube Highways and Infrastructure III Pte Limited	14,256.43	14,256.43	12,722.43	-
Cube Infrastructure Investment Company Pte. Limited	4,410.11	4,499.24	5,504.24	5,504.24
HCC Concessions Limited	-	-	-	733.12
Reliance Infrastructure Limited	-	-	-	-
PNC Infratech Limited	-	-	1,180.50	1,180.50
Bharat Road Network Limited	-	-	481.89	481.89
Galfar Engineering and Contracting India Private Limited	-	487.90	387.79	387.79
Unsecured short term borrowings				
PNC Infratech Limited	-	2,180.20	1,396.16	1,384.68
Galfar Engineering and Contracting India Private Limited	-	437.04	442.83	442.83
Bharat Road Network Limited	-	517.00	866.36	866.36
Interest accrued but not due on borrowings				
Cube Mobility Investment Pte. Limited	2,880.14	1,636.24	421.07	0.97
Cube Highways and Infrastructure Pte. Limited	462.04	14.64	0.28	-
Cube Infrastructure Investment Company Pte. Limited	581.40	1,033.52	1,196.99	1,480.58
Cube Highways and Infrastructure I-D Pte. Limited	245.40	163.28	35.75	-
Cube Highways and Infrastructure II Pte Limited	1,307.89	837.10	211.97	-
Cube Highways and Infrastructure III Pte Limited	1,261.43	1,762.23	426.65	-
HCC Concessions Limited	-	-	-	298.07
Investments				
Cube Highways Roots Foundation	0.01	0.01	0.01	-
Payables				
Cube Highways and Transportation Assets Advisors Private Limited	91.08	45.19	45.02	25.38
Cube Highways Roots Foundation	-	-	0.26	-
Cube Highways Operations Management Private Limited	6.16	3.03	2.46	-
Cube Highways Funds Advisors Private Limited (CHFAPL) [(ix)]	162.19	38.90		
HCC Operations & Maintenance Limited	-	-	-	154.39
Baharampore Highways Limited	-	-	-	0.09
Bharat Road Network Limited	-	21.60	21.60	21.60
Hindustan Construction Company Limited	-	-	-	3,828.90
Highbar Technocrat Limited	-	-	-	0.05
Highbar Technologies Limited	-	-	-	0.24
KNR Constructions Limited	-	-	-	17.05
PNC Infratech Limited	-	550.81	838.32	849.88
Galfar Engineering and Contracting India Private Limited	-	-	172.73	172.73
Share Application Money Pending allotment				
Cube Mobility Investment Pte Limited	-	-	-	5.20
Deemed Capital Contribution (Corporate Guarantee receivable)				
HCC Concessions Limited	-	-	-	75.64

48 Information on related party transactions

	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
d) Balances outstanding at the end of the period/year				
Other Advances				
Hindustan Construction Company Limited	-	-	-	95.46
Cube Highways and Transportation Assets Advisors Private Limited	10.71			
HCC Concessions Limited	-	-	-	3.28
Financial Guarantee Asset (unamortised)				
HCC Concessions Limited	-	-	-	54.72
Managerial Remuneration/ Director Sitting Fees payable				
Mr. Akhil Kumar Jain - Independent Director	-	0.06	-	-
Mr . Ashok Tyagi - Director	-	0.03	-	-
Corporate Guarantee given against Performance Security				
Hindustan Construction Company Limited	-	-	-	1,386.00
Cube Highways and Infrastructure Pte. Limited	-	333.60	-	-
Contingent Liability				
Hindustan Construction Company Limited				
Project related claims, payable on receipt from NHAI	-	-	-	11,133.47
HCC Concessions Limited				
Corporate Guarantee given	-	-	-	2,528.70

Notes:

(i) Excludes charges of KMP included in management services charges from fellow subsidiary.

(ii) Does not include provisions for gratuity and leave encashment liabilities, since the provisions are based on actuarial valuations.

(iii) Cube Highways & Infrastructure Pte. Ltd. (the “Holding Company”) has setup Special Purpose Vehicles (the "SPVs") for developing and operating road projects in India. Certain SPVs have availed financial assistance from certain lenders and one of the requirement is that the SPV is required to maintain a debt service reserve, major maintenance reserve and operation and maintenance reserve with an escrow bank (the "Reserves"). Cube Highways and Transportation Asset Advisors Private Limited (‘fellow subsidiary’) has obtained a bank guarantee facility from Barclays Bank PLC (Previous year: Induslnd Bank) (the "BG Lender") for issuance of bank guarantees for funding of the Reserves in favour of Escrow Bank (the "Bank Guarantee"). To facilitate the issuance of the Bank Guarantee by the BG Lender, the holding company [March 31, 2021 and March 31, 2020 : Cube Infrastructure Investment Company Pte Ltd. (‘fellow subsidiary’)] has provided a standby letter of credit or a bank guarantee (the "SBLC Facility") from a branch of the BG Lender to be issued in favour of the BG Lender. The above banks has issued bank guarantees on behalf of Cube Highways and Transportation Asset Advisors Private Limited (‘fellow subsidiary’) of ₹ 749.50 million (March 31, 2022 ₹ 749.50 million, March 31, 2021 and March 31, 2020 ₹ 610 million) in favour of lenders/debenture trustee of these SPVs, which are fully backed by SBLC Facility availed by the holding company (March 31, 2021 and March 31, 2020 : fellow subsidiary). As per understanding reached, the BG Lender would be paid out under SBLC Facility and there are no obligations on these SPVs.

(iv) Cube Mobility Investment Pte Limited (Holding company) has provided performance security amounting ₹ 760.00 million in aggregate to National Highway Authority of India (NHAI) for the due performance of the 9 SPVs (fellow subsidiaries) obligations under the 9 Concession agreements respectively entered in relation to projects comprising of 9 National Highway stretches (Bundle- 3) on Toll Operate Transfer Mode. The SPVs have entered into an intercompany guarantee agreement amounting ₹ 35,000 million for secured term loans, wherein in the event of the failure of any of the 9 SPVs (fellow subsidiaries) are liable to pay and discharge its Guarantee Obligations. Also refer note 22(i)

(v) Refer note 54(i) for transactions pursuant to SPA involving KNR constructions Limited, and Cube Highways and Infrastructure III Pte Limited and WVEPL.

(vi) Refer note 54(ii) for transactions pursuant to SPA involving Reliance Infrastructure Limited, and Cube Highways and Infrastructure III Pte Limited and DATRL.

(vii) Refer note 54(iii) for transactions pursuant to SPA involving HCC Concession Limited, Hindustan Construction Company Limited and Cube Highways and Infrastructure II Pte Limited and FRHL.

(viii) Refer note 54(iv) for transactions pursuant to SPA involving Bharat Road Network Limited, PNC Infratech Limited, Galfar Engineering and Contracting India Private Limited and Cube Highways and Infrastructure Pte Ltd and GAEPL.

(ix) Cube Highways Trust (the "Trust") has entered into Investment Management Agreement dated March 11, 2022 with CHFAPL. As per Schedule II of Investment Management Agreement, CHFAPL is entitled to receive management fee for investment management services rendered under the agreement from the date of the agreement. The management fees is included under "Other current assets" as the same would be adjusted from Unit capital as and when issued.

49 Information on segment reporting pursuant to Ind AS 108 - Operating Segments

The Proposed Trust Group primary business segment is reflected based on principal business activities carried on by the Proposed Trust Group i.e. building, operating and management of road projects and all other related activities which as per Ind AS 108 on 'Operating Segments" is considered to be the only reportable business segment. The Proposed Trust Group derives its major revenues from operation and maintenance of highways. The Proposed Trust Group is operating in India which is considered as a single geographical segment.

50 Disclosures as required by SEBI Circular no. CIR/IMD/DF/114/2016 dated 20 October 2016

A Project wise operating cash flows for the seven month ended October 31, 2022:

Particulars	HTL	JLTL	JVTL	KETL	KMTL	LRTL	MKTL	NKTL	SMTL
Profit/ (loss) before tax	(231.33)	57.92	63.99	(164.49)	(178.95)	(25.34)	(131.29)	(232.83)	(158.44)
Adjustments for:									
Depreciation and amortisation expense	199.43	119.94	76.02	123.52	198.80	120.46	190.45	148.02	121.89
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	-	-	-	-	-	-
Net gain on sale of mutual funds	-	-	-	(0.05)	-	-	(0.50)	(0.20)	(0.29)
Net loss on investments/ derivatives measured at fair value through profit or loss	(0.98)	(0.89)	(1.08)	(0.99)	(0.96)	(0.84)	(0.24)	(0.27)	(0.01)
Liabilities no longer required written back/ Remission of loan liability	-	-	-	-	-	-	-	-	-
Interest income	(20.88)	(16.48)	(14.23)	(7.12)	(18.56)	(14.39)	(7.88)	(11.20)	(4.52)
Claims for compensation/ concession extension	-	-	-	-	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	-	-	-	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	-	-	-	-	-	-	-	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	513.77	273.81	172.64	294.90	468.64	240.61	413.95	366.60	311.73
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**460.01**	**434.30**	**297.34**	**245.77**	**468.97**	**320.50**	**464.49**	**270.12**	**270.37**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(0.57)	(2.32)	(1.72)	(1.25)	(0.71)	(8.87)	(1.24)	(7.07)	(1.00)
Decrease/(Increase) in trade receivables	(0.03)	(0.85)	(0.64)	(0.31)	(0.03)	(0.49)	(0.78)	(0.49)	(0.39)
Decrease/(Increase) in financial assets and non financial assets	(2.72)	(0.84)	(1.88)	3.42	6.00	(1.32)	3.15	0.85	4.17
(Decrease)/Increase in trade payables	(0.17)	(2.89)	0.04	(23.40)	(46.64)	(6.89)	(18.93)	(38.11)	(24.20)
(Decrease)/Increase in provisions	(6.30)	(0.87)	(1.18)	0.29	0.47	(12.73)	0.76	0.21	0.17
(Decrease)/Increase in financial liabilities and non financial liabilities	(12.00)	(7.00)	(4.34)	(18.00)	(17.56)	(2.74)	(13.90)	(18.31)	(14.61)
Cash flow generated from operating activities post working capital changes	**438.22**	**419.53**	**287.62**	**206.52**	**410.50**	**287.46**	**433.55**	**207.20**	**234.51**
Income tax (paid)/ refund (net)	(2.21)	(1.69)	(1.43)	(0.80)	(1.94)	(1.58)	(0.70)	(1.27)	(0.52)
Net cash generated from operating activities	**436.01**	**417.84**	**286.19**	**205.72**	**408.56**	**285.88**	**432.85**	**205.93**	**233.99**

Project wise operating cash flows for the period ended October 31, 2022 (continued):

Particulars	APEL	JMTL	MBEL	WUPTL	WVEPL	NDEPL	FRHL	GAEPL	DATRL
Profit/ (loss) before tax	(168.15)	479.01	122.93	56.90	(33.98)	(174.21)	(209.53)	204.76	(285.51)
Adjustments for:									
Depreciation and amortisation expense	0.55	138.90	73.81	358.58	146.42	182.99	328.90	213.74	792.99
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	(0.15)	-	-	-	-	-	-	-
Net gain on sale of mutual funds	(0.24)	-	(0.71)	-	-	-	-	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	-	-	(0.41)	-	-	(1.45)	(0.96)	(2.76)	12.17
Liabilities no longer required written back/ Remission of loan liability	-	-	-	-	-	-	-	-	(44.43)
Interest income	(23.57)	(9.08)	(9.38)	(7.71)	(8.81)	(6.56)	(35.88)	(8.49)	(82.59)
Impairment loss allowance on financial assets (including write-offs)	1.08	-	-	-	-	-	-	-	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	266.33	142.28	163.68	290.83	330.80	239.23	960.07	766.58	1,705.49
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**76.00**	**750.96**	**349.92**	**698.60**	**434.43**	**240.00**	**1,042.60**	**1,173.83**	**2,098.12**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(1.46)	(3.89)	(2.14)	(0.02)	1.39	4.00	(5.58)	(29.69)	(15.77)
Decrease/(Increase) in trade receivables	(9.03)	(2.40)	0.50	33.77	(2.04)	(2.83)	(5.36)	(3.98)	(51.49)
Decrease/(Increase) in financial assets and non financial assets	25.11	(26.12)	(4.83)	(29.44)	10.43	59.05	323.02	1,116.97	(543.77)
(Decrease)/Increase in trade payables	148.73	(12.22)	(7.52)	13.89	12.39	(11.68)	(2.09)	(396.40)	970.78
(Decrease)/Increase in provisions	21.41	181.99	75.55	67.56	(592.71)	(265.24)	(1,145.65)	(219.30)	(2,461.29)
(Decrease)/Increase in financial liabilities and non financial liabilities	(31.27)	(1.32)	(1.21)	4.65	(11.10)	(11.14)	(34.16)	(585.57)	(109.60)
Cash flow generated from operating activities post working capital changes	**229.49**	**887.00**	**410.27**	**789.01**	**(147.21)**	**12.16**	**172.78**	**1,055.86**	**(113.02)**
Income tax (paid)/ refund (net)	(3.83)	(95.64)	(1.28)	(0.78)	(5.21)	(0.78)	(3.77)	(1.83)	5.24
Net cash generated from operating activities	**225.66**	**791.36**	**408.99**	**788.23**	**(152.42)**	**11.38**	**169.01**	**1,054.03**	**(107.78)**

Project wise operating cash flows for the year ended March 31, 2022:

Particulars	HTL	JLTL	JVTL	KETL	KMTL	LRTL	MKTL	NKTL	SMTL
Profit/ (loss) before tax	(427.67)	7.31	46.37	(311.72)	(258.90)	4.51	(312.42)	(435.97)	(287.79)
Adjustments for:	-	-	-	-	-	-	-	-	-
Depreciation and amortisation expense	344.31	202.24	126.78	202.58	351.22	219.00	317.12	253.67	200.59
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	-	-	-	-	-	-
Net gain on sale of mutual funds	(6.23)	(6.80)	(5.67)	(9.26)	(13.93)	(7.13)	(6.78)	(4.97)	(6.73)
Net loss on investments/ derivatives measured at fair value through profit or loss	-	-	-	-	-	-	-	-	-
Liabilities no longer required written back/ Remission of loan liability	-	-	-	-	-	-	-	-	-
Interest income	(10.80)	(9.55)	(6.22)	(6.65)	(11.70)	(9.57)	(6.56)	(4.01)	(4.77)
Claims for compensation/ concession extension	-	-	-	-	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	-	-	-	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	0.46	0.46	0.44	0.51	0.61	0.76	0.33	0.41
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	775.13	407.27	249.20	386.37	629.71	385.64	581.86	487.31	407.67
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**674.74**	**600.93**	**410.92**	**261.76**	**696.91**	**593.06**	**573.98**	**296.36**	**309.38**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(1.06)	(0.55)	(1.36)	-	(1.21)	(0.21)	-	-	-
Decrease/(Increase) in trade receivables	(0.40)	(0.92)	(0.60)	(0.57)	(0.98)	(0.61)	(0.91)	(0.38)	(0.50)
Decrease/(Increase) in financial assets and non financial assets	0.09	(3.64)	(1.21)	0.60	(2.31)	(2.30)	(2.10)	0.69	(0.41)
(Decrease)/Increase in trade payables	(3.88)	2.28	(1.26)	20.07	44.35	4.12	15.39	38.10	22.48
(Decrease)/Increase in provisions	112.10	(3.13)	(3.30)	(6.29)	281.02	298.96	(4.31)	39.66	(6.13)
(Decrease)/Increase in financial liabilities and non financial liabilities	3.45	4.02	1.81	13.97	11.11	2.54	9.50	9.83	11.19
Cash flow generated from operating activities post working capital changes	**785.04**	**598.99**	**405.00**	**289.54**	**1,028.89**	**895.56**	**591.55**	**384.26**	**336.01**
Income tax (paid)/ refund (net)	(1.43)	2.72	5.17	(0.63)	2.27	13.31	(1.46)	(0.68)	(0.49)
Net cash generated from operating activities	**783.61**	**601.71**	**410.17**	**288.91**	**1,031.16**	**908.87**	**590.09**	**383.58**	**335.52**

Project wise operating cash flows for the year ended March 31, 2022 (continued):

Particulars	APEL	JMTL	MBEL	WUPTL	WVEPL	NDEPL	FRHL	GAEPL	DATRL
Profit/ (loss) before tax	(63.05)	452.21	44.86	(31.51)	(642.09)	(776.85)	(780.58)	(2,209.41)	(3,006.55)
Adjustments for:									
Depreciation and amortisation expense	0.92	231.33	122.90	440.69	248.89	314.95	544.80	334.47	1,036.25
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	-	-	(2.12)	-	-	-
Net gain on sale of mutual funds	(1.68)	(2.33)	(8.50)	(5.21)	(0.01)	(4.97)	(5.29)	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	-	-	-	-	-	-	-	-	29.64
Liabilities no longer required written back/ Remission of loan liability	(0.11)	-	-	-	(1.85)	-	(83.53)	(126.83)	(8.36)
Interest income	(47.89)	(13.69)	(12.53)	(8.72)	(4.97)	(15.01)	(134.82)	(0.01)	(113.12)
Claims for compensation/ concession extension	-	-	-	-	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	-	-	(268.67)	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	18.15	3.86	17.10	-	-	-	-	1.73
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	418.46	392.18	277.77	605.75	579.61	365.07	1,659.70	1,604.89	3,697.01
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**306.65**	**1,077.85**	**428.36**	**749.43**	**179.58**	**(118.93)**	**1,200.28**	**(396.89)**	**1,636.60**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(0.49)	(0.62)	(1.79)	(3.90)	(4.35)	(6.68)	(0.47)	-	3.89
Decrease/(Increase) in trade receivables	(2.95)	12.83	3.06	14.60	(0.64)	(2.11)	(10.42)	(0.11)	(29.01)
Decrease/(Increase) in financial assets and non financial assets	706.28	(21.16)	1.26	6.38	(64.16)	(51.47)	2,918.00	(133.23)	40.74
Decrease/(Increase) in other assets	-	-	-	-	-	-	-	-	-
(Decrease)/Increase in trade payables	9.87	14.34	(0.75)	(77.43)	(12.30)	112.03	(104.70)	(470.28)	(22.35)
(Decrease)/Increase in provisions	0.52	299.22	120.96	(84.25)	235.35	350.74	(269.92)	2,581.21	962.38
(Decrease)/Increase in financial liabilities and non financial liabilities	(2.82)	(6.42)	(2.10)	(8.45)	0.28	(2.55)	(7,873.84)	533.29	(19.60)
Cash flow generated from operating activities post working capital changes	**1,017.06**	**1,376.04**	**549.00**	**596.38**	**333.76**	**281.03**	**(4,141.07)**	**2,113.99**	**2,572.65**
Income tax (paid)/ refund (net)	19.45	(113.40)	(1.40)	2.38	(0.26)	(1.43)	(1,285.77)	0.09	(24.32)
Net cash generated from operating activities	**1,036.51**	**1,262.64**	**547.60**	**598.76**	**333.50**	**279.60**	**(5,426.84)**	**2,114.08**	**2,548.33**

Project wise operating cash flows for the year ended March 31, 2021:

Particulars	HTL	JLTL	JVTL	KETL	KMTL	LRTL	MKTL	NKTL	SMTL
Profit/ (loss) before tax	(151.31)	7.14	20.64	(92.22)	(58.29)	68.57	(77.97)	(117.88)	(98.83)
Adjustments for:									
Depreciation and amortisation expense	153.57	77.65	49.81	86.00	157.11	81.38	117.47	89.01	90.97
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	-	-	-	-	-	-
Net gain on sale of mutual funds	-	-	-	-	-	-	-	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	(0.42)	(0.29)	(0.37)	(0.11)	(0.37)	(0.76)	(0.49)	(0.11)	(0.15)
Liabilities no longer required written back/ Remission of loan liability	-	-	-	-	-	-	-	-	-
Interest income	(3.92)	(2.90)	(1.53)	(3.50)	(5.02)	(2.78)	(3.60)	(3.08)	(3.19)
Claims for compensation/ concession extension	-	-	-	-	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	-	-	-	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	-	-	-	-	-	-	-	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	334.87	176.42	105.19	155.30	256.93	163.15	243.23	198.74	163.20
Provision for damages	2.10	1.62	1.44	6.65	8.57	3.34	4.86	6.43	6.60
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**334.89**	**259.64**	**175.18**	**152.12**	**358.93**	**312.90**	**283.50**	**173.11**	**158.60**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(0.22)	(0.02)	-	-	(0.80)	(0.04)	-	-	-
Decrease/(Increase) in trade receivables	(1.99)	(1.49)	(1.06)	(1.28)	(2.10)	(1.69)	(2.23)	(1.34)	(1.32)
Decrease/(Increase) in financial assets and non financial assets	(1.94)	30.48	(1.64)	(5.55)	(7.52)	(1.84)	(5.72)	(5.44)	(6.68)
(Decrease)/Increase in trade payables	16.61	11.00	10.57	18.29	34.21	15.87	22.87	17.92	17.21
(Decrease)/Increase in provisions	0.16	0.15	0.09	0.13	0.28	0.18	0.53	0.14	0.19
(Decrease)/Increase in financial liabilities and non financial liabilities	10.30	5.24	3.27	0.09	0.48	3.21	3.23	3.93	(0.01)
Cash flow generated from operating activities post working capital changes	**357.81**	**305.00**	**186.41**	**163.80**	**383.48**	**328.59**	**302.18**	**188.32**	**167.99**
Income tax (paid)/ refund (net)	(0.30)	(3.81)	(5.70)	(0.27)	(3.79)	(14.26)	(0.28)	(0.25)	(0.24)
Net cash generated from operating activities	**357.51**	**301.19**	**180.71**	**163.53**	**379.69**	**314.33**	**301.90**	**188.07**	**167.75**

Project wise operating cash flows for the year ended March 31, 2021 (continued):

Particulars	APEL	JMTL	MBEL	WUPTL	WVEPL	NDEPL	FRHL	GAEPL	DATRL
Profit/ (loss) before tax	(54.29)	386.03	57.08	(603.98)	(393.09)	(124.72)	2,097.97	(817.01)	(1,702.02)
Adjustments for:									
Depreciation and amortisation expense	1.08	218.69	109.17	362.38	249.45	68.58	518.88	445.72	901.11
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	0.08	0.05	0.31	-	-	-	-	-
Net gain on sale of mutual funds	(0.25)	(7.26)	(3.23)	(0.38)	-	-	-	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	(0.05)	(2.07)	(0.36)	(0.07)	(2.50)	-	(0.15)	-	101.08
Liabilities no longer required written back/ Remission of loan liability	(0.02)	(2.46)	-	(0.08)	(46.21)	-	(0.02)	-	(7.01)
Interest income	(48.15)	(12.93)	(8.42)	(27.08)	(9.12)	(1.33)	(102.01)	(0.10)	(46.29)
Claims for compensation/ concession extension	-	(67.13)	(43.38)	(143.24)	(36.28)	-	(286.27)	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	(0.38)	-	167.40	-	-	0.70	-	0.15
Impairment loss allowance on financial assets (including write-offs)	-	1.37	3.85	-	0.08	-	37.91	2.98	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	(19.38)
Finance costs (excluding derivative hedging cost)	452.56	421.27	277.71	662.17	383.02	82.61	1,335.99	1,839.85	3,064.17
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	(96.75)
Operating Profit before working capital changes and other adjustments	**350.88**	**935.21**	**392.47**	**417.43**	**145.35**	**25.14**	**3,603.00**	**1,471.44**	**2,195.06**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	-	2.09	(0.66)	(0.16)	(2.88)	(1.36)	(1.40)	-	(4.59)
Decrease/(Increase) in trade receivables	-	(4.56)	2.09	7.37	(2.01)	(1.09)	(1.95)	(6.02)	(109.46)
Decrease/(Increase) in financial assets and non financial assets	638.01	10.31	(3.30)	21.42	(9.24)	(15.82)	(3,154.47)	40.54	(405.40)
Decrease/(Increase) in other assets	-	-	-	-	-	-	-	-	-
(Decrease)/Increase in trade payables	(7.90)	(22.38)	(23.12)	64.81	30.50	57.81	107.49	135.23	613.35
(Decrease)/Increase in provisions	0.32	218.46	108.25	(276.66)	258.48	95.18	591.45	204.49	385.84
(Decrease)/Increase in financial liabilities and non financial liabilities	(0.52)	5.40	2.97	5.78	15.80	19.45	3,728.56	8.20	(1,715.07)
Cash flow generated from operating activities post working capital changes	**980.79**	**1,144.53**	**478.70**	**239.99**	**436.00**	**179.31**	**4,872.68**	**1,853.88**	**959.73**
Income tax (paid)/ refund (net)	85.48	(88.38)	(0.72)	0.44	(2.16)	(0.11)	45.31	0.09	21.14
Net cash generated from operating activities	**1,066.27**	**1,056.15**	**477.98**	**240.43**	**433.84**	**179.20**	**4,917.99**	**1,853.97**	**980.87**

CUBE HIGHWAYS TRUST
Notes forming part of Special Purpose Combined Financial Statements
(All amounts in ₹ million unless otherwise stated)

Project wise operating cash flows for the year ended March 31, 2020:

Particulars	HTL	JLTL	JVTL	KETL	KMTL	LRTL	MKTL	NKTL	SMTL
Profit/ (loss) before tax	(1.19)	(1.78)	(0.65)	(1.95)	(2.43)	(0.88)	(1.86)	(2.15)	(2.00)
Adjustments for:									
Depreciation and amortisation expense	-	-	-	-	-	-	-	-	-
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	-	-	-	-	-	-
Net gain on sale of mutual funds	-	-	-	-	-	-	-	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	-	-	-	-	-	-	-	-	-
Liabilities no longer required written back/ Remission of loan liability	-	-	-	-	-	-	-	-	-
Interest income	-	(0.21)	-	-	-	-	-	-	-
Claims for compensation/ concession extension	-	-	-	-	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	-	-	-	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	-	-	-	-	-	-	-	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	-	1.14	-	-	-	-	-	-	-
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	-
Operating Profit before working capital changes and other adjustments	**(1.19)**	**(0.85)**	**(0.65)**	**(1.95)**	**(2.43)**	**(0.88)**	**(1.86)**	**(2.15)**	**(2.00)**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	-	-	-	-	-	-	-	-	-
Decrease/(Increase) in trade receivables	-	-	-	-	-	-	-	-	-
Decrease/(Increase) in financial assets and non financial assets	-	(32.18)	-	(4.89)	(6.69)	-	(4.32)	(4.91)	(5.35)
(Decrease)/Increase in trade payables	1.15	0.82	0.61	1.18	1.39	0.84	1.18	1.39	1.16
(Decrease)/Increase in provisions	-	-	-	-	-	-	-	-	-
(Decrease)/Increase in financial liabilities and non financial liabilities	0.02	0.19	0.02	5.64	7.71	0.02	4.99	5.73	6.18
Cash flow generated from operating activities post working capital changes	**(0.02)**	**(32.02)**	**(0.02)**	**(0.02)**	**(0.02)**	**(0.02)**	**(0.01)**	**0.06**	**(0.01)**
Income tax (paid)/ refund (net)	-	(0.02)	-	-	-	-	-	-	-
Net cash generated from operating activities	**(0.02)**	**(32.04)**	**(0.02)**	**(0.02)**	**(0.02)**	**(0.02)**	**(0.01)**	**0.06**	**(0.01)**

Project wise operating cash flows for the year ended March 31, 2020 (continued):

Particulars	APEL	JMTL	MBEL	WUPTL	WVEPL	NDEPL	FRHL	GAEPL	DATRL
Profit/ (loss) before tax	457.99	296.56	(58.69)	(612.73)	47.02	(0.24)	(457.98)	(274.65)	(906.32)
Adjustments for:									
Depreciation and amortisation expense	1.25	225.28	121.17	455.25	325.02	-	513.12	459.15	1,155.49
(Profit)/Loss on sale/write-off of property, plant and equipment (net)	-	-	-	0.06	-	-	-	-	-
Net gain on sale of mutual funds	-	(1.56)	(0.63)	(0.15)	(4.77)	-	-	-	-
Net loss on investments/ derivatives measured at fair value through profit or loss	-	(0.26)	(0.14)	(0.50)	-	-	-	-	39.98
Liabilities no longer required written back/ Remission of loan liability	(120.00)	-	(1.47)	(0.52)	-	-	(1.03)	-	(2.30)
Interest income	(57.85)	(35.45)	(8.88)	(33.70)	(12.54)	-	(0.26)	(12.17)	(22.06)
Claims for compensation/ concession extension	-	(18.06)	(10.24)	(12.89)	-	-	-	-	-
Impairment charge/(reversal) of impairment of intangible assets and investment properties (net)	-	0.38	1.03	156.09	-	-	-	-	-
Impairment loss allowance on financial assets (including write-offs)	-	2.06	15.17	-	-	-	-	-	-
Gain on cash flows changes on non-convertible debentures (net)	-	-	-	-	-	-	-	-	-
Finance costs (excluding derivative hedging cost)	507.70	457.65	276.56	662.14	159.16	-	914.74	1,736.07	2,082.39
Provision for damages	-	-	-	-	-	-	-	-	-
Unrealised (gain)/ loss on foreign currency transaction	-	-	-	-	-	-	-	-	310.51
Operating Profit before working capital changes and other adjustments	**789.09**	**926.60**	**333.88**	**613.05**	**513.89**	**(0.24)**	**968.59**	**1,908.40**	**2,657.69**
Working capital changes and other adjustments:									
Decrease/(Increase) in inventories	(0.97)	(2.30)	0.34	0.20	-	-	-	-	-
Decrease/(Increase) in trade receivables	-	4.07	(26.32)	(23.13)	(10.35)	-	(64.75)	3.76	305.18
Decrease/(Increase) in financial assets and non financial assets	(551.39)	(6.28)	81.71	(32.06)	0.39	-	89.59	(47.25)	(151.72)
Decrease/(Increase) in other assets	-	-	-	-	-	-	-	-	-
(Decrease)/Increase in trade payables	24.73	9.83	(32.57)	2.48	12.96	0.15	(84.10)	388.55	48.01
(Decrease)/Increase in provisions	0.31	(472.41)	(278.87)	35.91	55.83	-	323.25	255.75	334.02
(Decrease)/Increase in financial liabilities and non financial liabilities	(9.44)	(1.98)	(3.75)	(2.40)	(4.60)	0.01	19.95	52.17	8.37
Cash flow generated from operating activities post working capital changes	**252.33**	**457.53**	**74.42**	**594.05**	**568.12**	**(0.08)**	**1,252.53**	**2,561.38**	**3,201.55**
Income tax (paid)/ refund (net)	(28.83)	(47.34)	(1.40)	6.49	58.57	-	(9.23)	54.79	(11.58)
Net cash generated from operating activities	**223.50**	**410.19**	**73.02**	**600.54**	**626.69**	**(0.08)**	**1,243.30**	**2,616.17**	**3,189.97**

B Capitalisation statement

Particulars	Pre-issue as at October 31, 2022	As adjusted for issue
Debt:		Corresponding details post private placement of units are not available, hence the required disclosure in respect of the same have not been provided.
Non-current borrowings (Refer note 22)	119,130.54	
Current borrowings (Refer note 27)	6,122.31	
Interest accrued on borrowings (Refer note 23, 29)	8,478.71	
Less: Cash and cash equivalent, Bank balances other than cash and cash equivalents net of restricted deposits and deposits with banks* (Refer note 15, 16, 9)	(12,834.98)	
Total adjusted debt (A)	**120,896.58**	
Equity:		
Capital (Refer note 20)	8,522.87	
Other equity (Refer note 21)	(7,636.53)	
Total equity (B)	**886.34**	
Debt equity ratio [A/B]	136.40	

*Cash and cash equivalents has been considered after excluding deposits maintained in MMR account amounting ₹4,430.69 million and restricted deposits of ₹ Nil million

C Debt payment history

Particulars	For the seven month ended October 31, 2022				For the year ended March 31, 2022				For the year ended March 31, 2021				For the year ended March 31, 2020			
	Term loans	Non Convertible Debentures and Optionally Convertible Debentures	Other long term borrowings	Loans from others	Term loans	Non Convertible Debentures and Optionally Convertible Debentures	Other long term borrowings	Loans from others	Term loans	Non Convertible Debentures and Optionally Convertible Debentures	Other long term borrowings	Loans from others	Term loans	Non Convertible Debentures and Optionally Convertible Debentures	Other long term borrowings	Loans from others
Carrying amount of debt at the beginning of the year	67,981.51	55,032.53	3,692.74	3,134.24	76,239.70	39,776.39	3,004.48	4,273.64	40,520.92	11,724.60	3,314.79	4,442.66	42,308.22	12,109.16	3,664.12	2,873.49
Cash adjustments:																
Additional borrowings during the period/year	4,956.79	9,350.00	-	-	19,273.30	21,661.00	1,250.00	458.00	40,429.96	29,028.29	-	64.58	660.00	70.00	-	1,284.84
Repayments during the period/year	(10,317.31)	(960.16)	(3,418.32)	(3,134.24)	(27,598.15)	(4,475.35)	(148.45)	(111.94)	(4,176.89)	(4,053.82)	(3,171.75)	(53.10)	-2,810.66	-351.85	-	-65.00
Other adjustments:																
Non-cash adjustment:																
- Conversion of subordinate loan into debentures/ Remission of loan liability	-	-	-	-	-	-	-	-	-	6,310.83	2,906.34	(180.50)	-	-120.00	-	-
- Impact in equity	-	(1,259.36)	-	-	-	(2,091.79)	(413.29)	(1,485.46)	-	(3,227.28)	111.18	-	-	-	-	-
- Valuation gain on non-convertible debentures	-	-	-	-	-	-	-	-	-	(19.38)	(160.58)	-	-	-	-	-
- Foreign exchange fluctuation	-	-	-	-	-	-	-	-	(96.75)	-	-	-	310.47	-	-	-
- Unwinding of interest	54.46	134.06	5.91	-	66.66	162.28	-	-	(437.54)	13.15	4.50	-	52.89	17.29	-	-
- Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-349.33	349.33
Carrying amount of debt at the end of period/year	**62,675.45**	**62,297.07**	**280.33**	**-**	**67,981.51**	**55,032.53**	**3,692.74**	**3,134.24**	**76,239.70**	**39,776.39**	**3,004.48**	**4,273.64**	**40,520.92**	**11,724.60**	**3,314.79**	**4,442.66**
Interest paid (including capitalised) during the period/year	**5,391.29**				**9,204.41**				**10,458.04**				**5,578.64**			

Reconciliation of borrowings and debt repayment history

Particulars	As at October 31, 2022	As at March 31, 2022	As at March 31, 2021	As at March 31, 2020
Long Term Borrowings	119,130.54	112,338.40	110,138.20	50,469.38
Short Term Borrowings	6,122.31	17,502.62	13,156.01	9,533.58
Total Borrowings	**125,252.85**	**129,841.02**	**123,294.21**	**60,002.96**

D Statement of net assets at fair value as at October 31, 2022

Particulars	Book value	Fair value
A. Assets	148,217.33	296,712.92
B. Liabilities (at book value)	147,330.99	147,330.99
C. Net assets (A-B)	886.34	149,381.93

The number of units that Cube Highways Trust will issue to investors in connection with the proposed private placement of units of the Proposed Trust Group in exchange of the shareholdings in the Proposed Trust Group is not presently ascertainable. Accordingly, disclosures in respect of Net Asset Value (NAV) per unit have not been given.

Fair values of total assets relating to the Proposed Trust Group as at October 31, 2022 as disclosed above have been computed by the management considering the Enterprise Value based on the fair valuation report of the independent valuer appointed under SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended and after making necessary adjustments to arrive at fair value of total assets.

Note:

SPV wise break up of fair value of assets as at October 31, 2022:

Particulars	Fair value [(i)]
HTL	19,275.12
JLTL	12,910.59
JVTL	8,952.48
KETL	8,900.14
KMTL	16,915.83
LRTL	12,882.07
MKTL	15,487.98
NKTL	10,339.01
SMTL	9,516.99
APEL	3,423.34
JMTL	15,332.68
MBEL	7,002.52
WUPTL	4,903.43
WVEPL	8,843.12
NDEPL	7,500.63
FRHL	30,736.50
GAEPL	27,264.33
DATRL	76,526.15
Total	**296,712.92**

(i) Fair values of assets as disclosed above are the fair values of the total assets of the Proposed Trust Group which are included in the Special Purpose Combined Financial Statements.

E Statement of total return at fair value:

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022
Total comprehensive income for the period/year (As per the Special Purpose Combined Statement of Profit and Loss)	(569.89)	(8,252.94)
Add/Less: Other changes in fair value (excluding tax) for the period/year (e.g., in investment property, property, plant & equipment (if cost model is followed)) not recognized in Total Comprehensive Income [(i)]	(6,185.90)	12,563.41
Total return	**(6,755.79)**	**4,310.47**

Note:

(i) In the above Statement, the amount of other changes in the fair value for the seven month ended October 31, 2022 has been computed based on the difference in fair values of Assets as at October 31, 2022 and as at March 31, 2022, which are based on the Enterprise Value as determined in the valuation report of the independent valuer appointed under SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended and after making necessary adjustments to arrive at fair value of Assets.

51 Provisions

(a) Provision for periodic major maintenance work

The Proposed Trust Group is required to operate and maintain the project highway during the entire concession period and hand over the project back to the Authority as per the maintenance standards prescribed in Concession agreement.

For this purpose, a regular maintenance along with periodic maintenances is required to be performed. Normally periodic maintenance includes resurface of pavements, repairs of structures and other equipment's and maintenance of service roads.

The maintenance cost/ bituminous overlay may vary based on the actual usage during maintenance period. Accordingly on the grounds of matching cost concept and based on technical estimates, a provision for major maintenance expenses is reviewed and is provided for in the financial statements annually.

Movement in provisions for periodic major maintenance work

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
Opening balance	10,564.26	5,820.97	3,901.90	3,399.11
Add : Additional provision charged to Special Purpose Combined Statement of Profit and Loss [(i)]	471.93	5,123.47	1,919.57	2,192.74
Less : Utilised	(4,803.99)	(933.52)	(342.86)	(1,934.40)
Add : Unwinding of discount and changes in discount rate	73.79	553.34	342.36	244.45
Closing balance	**6,305.99**	**10,564.26**	**5,820.97**	**3,901.90**
Non-current [(ii)]	3,041.89	2,808.42	2,952.48	3,901.20
Current [(iii)]	3,264.10	7,755.84	2,868.49	0.70

Notes:

(i) For the year ended March 31, 2022, provisioning for the periodic major maintenance has increased in GAEPL by ₹ 2,580.48 million mainly on account of increase in bitumin prices and significant repairs to pavement of carriageways brought about by an independent third party in recent survey.

(ii) The expected period of utilisation of non current provision is within 5 years.

(iii) The expected period of utilisation of current provision is within next 1 year.

(b) Provisions for contractual obligation for infrastructure upgrade work, etc

Certain SPVs estimates and provides for contract liability in respect of unavoidable obligations to improve/upgrade the infrastructure to be undertaken as per Concession Agreement with NHAI. These estimates are corroborated through purchase orders/ work orders placed or to be placed by these SPVs as per the road survey reports issued by an independent field expert. As the estimated cost is based on the various assumptions such as current infrastructure (road, pavements, etc.) condition, inflation in material cost etc., hence the Management is required to apply judgement over these factors.

Movement in Provisions for contractual obligation for infrastructure upgrade work, etc

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
Opening balance	3,777.14	10,481.13	-	-
Add : Additional provision capitalised under service concession arrangement	485.63	700.00	10,481.13	-
Less : Utilised	(862.47)	(6,657.24)	-	-
Add : Unwinding of discount and changes in discount rate	21.43	35.89	-	-
Less : Reversal on account of change in estimation [Refer note 6]	(47.30)	(782.64)	-	-
Closing balance	**3,374.43**	**3,777.14**	**10,481.13**	**-**
Non-current [(i)]	488.03	466.60	430.71	-
Current [(ii)]	2,886.40	3,310.54	10,050.42	-

(i) The expected period of utilisation of non current provision is within 2-3 years.

(ii) The expected period of utilisation of current provision is within next 1 year.

52 Micro, Small and Medium Enterprises Development Act, 2006

Particulars	For the seven month ended October 31, 2022	For the year ended March 31, 2022	For the year ended March 31, 2021	For the year ended March 31, 2020
(i) Principal amount remaining unpaid to any supplier as at the end of the accounting period/year	127.45	148.07	149.07	58.11
(ii) Interest due thereon remaining unpaid to any supplier as at the end of the accounting period/year	0.03	0.91	0.76	0.54
(iii) The amount of interest paid along with the amounts of the payment made to the supplier beyond the appointed day				
- Principal	330.14	60.57	6.24	12.26
- Interest	-	-	-	-
(iv) The amount of interest due and payable for the period/year	13.42	1.42	0.53	0.70
(v) The amount of interest accrued and remaining unpaid at the end of the accounting period/year	16.27	2.72	1.46	0.71
(vi) The amount of further interest due and payable even in the succeeding year, until such date when the interest dues as above are actually paid	-	-	0.01	0.35

Note :

(i) Dues to Micro Enterprises and Small Enterprises have been determined to the extent such parties have been identified on the basis of information collected by the Management. This has been relied upon by the auditors.

(ii) In Ghaziabad Aligarh Expressway Private Limited interest of MSME has been waived off based on agreement with MSME vendors.

53 Service Concession Arrangement

The details of service concession arrangements of all the SPVs are as follows:

Hazaribagh Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Hazaribagh – Ranchi Section (KM 41.500 – KM 115.290) Road Project on NH-33 in the state of Jharkhand as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-33 (NH-33) from KM-41.50 to KM 115.29
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
End of Concession	October 18, 2050
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and routine maintenance of the highway
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	27 years, 11 months and 18 days

Jhansi-Lalitpur Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Jhansi-Lalitpur Section (KM 00.00 – KM 49.70) Road Project on NH-25 in the state of Uttar Pradesh as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-25 (NH-25) from KM-00.00 to KM 49.70
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
Reduction of period (estimated)	1826 Days
End of Concession period	October 18, 2045 (Including Estimated reduction period)
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and routine maintenance of the highway
Major Overlays	In terms of the SCA , the SPV is not obligated to carry out any overlay of the roads. It is just required to operate the highway and carry out routine maintenance works.
Remaining amortisation period of rights under SCA as at October 31, 2022	22 years, 11 months and 18 days

Jhansi-Vigakhet Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Jhansi-Lalitpur Section (KM 49.70 – KM 99.00) Road Project on NH-26 in the state of Uttar Pradesh as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-26 (NH-26) from KM-49.70 to KM 99.00
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
Reduction of period (estimated)	1826 Days
End of Concession period	October 18, 2045 (Including estimated reduction period)
Extension of Period	No extension as at October 31, 2022
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and routine maintenance of the highway
Major Overlays	In terms of the SCA , the SPV is not obligated to carry out any overlay of the roads. It is just required to operate the highway and carry out routine maintenance works.
Remaining amortisation period of rights under SCA as at October 31, 2022	22 years, 11 months and 18 days

Kanyakumari-Etturavattam Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Madurai-Kanyakumari Section (KM 52.300 – KM 116.500) Road Project on NH-07 in the state of Tamil Nadu as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-07 (NH-07) from KM-52.30 to KM 116.50
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
End of Concession period	October 18, 2050
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and maintain the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	27 years, 11 months and 18 days

Kotwa-Muzaffarpur Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Kotwa-Muzaffarpur Section (KM 440.00 – KM 520.00) Road Project on NH-28 in the state of Bihar as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-28 (NH-28) from KM-440.00 to KM 520.00
Nature of Asset	Intangible
Year when SCA granted	October 19, 2020
Period	30 Years
End of Concession	October 18, 2045 (Including Estimated reduction period)
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and maintain the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	22 years, 11 months and 18 days

Lucknow-Raebareli Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Lucknow-Raibareli Section (KM 12+700 to KM 82+700) Road Project on NH 24B in the state of Uttar Pradesh as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-24B (NH-24B) from KM-12+700 to KM 82+700
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 years
Reduction of Period (estimated)	5 years
End of Concession	October 18, 2045 (Including Estimated reduction period)
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and routine maintenance of the highway
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	22 years, 11 months and 18 days

Madurai Kanyakumari Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Madurai-Kanyakumari Section (KM 00.00 – KM 52.30) Road Project on NH-07 in the state of Tamil Nadu as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-07 (NH-07) from KM-00.00 to KM 52.30
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
End of Concession period	October 18, 2045 (Including Estimated reduction period)
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and maintain the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	22 years, 11 months and 18 days

Nanguneri-Kanyakumari Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Madurai-Kanyakumari Section (KM 180.00 – KM 243.47) Road Project on NH-07 in the state of Tamil Nadu as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-07 (NH-07) from KM-180.00 to KM 243.47
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
End of Concession period	October 18, 2050
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and maintain the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	27 years, 11 months and 18 days

Salaipudhur- Madurai Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Madurai-Kanyakumari Section (KM 116.50 – KM 180.00) Road Project on NH-07 in the state of Tamil Nadu as agreed between the SPV and National Highway Authority of India (NHAI) on Tolling, operation, maintenance and transfer (TOT) basis.
Project	National Highway-07 (NH-07) from KM-116.50 to KM 180.00
Nature of Asset	Intangible
Year when SCA granted	October 20, 2020
Period	30 Years
End of Concession period	October 18, 2050
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Operation and maintenance of the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	27 years, 11 months and 18 days

DA Toll Road Private Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of six lanes Delhi - Agra Section (KM 20.500 – KM 200.000) Road Project on NH-2 in the state of Haryana/Uttar Pradesh as agreed between the SPV and National Highway Authority of India (NHAI) on Design, Built, Finance, Operate and Transfer (DBFOT) basis under National Highway Development Program (NHDP) phase -V.
Project	Project Six lanes Delhi-Agra Section (KM 20.500 – KM 200.000) Road Project on NH-2
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) for Toll Road Carriageway)
Year when SCA granted	October 16, 2012
Concession period	26 Years
Estimated extension of concession period	857 days (March 31, 2022 - 857 days, March 31, 2021- 1898 days)
Stage of completion	Completed with Provisional Commercial Operation Date (COD) as May 20, 2022. The date of issue of this Provisional Completion date shall be the COD, as defined in the said concession agreement.
End of concession period	February 18, 2041 (Including estimated extension period)
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	To establish, develop, finance, design, construct the roads & bridges and operation and maintenance of rehabilitation and strengthening of existing 6 lane highway of KM 20.500 to KM 200.000 of NH-2 (Delhi - Agra section) in state of Haryana/Uttar Pradesh on DBFOT basis under National Highway Development Program (NHDP) phase -V.
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	18 years and 3 months

Farakka Raiganj Highways Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of four lanes Farakka – Raiganj Section (KM 295.00 – KM 398.000) Road Project on NH-34 in the state of West Bengal as agreed between the SPV and National Highway Authority of India (NHAI) on Design, Built, Finance, Operate and Transfer (DBFOT) basis under National Highway Development Program (NHDP) phase -III
Project	Four lanes Farakka – Raiganj Section (KM 295.00 – KM 398.000) Road Project on NH-34
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway)
Year when SCA granted	February 01, 2011
Period	30 Years
Extension of Period	90 Days
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	To establish, develop, finance, design, construct the roads & bridges and operation and maintenance of rehabilitation and strengthening of existing 4 lane divided highway of (KM 295.00 to KM 398.00) of NH-34 (Farakka- Raiganj section) in state of West Bengal on DBFOT basis under National Highway Development Program (NHDP) phase -III.
Major Overlays	In terms of the SCA , the SPVs obligation to carry out overlay of the roads has not been defined. However, basis quality parameters to be maintained as per SCA, the management is expecting to carry out the overlay of the roads at interval of five to six years.
Remaining amortisation period of rights under SCA as at October 31, 2022	18 years and 6 months

Walayar Vadakkencherry Expressways Private Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Walayar – Vadakkancherry (KM 182.250 to KM 240.000) Road Project on NH-47 (Now NH-544) in the State of Kerala as agreed between the SPV and National Highway Authority of India (NHAI) on Design, Build, Finance, Operate and Transfer (DBFOT) basis.
Project	National Highway-47 (Now NH-544) from KM 182.250 to KM 240.000 (approx 54 km) on the Walayar- Vadakkencherry section.
Nature of Asset	Intangible
Year when SCA granted	September 17, 2012
Cash support by way of grant	2646.00 million (29% of the total project cost) adjusted with intangible asset.
Period	20 Years
Extension of Period	1550 days
Stage of completion	Completed with commercial operation date (COD) on October 31, 2015
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	Establish, develop, finance and design and construct the roads and bridges on NH-47 (NH-544) and to operate and maintain the project.
Major Overlays	In terms of the SCA , the SPVs obligation to carry out overlay of the roads has not been defined. However, basis quality parameters to be maintained as per SCA, the management is expecting to carry out the overlay of the roads at interval of six to seven years.
Remaining amortisation period of rights under SCA as at October 31, 2022	14 years, 9 months and 15 days

Nelamangala Devihalli Expressway Private Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of four lanes (KM 28.200 – KM 110.000) Road Project on NH-48 in the state of Karnataka as agreed between the SPV and National Highway Authority of India (NHAI) on Built, Operate and Transfer (BOT) basis under National Highway Development Program (NHDP) phase -III A.
Project	Four lanes (KM 28.200 – KM 110.000) Road Project on NH-48
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway)
Year when SCA granted	July 9, 2007
Original Concession Period	25 Years w.e.f January 5, 2008 i.e. Appointed Date (180 days from date of signing of agreement i.e. July 07, 2007)
Details of substitution of concessionaire	Substitution of concessionaire vide Supplementary agreement dated January 11, 2021 to Original concession agreement dated July 9, 2007 for balance concession period from January 11, 2021 to February 13, 2033.(Including estimated extension period)
Premature termination	On force majeure event or parties defaulting on their obligation
Stage of completion	Completed with Provisional Commercial Operation Date (COD) as June 23, 2012. The date of issue of this Provisional Completion date shall be the COD, as defined in the said concession agreement.
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay during the entire concession period and hand over the project back to the Authority (NHAI) as per the maintenance standards prescribed in Concession agreement.
Obligation to provide services:	To establish, design, engineering, financing, construction and operation and maintenance of rehabilitation and strengthening of existing 2- lane road and widening to 4 lane divided highway of KM 28.200 to KM 110.000 of NH-48 in state of Karnataka on BOT basis under National Highway Development Program (NHDP) phase -III A.
Remaining amortisation period of rights under SCA as at October 31, 2022	10 years, 3 months and 13 days

Western UP Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of four lanes Meerut – Muzaffarnagar Section (KM 52.250 – KM 131.000) Road Project on NH-58 in the state of Uttar Pradesh as agreed between the SPV and National Highway Authority of India (NHAI) on Built, Operate and Transfer (BOT) basis under National Highway Development Program (NHDP) phase -III A.
Project	Four lanes Meerut – Muzaffarnagar Section (KM 52.250 – KM 131.000) Road Project on NH-58
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway)
Year when SCA granted	September 09, 2005
Period	20 Years
Extension of Period	85 days
Stage of completion	Completed with Commercial Operation Date (COD) as April 25, 2011
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	To establish, develop, finance, design, construct the roads & bridges and operation and maintenance of rehabilitation and strengthening of existing 2- lane road and widening to 4 lane divided highway of KM 52.250 to KM 131.000of NH-58 (Meerut-Muzaffarnagar section) in state of Uttar Pradesh on BOT basis under National Highway Development Program (NHDP) phase -III A.
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	3 years and 7 months

Jaipur-Mahua Tollway Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of Jaipur – Mahua Section (KM 120.000 – KM 228.000) Road Project on NH-21 in the state of Rajasthan as agreed between the SPV and National Highway Authority of India (NHAI) on Built, Operate and Transfer (BOT) basis. ("Project Highway")
Project	National Highway-21 (NH-21) from KM-120.00 to KM 228.00
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway)
Year when SCA granted	September 23, 2005
Period	25 Years
Extension of Period	47 Days
Stage of completion	Completed with Commercial Operation Date (COD) as March 8, 2008
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	To establish, develop, finance and design and construct the roads and bridges on NH-21 and to operate and maintain the project.
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	8 years and 9.5 months

Mahua Bharatpur Expressways Limited

Description and right to use specified asset	Toll collection from the users and operation and maintenance of four lanes Bharatpur – Mahua Section (KM 63.000 – KM 120.000) Road Project on NH-11 in the state of Rajasthan as agreed between the SPV and National Highway Authority of India (NHAI) on Built, Operate and Transfer (BOT) basis. ("Project Highway")
Project	Four lanes Bharatpur – Mahua Section (KM 63.000 – KM 120.000) Road Project on NH-11
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) i.e. Intangible Assets-Toll Road Carriageway)
Year when SCA granted	October 13, 2005
Period	25 Years
Extension of Period	49 Days
Stage of completion	Completed with Commercial Operation Date (COD) as May 8, 2009
Premature termination	On force majeure event or parties defaulting on their obligation
Obligation to provide services:	To establish, develop, finance and design and construct the roads and bridges on NH-11 and to operate and maintain the project
Major Overlays	In terms of the SCA , the SPV is obligated to carry out overlay of the roads at the end of specified periods.
Remaining amortisation period of rights under SCA as at October 31, 2022	8 years and 7 months

Ghaziabad Aligarh Expressway Private Limited

Description and right to use specified asset	Design, Engineering, Finance, Construction, Operation and Maintenance of Ghaziabad – Aligarh Section of NH-91 from Km. 23.600 to Km. 149.900 in the State of Uttar Pradesh under NHDP Phase-III on Design, Build, Finance, Operate and Transfer (the "DBFOT") Basis
Project	Project 4/6 lanes Ghaziabad – Aligarh Section of NH-91 from Km. 23.600 to Km. 149.900
Nature of Asset	Intangible (Rights under Service Concession Arrangements (SCA) for Toll Road Carriageway)
Year when SCA granted	20th May 2010
Period	24 Years
Extension of Period	1553 Days
End of concession period	31st May 2039
Premature termination	On force majeure event or parties defaulting on their obligation
Major Overlays	In terms of the SCA , the SPVs obligation to carry out overlay of the roads has not been defined. However, basis quality parameters to be maintained as per SCA, the management is expecting to carry out the overlay of the roads at interval of six to seven years.
Remaining amortisation period of rights under SCA as at October 31, 2022	16 years and 7 months

54 (i) During the year ended March 31, 2021, Cube Highways and Infrastructure III Pte. Ltd ("Cube Highways") acquired 100% equity share capital of WVEPL from KNR Constructions Limited ("KNR" or "Seller") pursuant to the Share Purchase Agreement dated January 9, 2020 as amended by Amendment Agreement dated September 18, 2020 (collectively referred as "SPA") entered into between Cube Highways, KNR and WVEPL.

In earlier years KNR had partially funded construction and development of the Carriage-Way by way of extending interest free unsecured shareholder loans to WVEPL aggregating ₹ 3,965.10 million ("Seller Loans"). Of the Seller Loans, ₹ 2,615.00 million was extended pursuant to the Subordinated Loan Agreement and balance ₹ 1,350.10 million was regulated by the Sponsor's Undertaking. This Seller Loans being in the nature of subordinate loan were repayable only after satisfaction of senior debt and at the option of WVEPL, were recognized as "Equity Component of Seller Loans" in Other Equity upto the year ended March 31, 2020.

During the year ended March 31, 2021, WVEPL and KNR agreed to the amount and terms of repayment etc. of Seller Loans in accordance with the terms of SPA. In terms of SPA, the Seller waived off ₹ 168.24 million prior to the closing date referred to in the SPA. On account of modification in terms and conditions of Sellers Loans, ₹ 3,796.85 million had been reclassified into borrowings during the year ended March 31, 2021. Further, during year ended March 31, 2021 pursuant to SPA, WVEPL paid ₹ 3,030.34 million to the Seller. WVEPL also entered into Subordinated Outstanding Seller Loan Agreement dated September 24, 2020 with KNR ("Seller Loan Agreement") to define and record the terms of the Subordinated Outstanding Seller Loan, including terms of its repayment. Consequent to the above, WVEPL recognised liability related to Subordinated Outstanding Seller Loan at fair value on the date of modification and the difference between the carrying amount of Subordinated Outstanding Seller Loan and fair value amounting ₹ 160.58 million had been recognised as "Equity Component of Seller Loans" in Other Equity considering the transaction is with the shareholders in their capacity as owner.

During the year ended March 31, 2022, WVEPL repaid ₹ 141.41 million as per terms of events specified in the Seller Loan Agreement and forfeited ₹ 46.21 million on account of non-achievement of conditions referred to in the Seller Loan Agreement.
Further, ₹ 9.51 million for the year ended March 31, 2022 (March 31, 2021 ₹ 4.5 million) being unwinding of interest on unsecured loan has been recognized as finance costs.

The repayment terms of outstanding Subordinated Outstanding Seller Loans as per the Seller Loan Agreement are as under:

Sr. No.	As on October 31, 2022 (in ₹ million)	As on March 31, 2022 (in ₹ million)	As on March 31, 2021 (in ₹ million)	Event based repayment schedule (in ₹ million)
1	123.43	123.43	113.92	A portion of the outstanding unsecured loan equal to the Earnout Holdback Amount of ₹ 270.00 million (undiscounted amount) shall continue to remain outstanding till the preparation and finalization of WVEPL audited MIS for the financial years ending March 31, 2022 and March 31, 2023.
2	2.10	2.10	160.00	A portion of the outstanding unsecured loan equal to the Transition Tax Holdback Amounts shall continue to remain outstanding till the income tax assessment for the financial years 2017-18 and 2018-19 is completed by the relevant taxation authorities.
3	148.89	148.89	148.89	The portion of the outstanding unsecured loan equal to the WC Pass Through Amounts shall be payable only after it has actually received such amounts from National Highways Authority of India, Insurance company, State transport Authorities and the relevant Government/ taxation authorities in terms of the Claims Management Agreement, as amended. Expected to be settled within next one year.
Total	**274.42** [(i)]	**274.42** [(i)]	**422.81**[(i)]	

(i) Disclosed ₹ 123.43 million (March 31, 2022 ₹ 123.43 million, March 31, 2021 ₹ 113.92 million) under non-current borrowings and ₹ 150.99 million (March 31, 2022 ₹ 150.99 million, March 31, 2021 ₹ 308.89 million) as current borrowings as per above repayment schedule.

During the year ended March 31, 2021, in terms of SPA, prepayment penalty to lenders of ₹ 9.34 million has been recovered and adjusted against amount payable to KNR by WVEPL. This transaction is with the shareholders in their capacity as owners and therefore has been recognised in Other Equity during the year ended March 31, 2021.

Waiver of loan by Seller of ₹ 168.24 million, difference between the carrying amount of Subordinated Outstanding Seller Loan and fair value amounting ₹ 160.57 million and recovery of prepayment penalty to lenders of ₹ 9.34 million referred above are being reflected as "Equity Component of Seller Loans" under Other Equity during the year ended March 31, 2021.

WVEPL has certain potential claims against various third parties inter alia including National Highway Authority of India, state transport authorities, insurance companies and also certain receivables for the period prior to March 31, 2019. WVEPL has entered Claims Management Agreement dated January 9, 2020 as amended by the Amendment Agreement dated September 18, 2020 with KNR ("Agreement') wherein WVEPL and KNR have commercially agreed that any monetary compensation received by WVEPL pursuant to such claims shall be passed through to KNR, subject to deductions of related costs and expenses, applicable taxes and certain specific adjustments as stipulated in the Agreement. No amounts have been received from third parties referred above and therefore, no adjustments have been made in these Special Purpose Combined Financial Statements for the same.

54 (ii) During the year ended March 31, 2021, Cube Highways and Infrastructure III Pte Ltd ("Cube Highways") acquired 100% equity share capital of DATRL from Reliance Infrastructure Limited ("RIL" or "Subscriber" or "Seller") pursuant to the Share Purchase Agreement dated March 14, 2019 as amended by Amendment Agreement dated December 17, 2020 (collectively referred as "SPA") entered into between Cube Highways, RIL and DATRL.

Pursuant to the SPA, following rights and obligations were agreed to be settled by DATRL:

(a) **Unsecured Non-convertible debentures ("NCD" or "Seller Debentures")**

In earlier years, DATRL had availed interest free subordinate debt of ₹ 4,449.10 million from RIL pursuant to a subordinate debt agreement executed between DATRL and RIL ("Subordinate Loan Agreement" or "SLA"). This subordinate debt was repayable only after satisfaction of senior debt and had been recognized as part of equity in the Special Purpose Combined Financial Statements for the year ended March 31, 2021.

DATRL and RIL entered into a Debenture Subscription Agreement dated December 23, 2020 ("DSA") to convert subordinate debt of ₹ 4,449.10 million along with unsecured loan from RIL of ₹ 180.50 million, trade payables to RIL of ₹ 587.87 million and trade payable to CLE Pvt Ltd of ₹ 34.59 million into different classes of debentures for ₹ 5,252.06 million to be issued to RIL ("Seller Debentures") to be redeemed as per terms mentioned in the DSA. In terms of DSA, upon issuance of Seller Debentures the loan granted by RIL under the terms of the SLA has got fully settled and extinguished.

The details of various tranches of Seller Debentures contingent on specified redemption events as described in Schedule I "Terms of the Seller Debentures" of Debenture Subscription Agreement are set out below:

Sr. No.	Relevant tranche of Seller Debenture	Debentures of ₹ 1 each (in ₹ million)	Redemption Event	Redemption Amount (in ₹ million)	Redemption Premium (in ₹ million)
1	Tranche I-A Seller Debentures	320.79	Amount to be released on First Closing Date (December 31, 2020)	321.00	0.21
2	Tranche I-B Seller Debentures	1,241.44	Amount to be released on 15 (fifteen) Business Days following the later of (i) receipt of the Provisional COD Certificate; (ii) receipt of final assessment order for cess payable under the Building and Other Construction Workers Welfare Cess Act, 1996 in relation to the Project, and challans evidencing payment of such cess; and (iii) date of receipt of balance confirmation in a form set out in Schedule XXI of the SPA from all contractors whose names are set out in the SPA.	1,338.00	96.56
3	Tranche II Seller Debentures	400.37	Amount to be released on Second Closing Date (completion of construction at Palwal structure and uninterrupted toll collection for 6 months post receipt of Toll Notification -2)	1,580.00	1,179.63
4	Tranche III Seller Debentures	789.48	Same as for Tranche II Seller Debentures	1,010.00	220.52
5	NHAI Earmarked Escrow Seller Debentures	961.58	Same as Tranche I-B Seller Debentures	1,036.00	74.42
6	Tranche IV Seller Debentures	987.80	The Cumulative Sustainable Revenue being equal to or in excess of the Earn-out Threshold *	1,300.00	312.20
7	Tranche I Holdback Amount	550.60	After completion of all Pending Works and achievement of FCOD as certified by NHAI, and settlement/waiver of all claims made by all Third Party contractors engaged for Pending Works.	644.00	93.40
8	Carry amount	-		12.00	12.00
		5,252.06		**7,241.00**	**1,988.94**

* In terms of DSA read with SPA, till date DATRL paid ₹ 1,833.75 million out of these tranches against the bank guarantee furnished by RIL.

Redemption premium: DATRL will pay the redemption premium amount when the respective Redemption Event is met along with relevant tranche of Seller Debentures.

Further, in terms of DSA read with SPA, there are specific deductions to be made from tranches in case the Redemption Event is delayed beyond the dates envisaged in the SPA or in case any Redemption Event do not occur, the Redemption Amount of such tranche will be partially or fully written back, as the case may be, by DATRL.Accordingly, DATRL has started adjusting such reductions from tranches payable towards Seller Debentures.

During the year ended March 31, 2021, DATRL has recognised liability related to respective Seller Debentures at fair value on initial recognition. Accordingly, ₹ 8.86 million being the difference between the carrying amount and fair value of the Seller Debentures on initial recognition has been recognised as a credit to Other Equity (Retained Earnings), considering the transaction is with the shareholders in their capacity as owners. DATRL redeemed the Seller Debentures tranche as set out at Sr.No. 1 on December 31, 2020.

Subsequent to the initial recognition, DATRL has recognized the changes in redemption amount on account of reductions due to delays beyond the dates envisaged as referred above, in the Special Purpose Combined Statement of Profit and Loss by re-estimating the cash flows of adjusted redemption amount of the relevant tranches as discounted at the original effective interest rate upto estimated redemption due date. The adjustments, if any, with respect to redemption of above debentures along with amount recoverable from RIL aggregating ₹ 898.57 million [refer to in (c) below] will be considered and accounted on settlement with RIL at the time of redemption i.e. subsequent to seven month period ended October 31, 2022.

(b) Pursuant to the SPA, a Memorandum of Understanding (MOU) dated November 02, 2020 was entered into between Larsen & Toubro ("EPC Contractor"), DATRL, Reliance Infrastructure Limited (RIL) and Cube Highways and Infrastructure III Pte Ltd (collectively referred as "Parties"), to address pending issues under the Agreement dated August 21, 2012 between RIL and EPC Contractor. In terms of MOU, the Parties agreed that DATRL should pay an amount of Rs. 1,575.20 million which was due and payable by RIL to the EPC Contractor towards the work executed and certified as on November 30, 2019 by the EPC Contractor in the manner prescribed in the MOU.
Further, as per the terms of SPA, DATRL had made payments of Rs.149.47 million to certain other EPC contractors of RIL as per the request made by RIL.
The above payments aggregating Rs.1,724.67 million has been debited to Other Equity (Deemed Distribution) considering the transaction is with the shareholders in their capacity as owners.

(c) During the year ended March 31, 2021, the seller agreed to bear ₹ 292.93 million towards penal or default interest, penalty etc. on borrowings paid to various banks & financial institutions and ₹ 72.08 million towards reimbursement of operational expenses paid to various vendors.
During the year ended March 31, 2022, DATRL has received an insurance claim amounting ₹ 18.35 million which will be passed through to RIL and has been adjusted with the above receivable.
Subsequent to the seven month period ended October 31, 2022, RIL agreed to DATRL that ₹ 551.91 million to be recovered by DATRL from the amount payable by it to RIL under the SPA and/or any other Transaction Document (as defined in the SPA) in respect of payments to certain EPC contractors (including those referred to in note 44 (h)), which is included under "Receivable from Reliance Infrastructure Limited" has been disclosed under note 17 "Other financial assets"

The resultant balance of ₹ 898.57 million recoverable from RIL as on October 31, 2022 has been disclosed in Other financial assets.

(d) RIL or its affiliates are entitled to receive certain NHAI claims, tax refunds etc. pertaining to period prior upto April 01, 2019 to the extent of amounts received by DATRL. DATRL has estimated possible obligations towards assets appearing in the books of account for such items and carrying liabilities as at October 31, 2022 aggregating ₹ 150.97 million (March 31, 2022 : ₹ 169.32 million March 31, 2021: ₹ 234.82 million) which is included under Other Financial Liabilities.

The aggregate amount of ₹ 1,668.61 million in respect of settlement of above transactions through DATRL on acquisition of shareholding of DATRL by the New Shareholder, got recorded in "Other Equity- Retained earnings" for the year ended March 31, 2021 considering the transactions are with the shareholders in their capacity as owner.

54 (iii) FRHL and National Highway Authority of India ("NHAI") had entered into a Concession Agreement dated July 19, 2010 ("the Concession Agreement") for undertaking work of 4 laning of Farakka-Raiganj section of NH-34 in the State of West Bengal on design, build, finance, operate and transfer ("DBFOT") Toll basis. As per the Concession Agreement, the concession period is for 30 years which included, a) construction period for 2.5 years i.e. scheduled for completion by July 2013 (extended from time to time until March 31, 2021) and b) operation and maintenance period for 27.5 years.

FRHL had raised various claims on NHAI related to compensation to offset the losses suffered due to extended construction period and other matters. NHAI had also filed counter claims against FRHL relating to recovery of overloading charge collected by FRHL and negative change in scope. The settlement of aforementioned claims were pending at Delhi High Court and various arbitration panels.
As on March 31, 2020, NHAI claims of ₹ 1,874.05 million was disclosed as contingent liabilities. In the year ended March 31, 2021, FRHL and NHAI entered into a settlement agreement dated March 30, 2021 ("the Settlement Agreement") for full and final settlement of claims/counter claims between FRHL and NHAI for a lumpsum amount of ₹ 8,535.4 million payable by NHAI to FRHL.

FRHL had received various claims related to overrun and other costs attributed to delayed execution of construction contract from Engineering, Procurement and Construction ("EPC") Contractor i.e. Hindustan Construction Company Limited ("HCL") in earlier years and FRHL accepted a claim of ₹ 4,100.00 million and capitalised as ₹ 2,350.00 million as Intangible Assets and ₹ 1,750.00 million as Intangible Assets under Development.

Cube Highways and Infrastructure II Pte Ltd ("Cube Highways") acquired 100% equity share capital of FRHL from HCC Concession Limited ("HCC") pursuant to the Share Purchase Agreement dated September 28, 2018 as amended by Amendment Agreement dated September 09, 2020 (collectively referred as "SPA") entered into between Cube Highways, HCC and HCL (HCC and HCL are hereinafter collectively referred to as "Sellers") and FRHL (collectively referred as "Parties").

Pursuant to the SPA, following rights and obligations were agreed to be settled by the FRHL:

(a) Non-convertible debentures ("NCD" or "Seller Debentures")

FRHL had outstanding principal of subordinate debt of ₹ 733.12 million outstanding as at March 31, 2020 that was availed by FRHL from HCC Concessions Limited ("HCC") pursuant to a subordinate debt agreement dated December 10, 2015 executed between FRHL and HCC Concessions Limited ("HCC") carrying an interest at the rate of 10.75% per annum ("Subordinate Loan Agreement"). During the year ended March 31, 2021, FRHL and HCC entered into a Debenture Subscription Agreement dated August 21, 2020 ("DSA") to convert the aforementioned subordinate debt into different classes of debentures to be issued to HCC ("Seller Debentures") and to be redeemed as per terms therein. Upon issuance of Seller Debentures, the loan granted by HCC under the terms of the Subordinate Loan Agreement was fully settled and extinguished, and HCC released FRHL from any and all liabilities in relation to such subordinate debt.

The details of each class of Seller Debentures issued by FRHL to HCC against the subordinate debt amounting to ₹ 1,058.78 million (including accrued interest of ₹ 325.64 million from June 2015 to August 2020) is set out below:

S. No	Relevant tranche of Seller Debenture	Debentures of ₹ 1 each (in ₹ million)	Redemption event	Redemption Amount (in ₹ million)	Redemption Premium (in ₹ million)
1	Overloading Claim Seller Debentures - Tranche 1	157.07	Receipt of Final decree from a single bench of a high court of competent jurisdiction for enforcement of a final arbitration award passed in favour of Baharampore Farakka Highways Limited ("BFHL") in BHFL overloading claim dispute.	431.81	274.74
2	Overloading Claim Seller Debentures - Tranche 2	157.07	Final Resolution (non-appealable order) of BFHL overloading claim dispute.	431.81	274.74
3	Overloading Claim Seller Debentures - Tranche 3	157.07	Final resolution of overloading dispute between the FRHL and NHAI.	431.81	274.74
4	Negative COS Claim 1 Seller Debenture	81.98	Respective Negative COS Claim being finally resolved in favour of the FRHL; or (ii) receipt of an unconditional written waiver of respective Negative COS Claim from NHAI.	205.90	123.92
5	Negative COS Claim 2 Seller Debenture	72.02		176.50	104.48
6	Negative COS Claim 3 Seller Debenture	72.02		174.40	102.38
7	Negative COS Claim 4 Seller Debenture	29.88		93.60	63.72
8	Independent Engineer (IE) Debenture	40.61	(i) Final resolution of IE Claim in favour of the FRHL; or (ii) receipt of an unconditional written waiver of IE Claim from NHAI.	70.15	29.54
9	Pending Work Seller Debenture	121.06	Issuance of final completion certificate for entire stretch of project highway provided the supplementary EPC agreement is not terminated.	154.65	33.59
10	Earn out Seller Debenture	170.00	In case the actual revenue of the FRHL (excluding overloading revenue) from March 31, 2021 to March 31, 2023 ("Cumulative Sustainable Revenue") is in excess of ₹ 4,290.00 million ("Earnout Threshold").	₹ 3.70 for every ₹ 1 by which the Cumulative Sustainable Revenue (excluding overloading revenue) exceeds the Earn-out Threshold.	Nil
	Total	**1,058.78**		**2,170.63**	**1,281.85**

Redemption premium: FRHL will pay the redemption premium amount when the respective redemption event is met and while redeeming relevant tranche of NCDs

Further, as mentioned in the SPA, if above (Sr.No.1 to 8) ongoing and pre-existing disputes with NHAI were resolved in favour of FRHL it would not be required to make any payments to NHAI. If, however, such ongoing and pre-existing disputes with NHAI were resolved against FRHL, FRHL would be required to make payments to NHAI for such ongoing and pre-existing disputes and as such NCDs would not be required to make payments to HCC by FRHL for redemption of Sellers Debentures and as a result any liability accounted in the books of FRHL would be written back.

As on October 31, 2022, the status of Relevant tranche of NCDs is as under:

(i) In terms of the Settlement Agreement dated March 30, 2021 with NHAI, the claims from NHAI relating to Overloading Dispute, Negative COS Claims and IE Claims have been settled in favour of FRHL. Thus, the NCDs set out as (Sr.no.1-8) above have been redeemed and respective redemption amount has been paid by FRHL to HCC.

(ii) The Seller Debenture relating to Pending Work set out at Sr.No. 9 was subject to final completion certificate and was contingent on completion of pending work. The pending work has been completed as on March 31, 2021 and FRHL had received the final COD on March 25, 2022 with 15 days payment terms. FRHL has paid ₹ 24.20 million and balance amount of ₹ 127.93 million has been held back on account of payment of tax liability by FRHL on behalf of HCC amounting ₹ 139.50 million, which is under discussion with HCC. Final adjustments, if any, on this account will be considered and accounted for when settled.

(iii) As per the future revenue projections, the redemption event set out for NCDs at Sr. No 10 will not be met and redemption is unlikely to happen and therefore, this tranche will not be payable and hence accordingly adjusted in fair value of NCDs in the year ended March 31, 2021.

FRHL has recognised liability related to respective NCDs at fair value on initial recognition and measured such liabilities at amortised cost for subsequent periods.

The difference between the carrying amount of subordinate loan as at August 21, 2020 and fair value of NCDs on initial recognition amounting to ₹ 1,111.85 million has been recognised as a debit to "Other Equity - Retained Earnings" during the year ended March 31, 2021 considering the transactions are with the shareholders in their capacity as owners.

(b) Claims between the FRHL and NHAI

Pursuant to the Settlement Agreement dated March 30, 2021, FRHL has settled claims with NHAI for a lumpsum amount of ₹ 8,535.40 million. In terms of various clauses of SPA this claim amount has to be transferred by FRHL to the Seller. The aforesaid lumpsum amount has been apportioned amongst following categories on the basis of various claims submitted to NHAI by FRHL:

Particulars	Amount (₹ in million)	Payable to
EPC Contractor liability	3,932.79	Pursuant to SPA, payable to HCL on account of EPC claim for cost-over runs
Subtotal: Towards EPC Liabilities	**3,932.79**	
Revenue loss on delay of possession of land	3,174.42	Pursuant to SPA, ₹ 3,636.22 million (after netting off taxes of ₹ 966.37 million) payable to HCC
Additional interest cost on loan during construction period	1,321.13	
NHAI grant receivable	37.75	
Others claims	69.31	
Subtotal: Towards additional NHAI claims	**4,602.61**	
TOTAL	**8,535.40**	

The EPC Contractor liability of ₹ 3,932.79 million and additional interest cost on loan during construction period of ₹ 1,321.13 million are adjusted from:

a) gross carrying value of Intangible assets - Rights under Service Concession Arrangements by ₹ 2,984.38 million; and

b) from Intangible assets under development by ₹ 2,269.54 million.

The difference of ₹ 4,160.04 million between (i) the pre-existing liabilities of ₹ 3,408.98 million in books of accounts of FRHL towards the HCL relating EPC contracts and (ii) both EPC Liabilities of ₹ 3,932.79 million and Additional NHAI Claims of ₹ 3,636.22 million (net of taxes) has been recognised as a debit to Other Equity - Retained Earnings considering the transaction is with the shareholders in their capacity as owners.

Further the claim receivable of ₹ 3,243.74 million comprising of revenue loss claim on delay of possession of land amounting to ₹ 3,174.42 million and other claims of ₹ 69.31 million, has been disclosed as “Exceptional item” in the Special Purpose Combined Statement of Profit and Loss in the year ended March 31, 2021.

(c) Sellers’ share in overloading revenue

FRHL and HCC Concessions Limited (“HCC”) have executed a Royalty agreement pursuant to which FRHL has commercially agreed to pay royalties to HCC with effect from July 1, 2020 until the expiry of term of the Concession Agreement.

As per the agreement, such royalty payment is being paid since HCC had been instrumental in setting up the process and system pursuant to which FRHL is able to collect overloading revenue from overloaded vehicles and has been able to comply with the requirements of NHAI. Royalty amount shall be 75% of the overloading revenue collected for the period by FRHL net of all taxes, which is recognised in Special Purpose Combined Statement of Profit and Loss.

(d) Other payments/ adjustments

FRHL has agreed to settle following transactions:

1) Post execution of Settlement Agreement with NHAI, for permanently settling the overloading claims FRHL has paid to HCL an amount of ₹ 555.18 million.

2) It was agreed to reduce ₹ 400.00 million along with accretion @15% starting from September 22, 2020 till date of settlement of ₹ 400.00 million from any amounts payable to HCC. Accordingly, FRHL has debited ₹ 447.97 million (including accretion of ₹ 16.58 million (March 31, 2021: ₹ 31.40 million) charged to the Special Purpose Combined Statement of Profit and Loss to HCC.

3) FRHL had paid ₹ 39.77 million to IIFCL in terms of balance confirmation and settlement of interest and principal. This amount has been debited to HCC in the year ended March 31, 2021.

4) The Sellers are entitled to receive certain tax refunds pertaining to period prior to March 31, 2020 to the extent of amounts received by FRHL. During the year ended March 31, 2021, FRHL has estimated possible obligations towards assets appearing in the books of account for such items and recognised liabilities aggregating ₹ 23.85 million with corresponding debit to “Other Equity – Retained Earnings” considering the transactions are with the shareholders in their capacity as owners.

5) It is agreed that FRHL shall pay working capital adjustment of ₹ 12.50 million for the period between June 30, 2020 to September 22, 2020 to HCC. Therefore, the working capital adjustment of ₹ 12.50 million has been credited to HCC.

During the year ended March 31, 2021, the net amount of ₹ 151.77 million referred to in (1) to (5) above have been accounted with a corresponding debit to “Other Equity- Retained Earnings” considering the transaction is with the shareholders in their capacity as owners.

During the year ended March 31, 2021, the aggregate amount of ₹ 5,423.66 million in respect of settlement of transactions referred to in (a) to (d) above through the FRHL on acquisition of shareholding of the FRHL by the New Shareholder, is recorded in “Other Equity- Retained Earnings” considering the transactions are with the shareholders in their capacity as owners.

e) During the year ended March 31, 2022 , FRHL has adjusted amount of ₹ 74.90 million from the outstanding balance of Hindustan Concession Limited on settlement due to delay in toll notification from NHAI.

54 (iv) (i) On May 25, 2022 Cube Highways and Infrastructure Pte Ltd ("Cube Highways") acquired 100% equity share capital of Ghaziabad Aligarh Expressways Private Limited ("GAEPL") from Bharat Road Networks Limited (BRNL), PNC Infratech limited (PIL), PNC Infra Holding Limited (PIHL), Galfar Engineering and Contracting India Private Limited (GECIPL), Galfar Engineering and Contracting SAOG (GECS) (BRNL, PIL, PIHL, GECIPL and GECS are hereinafter referred collectively as "Sellers") pursuant to Share Purchase Agreement dated April 1, 2021 as amended by Amendment Agreement dated May 11, 2022 (collectively referred to as "SPA") entered into between Cube Highways, Sellers and GAEPL.

(ii) GECIPL, being the Sponsor and Guarantor of the loan of ₹ 500 million from SREI Equipment Finance Limited (SEFL) (outstanding as on March 31,2022- ₹ 487.90 million), had been meeting the obligations related to loan of SEFL directly over a period of time, and subsequently GECIPL became beneficiary of the said loan.

(iii) Vide letter dated May 10, 2022 regarding consent for release of pledges on equity shares and for transfer of equity shares to Cube Highways, in terms of SPA SREI Equipment Finance Limited (lender of GAEPL) have confirmed the following:
(a) As on date of the letter, total amounts payable under SREI-GAEPL Facilities by GAEPL to SREI is ₹ 1,709 million and
(b) Any other dues payable under SREI-GAEPL Facilities shall be paid by BRNL to SEFL for which BRNL has given Undertaking vide its undertaking dated May 10,2022.

In view of the above, GAEPL has written back interest payable by GAEPL until March 31, 2022 aggregating ₹ 267.84 million which is disclosed under Other Income in the Special Purpose Combined Statement of Profit and Loss for the year ended March 31,2022.

(iv) BRNL waived off the following interest on loans payable by GAEPL, which are written back by GAEPL in the Special Purpose Combined Financial Statements under respective years/period:

For the year/seven month period ended	**Interest waived off ***
	(₹ in million)
March 31, 2020	261.66
March 31, 2021	367.79
March 31, 2022	365.53
October 31, 2022	24.67
TOTAL	**1,019.65**

* including interest on loan from SREI Equipment Finance Limited (SEFL) for the respective year, which in terms of the inter se agreement dated May 4, 2019 signed amongst the shareholders of GAEPL and SEFL, BRNL had undertaken to pay to SEFL.

(v) During the seven month ended October 31, 2022 PIL, GECIPL and BRNL have provided confirmation on the amounts of outstanding balance of unsecured loans given to GAEPL as at March 31, 2022 wherein they also agreed to waive off following loan amounts payable by GAEPL, which is written back by GAEPL in the Special Purpose Combined Financial Statements for the year ended March 31, 2022 :

Name of seller	**Loan waived off**
	(₹ in million)
PIL	694.26
GECIPL	391.84
BRNL	812.70
TOTAL	**1898.80**

The amounts in (iv) and (v) above have been recorded in "Deemed capital contribution" under "Other Equity" considering the transactions are with the shareholders in their capacity as owners.

55 Estimation of uncertainties relating to the global health pandemic from COVID-19:

On account of Coronavirus (COVID-19) pandemic, nationwide lockdown was imposed by Government of India frequently at various intervals from March 2020. The outbreak of COVID -19 pandemic globally and in India has caused significant disturbance and slowdown of economic activities.

In compliance with the lockdown instructions issued by the Central and State Governments, the operations at toll plaza of the SPVs were impacted resulting in significant loss of toll collection and delays in construction of balance project roads. The Management has assessed the possible impact of COVID 19 on financial position including carrying amounts of intangible assets, intangible assets under development, other financial and non-financial assets, based on the information available and discussions with various stakeholders, views from experts and industry participants, forecasts by various agencies and organizations, and market estimates, etc., up to the date of approval of the Special Purpose Combined Financial Statements. Based on the assessment carried out, the Management expects that the carrying amount of these assets will be recovered and SPVs will be able to meet its obligations as and when they fall due.

Considering that it is a dynamic and evolving situation, the Management will continue to closely monitor and evaluate the impact of any material change in macro-economic and other related factors, which may have bearing on the Proposed Trust Group operations.

56 Going Concern

Net worth of the Proposed Trust Group has significantly eroded due to accumulated losses of ₹ 29,037.42 million. Further the Prposed Trust Group has a net current liabilities of ₹ 2,261.74 million (including current maturities of non-current borrowings) as at October 31, 2022. This is mainly on account of higher finance costs and lower revenues in initial years of the Service Concession Arrangements (“the SCA”) referred to in note 53. The Proposed Trust Group has positive cash flows from operating activities.

Based on projected toll revenue, future cash flows and projected profits, the Proposed Trust Group expects to recoup its accumulated losses well within the remaining concession periods of the SPV’s . For its assessment relating to going concern, the management has considered the future cash flow projections of the SPVs based on projected traffic by an expert and fair value of the project by an independent valuer indicating that the fair value is significantly higher and accordingly, the management is confident that the Proposed Trust Group will be able to meet its obligations as and when they fall due.

On the basis of the projected profits, expected dates of realization of financial assets and payment of financial liabilities and the Management plans as approved by the Board of Directors of the respective SPVs and Investment Manager, the management is of the view that no material uncertainty exists as on the date of approval of these Special Purpose Combined Financial Statements with respect to the Proposed Trust Group continuing as a going concern and the Proposed Trust Group is capable of meeting its obligations in the next twelve months as and when they fall due.

57 Impairment of assets

WUPTL conducted impairment evaluation on value of intangible assets - Rights under Service Concession Arrangements as at each reporting period.
The recoverable amount of this cash-generating unit is determined at ₹ 3,896.70 million as at October 31, 2022 (₹ 4,041.51 million as at March 31, 2022, ₹ 3,351.09 million as at March 31, 2021; ₹ 3,722.46 million as at March 31, 2020) as calculated by the SPV's management, based on a value in use calculation which uses cash flow projections based on financial budgets approved by the Board of Directors of WUPTL covering the balance service concession arrangement period. The amount of the impairment loss recognised or reversed in the Special Purpose Combined Statement of Profit and Loss are as under:

Year ended	**Impairment loss recognised/ (reversed)**
March 31, 2020	156.09
March 31, 2021	167.40
March 31, 2022	(268.67)

The recoverable amount has been calculated as per the provisions of Ind AS 36 and following assumptions have been used:
1. Future traffic growth rate - This is based on past performance and management expectation of future. In addition the Management has also considered impact of check plaza to eliminate micro diversion and easing of ban on sand mining.

2. Future Wholesale Price Index (WPI) - As per external publication has been considered.

3. Risk-adjusted discount rate - The discount rates are derived from the SPVs weighted average cost of capital, taking into account the cost of capital and cost of long term debts.

58 In the financial year 2016-17, WUPTL issued Non-convertible Debentures (NCDs) of ₹ 2,367.81 million to Cube Infrastructure Investments Company Pte. Ltd. (CIICPL, a fellow subsidiary) carrying an annual simple interest rate upto SBI PLR + 400 bps, or lower as mutually agreed. These NCDs are compulsorily redeemable in full on or before February 28, 2026. The liability related to these NCDs (interest and principal), as per waterfall arrangement in the debenture trust deed, is subject to the SPV having met all the Restricted Payment Conditions as defined under the Common Loan Agreement of Senior Lenders. CCIPL has waived off interest for seven months ended October 31, 2022 amounting ₹ 198.52 and for the years ended March 31, 2022 and 2021 each amounting ₹ 338.60 million and March 31, 2020 amounting ₹ 339.52 million on the above NCDs which has been accounted as "Deemed Capital Contribution" under the head 'Other Equity'. Further, it was agreed that interest accrued upto March 31, 2019 of ₹ 912.59 million (disclosed as current liabilities as on March 31, 2020) will be repaid by the SPV from the cash surplus, if any, arising in the future years due to any upside in the revenue pattern.

The SPV in terms of "Ind AS 32 - Financial Instruments: Presentation", computes the equity and debt components at each balance sheet date based on the projected future cash flows as on that date. Accordingly during the year ended March 31, 2021, WUPTL disclosed equity component of ₹ 397.75 million as equity component of compound financial instruments under the head 'Other Equity' and debt component of ₹ 531.38 million as financial liability including unwinding of interest cost of ₹ 16.54 million disclosed under 'Finance Costs' in the Special Purpose Combined Statement of Profit and Loss for the year ended March 31, 2021.

Due to significant improvement of operations during the year ended March 31, 2022 together with substantial increase in projected revenue of WUPTL, the management is of the view that the principal and interest thereon will be fully repaid in future years. Further, subsequent to the year ended March 31, 2022, WUPTL has repaid ₹ 396.80 million out of interest accrued upto March 31, 2019. Accordingly, WUPTL has accounted reversal of equity component of compound financial instruments by ₹ 204.33 million under the head 'Other Equity' and balance disclosed as debt component amounting to ₹ 848.44 million (including unwinding of interest cost of ₹ 112.73 million disclosed under 'Finance Costs' in the Special Purpose Combined Statement of Profit and Loss for the year ended March 31, 2022)

59 Pursuant to the Settlement Agreement dated April 8, 2022 between GAEPL and NHAI, the claims and counter claims got settled with NHAI for a lumpsum amount of ₹ 1,500.00 million towards compensation payable by NHAI for delay in issuance of PCOD. The lumpsum amount has been apportioned amongst following categories on the basis of various claims submitted to NHAI by GAEPL and accounted for in the Special Purpose Combined Financial Statements for the year ended March 31, 2022:

Particulars	Amount (₹ in million)
Towards construction of project – reduced from gross block of Intangible assets - Rights under Service Concession arrangements	1,367.60
Towards revenue loss – accounted as other income	132.40
Total (disclosed under other current financial assets)	**1,500.00**

Further, in terms of above settlement agreement, NHAI has recovered the following:

1. ₹ 495.40 million towards negative change in scope / descoping etc.
2. Revenue Shortfall Loan (RSL) of ₹ 1,250.00 million released during the year ended March 31, 2022 along with the interest of ₹ 26.70 million as per the Concession Agreement.
3. Damages of ₹ 61.50 million imposed due to breach in maintenance obligation.

Accordingly, pursuant to the Settlement Agreement dated April 8, 2022 between GAEPL and NHAI, the receivables and payables from/to NHAI has been settled and ₹ 333.60 million has been paid by GAEPL to NHAI.

60 (i) In earlier years, WUPTL received favourable Arbitration Award dated July 22, 2020 amounting to ₹ 1,244.30 million (including interest upto the date of award) towards its claim of Prolongation of Concession Period, change of scope, toll loss due to incorrect rounding off, etc. The aforesaid Award was challenged under section 34 of the Arbitration and Conciliation Act, 1996 before the Hon'ble High Court of Delhi at New Delhi by WUPTL and NHAI. WUPTL also invoked another arbitration in respect of Change of Law due to ECC & mining ban and initiated arbitration proceeding vide email dated July 13, 2020.

Pursuant to the Settlement Agreement with NHAI dated December 19, 2022, WUPTL has settled for a lumpsum amount of ₹ 985.00 million (including interest) against all the disputes between the Company and NHAI ("Parties"), arbitration cases/ arbitration awards as a full and final settlement. It was also agreed that the Parties shall not raise any claims or damages against each other of whatsoever nature under any clause of the Concession Agreement and otherwise.

(ii) In terms of the Letter Agreement dated May 10, 2016 entered into amongst WUPTL and other parties [including Gayatri Projects Limited and NCC Limited (together referred as "EPC contractors")], it was agreed that WUPTL shall be required to make payments, net of applicable taxes if any, to the EPC contractors towards the work undertaken by them upon WUPTL receiving monies from NHAI.

Since, the Settlement Agreement with NHAI was executed subsequent to the period ended October 31, 2022, no adjustments have been made in these Special Purpose Combined Financial Statements.

61 The Code on Social Security, 2020 ('Code') relating to employee benefits during employment and post employment benefits received Presidential assent in September 2020. The Code has been published in the Gazette of India. However, the date on which the Code will come into effect has not been notified. Proposed Trust Group will assess the impact of the Code when it comes into effect and will record any related impact in the period the Code becomes effective.

For and on behalf of the Board of Directors of
Cube Highways Fund Advisors Private Limited
(the "Investment Manager") in its capacity
as the Investment Manager of Cube Highways Trust

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Hyderabad
Date: January 20, 2023

PROJECTIONS OF REVENUE FROM OPERATIONS AND CASH FLOW FROM OPERATING ACTIVITIES

(*This page has been left intentionally blank*)

S. B. BILLIMORIA
& CO. LLP

Chartered Accountants
7th floor, Building 10
Tower B
DLF Cyber City Complex
DLF City Phase II
Gurugram-122 002
Haryana, India

Tel: +91 124 679 2000
Fax: +91 124 679 2012

To
The Board of Directors,
Cube Highways Fund Advisors Private Limited (the "Investment Manager") in its capacity as an Investment Manager of Cube Highways Trust (the "Issuer" or the "Trust")
B-376, Upper Ground Floor,
Nirman Vihar,
New Delhi 110092

1. We have examined, as appropriate (refer paragraph 3 below), the accompanying statements of projections of revenue from operations and cash flows from operating activities and the underlying assumptions of Cube Highways Trust (the "Issuer" or the "Trust") and its proposed subsidiaries, comprising of:

   i. Jaipur-Mahua Tollway Limited;
   ii. Mahua Bharatpur Expressways Limited;
   iii. Western UP Tollway Limited;
   iv. Farakka-Raiganj Highways Limited;
   v. DA Toll Road Private Limited;
   vi. Nelamangala Devihalli Expressway Private Limited;
   vii. Walayar Vaddakencherry Expressways Private Limited;
   viii. Hazaribagh Tollway Limited;
   ix. Kotwa-Muzaffarpur Tollway Limited;
   x. Jhansi-Lalitpur Tollway Limited;
   xi. Jhansi-Vigakhet Tollway Limited;
   xii. Lucknow-Raebareli Tollway Limited;
   xiii. Madurai-Kanyakumari Tollway Limited;
   xiv. Kanyakumari-Etturavattam Tollway Limited;
   xv. Salaipudhur-Madurai Tollway Limited;
   xvi. Nanguneri-Kanyakumari Tollway Limited;
   xvii. Ghaziabad Aligarh Expressway Private Limited; and
   xviii. Andhra Pradesh Expressway Limited

   (collectively, the "Proposed Trust Group") as described in Note (a) of the prospective combined financial information for the years ending March 31 2024, 2025 and 2026 (collectively, hereinafter referred to as the "Projection Information"), in accordance with Standard on Assurance Engagement 3400, "The Examination of Prospective Financial Information", issued by the Institute of Chartered Accountants of India. The preparation and presentation of the projections including the underlying assumptions and the basis of combination, set out in Note (b) to the Projection Information, is the responsibility of the Investment Manager and has been approved by the Board of Directors of the Investment Manager. Our responsibility is to examine the evidence supporting

the assumptions (excluding the hypothetical assumptions) and other information in the Projection Information. Our responsibility does not include verification of the accuracy of projections (including quantitative details). Therefore, we do not vouch for the accuracy of the same.

2. The Projection Information have been prepared for the proposed private placement of units (the "Issue") of Cube Highways Trust in accordance with the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended ("InvIT Regulations"). The projections have been prepared using a set of assumptions that include hypothetical assumptions about future events and the Investment Manager's actions that are not necessarily expected to occur, as set out in Note (b) to the Projection Information and has been approved by the Board of Directors of the Investment Manager. Consequently, users are cautioned that the Projection Information may not be appropriate for purposes other than that described above.

3. We did not examine the projection information of Ghaziabad Aligarh Expressway Private Limited ("GAEPL"), whose projection information (the "GAEPL Projection Information") for the relevant years as considered in the Projection Information of the Proposed Trust Group. These GAEPL Projection Information have been examined by other auditors whose report have been furnished to us by the Management and our examination on the Projection Information, in so far as it relates to the amounts and disclosures included in respect of GAEPL is based solely on the report of the other auditors.

4. We have carried out our examination of the Projection Information on a test basis. Based on our examination of the evidence supporting the assumptions (excluding the hypothetical assumptions) and based on report of other auditors in respect of GAEPL Projection Information as mentioned in the Projection Information, nothing has come to our attention which causes us to believe that these assumptions do not provide a reasonable basis for the Projection Information assuming that Cube Highways Trust post offer capital structure and corporate structure, will be in existence from on or before March 31, 2023 as more fully described in Note (b) to the basis of preparation of the Projection Information.

5. Further, in our opinion and based on report of other auditors in respect of GAEPL, nothing has come to our attention that causes us to believe, that the Projection Information read with the basis of preparation and notes therein, has not been properly prepared on the basis of the assumptions as set out in Note (b) to the Projection Information and on a consistent basis, to the extent applicable, with the accounting policies and the basis of preparation used for the preparation of the historical special purpose combined financial statements of Cube Highways Trust which is included in the Placement Memorandum and Final Placement Memorandum (collectively, the "Offer Documents"). Even if the events anticipated under the hypothetical assumptions described above occur, actual results are still likely to be different from the projection since other anticipated events frequently do not occur as expected and the variation may be material.

6. This Report is required by InvIT Regulations requiring the independent auditor to issue a report on the projections and is issued for the sole purpose of the proposed Issue in accordance with the InvIT Regulations. Our work has not

been carried out in accordance with auditing or other standards or practices accepted in jurisdictions outside India, including the United States of America, and accordingly should not be relied upon as if it had been carried upon in accordance with those standards and practices. US securities regulations do not require profit forecast to be reported by a third party. This report should not be relied upon by prospective investors in the United States of America, including persons who are qualified institutional buyers as defined under Rule 144A under the United States Securities Act of 1933, as amended participating in the Issue. We accept no responsibility and deny any liability to any person who seeks to rely on this report and who may seek to make claim in connection with any offering of securities on the basis that they had acted in reliance on such information under the protections accorded by United States of America law and regulation.

7. This report is addressed to and is provided to enable the Investment Manager to include this report in the Offer Documents in connection with the proposed Issue of units of Cube Highways Trust and the Projection Information may not be meaningful for any other purpose.

For S.B. Billimoria & Co. LLP
Chartered Accountants
(Firm's Registration No. 101496W/W100774)

Pramod B. Shukla
Partner
Membership No. 104337
UDIN: 22104337BABBTT3638

Place: Noida
Date: October 17, 2022

Cube Highways Trust
Projection Information
(All amounts in ₹ million unless otherwise stated)
Statement of projection of revenue from operations

Particulars	For the year ending March 31, 2024	For the year ending March 31, 2025	For the year ending March 31, 2026
A. Combined projected revenue from operations			
Cube Highways Trust	**30,326.46**	**31,348.20**	**33,691.80**
B. Project wise projected revenue from operations			
i. Jaipur-Mahua Tollway Limited	2,647.02	3,059.02	3,240.39
ii. Mahua Bharatpur Expressways Limited	1,219.94	1,394.72	1,548.05
iii. Western UP Tollway Limited	1,750.82	1,938.07	2,155.95
iv. Andhra Pradesh Expressway Limited	1,094.70	1,124.30	338.56
v. Ghaziabad Aligarh Expressway Private Limited	4,874.48	3,230.81	3,545.29
vi. Nelamangala Devihalli Expressway Private Limited (formerly known as "Gradient Infra Assets Advisors Private Limited")	1,125.73	1,273.48	1,422.52
vii. Farakka-Raiganj Highways Limited	2,646.99	2,934.21	3,273.34
viii. DA Toll Road Private Limited	6,377.41	6,886.99	7,545.91
ix. Walayar Vaddakencherry Expressways Private Limited (formerly known as "KNR Walayar Tollways Private Limited")	961.19	1,059.53	1,174.28
x. Hazaribagh Tollway Limited	1,063.09	1,181.95	1,317.72
xi. Jhansi-Lalitpur Tollway Limited	872.10	961.74	1,071.84
xii. Jhansi-Vigakhet Tollway Limited	615.31	675.11	754.03
xiii. Lucknow-Raebareli Tollway Limited	851.99	948.34	1,073.57
xiv. Kotwa-Muzaffarpur Tollway Limited	1,199.02	1,329.19	1,490.21
xv. Madurai-Kanyakumari Tollway Limited	1,088.62	1,213.14	1,357.98
xvi. Kanyakumari-Etturavattam Tollway Limited	627.67	688.33	764.78
xvii. Salaipudhur-Madurai Tollway Limited	655.75	722.56	808.43
viii. Nanguneri-Kanyakumari Tollway Limited	654.63	726.71	808.95

See accompanying notes forming an integral part of the Projection Information

For and on behalf of Board of Directors of Cube Highways Fund Advisors Private Limited in its capacity as an Investment Manager of Cube Highways Trust

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Mumbai
Date: 17.10.2022

Cube Highways Trust
Projection Information
(All amounts in ₹ million unless otherwise stated)
Statement of projection of cash flows from operating activities

Particulars	For the year ending March 31, 2024	For the year ending March 31, 2025	For the year ending March 31, 2026
A. Combined projected cash flows from operating activities			
Cube Highways Trust	**21,395.00**	**25,020.45**	**27,354.12**
B. Project wise projected cash flows from operating activities			
i. Jaipur-Mahua Tollway Limited	1,489.18	2,396.19	2,500.89
ii. Mahua Bharatpur Expressways Limited	180.42	1,020.40	1,122.18
iii. Western UP Tollway Limited	1,411.49	1,534.26	1,074.86
iv. Andhra Pradesh Expressway Limited	489.89	463.02	956.69
v. Ghaziabad Aligarh Expressway Private Limited	2,501.00	2,754.18	3,036.38
vi. Nelamangala Devihalli Expressway Private Limited	860.75	977.36	1,075.53
vii. Farakka Raiganj Highways Limited	2,196.73	2,431.49	2,730.04
viii. DA Toll Road Private Limited	5,590.47	6,010.99	6,469.55
ix. Walayar Vaddakencherry Expressways Private Limited	771.30	847.92	947.90
x. Hazaribagh Tollway Limited	949.15	1,058.42	1,184.12
xi. Jhansi-Lalitpur Tollway Limited	777.19	858.96	960.67
xii. Jhansi-Vigakhet Tollway Limited	532.95	586.08	657.84
xiii. Lucknow-Raebareli Tollway Limited	743.80	831.10	946.57
xiv. Kotwa-Muzaffarpur Tollway Limited	948.67	1,060.91	1,203.11
xv. Madurai-Kanyakumari Tollway Limited	886.69	996.31	1,125.61
xvi. Kanyakumari-Etturavattam Tollway Limited	432.42	479.49	541.79
xvii. Salaipudhur-Madurai Tollway Limited	473.00	527.14	599.75
viii. Nanguneri-Kanyakumari Tollway Limited	477.78	537.31	606.58
C. Trust Standalone			
i. Cube Highways Trust – Standalone	(317.88)	(351.08)	(385.94)

See accompanying notes forming an integral part of the Projection Information

For and on behalf of Board of Directors of Cube Highways Fund Advisors Private Limited in its capacity as an Investment Manager of Cube Highways Trust

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Mumbai
Date: 17.10.2022

Notes to the Projection Information of Cube Highways Trust

a) General Information

Cube Highways Trust (the "Trust") was set up on December 7, 2021, as a contributory irrevocable trust under the provision of the Indian Trusts Act, 1882. The Trust was registered as an infrastructure investment trust under the Securities Exchange Board of India ("SEBI") (Infrastructure Investment Trust) Regulations, 2014, as amended read together with circulars and guidelines issued thereunder (the "SEBI InvIT Regulations") on April 5, 2022, having registration number IN/InvIT/22-23/0022. The registered office address of the Trust is B-376, UGF, Nirman Vihar, New Delhi -110092.

Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure III Pte. Ltd. (the "Sponsors"), are companies registered in Singapore are the Sponsors of the Trust.

The Trustee to the Trust is Axis Trustee Services Limited (the "Trustee"). Investment manager for the Trust is Cube Highways Fund Advisors Private Limited (the "Investment Manager").

The investment objective of the Trust is to carry on the activities of an infrastructure investment trust, as permissible under the SEBI InvIT Regulations. The Trust has been formed to invest in infrastructure assets primarily being in the road sector in India. All the Trust's Road projects are implemented and held through special purpose vehicles ("SPVs" together with the Trust referred as "Proposed Trust Group").

Under the share purchase agreements proposed to be entered amongst the Sponsors, the Trustee, the Investment Manager, and the relevant SPVs and their respective shareholders, Cube Highways Trust shall acquire 100% of fully paid-up equity shares of the SPVs except MBEL where 99.98% of fully paid-up equity shares will be acquired from their respective holders who shall be issued and allotted units of Cube Highways Trust.

The prospective combined financial information of the Proposed Trust Group comprise of the projected revenue from operations and projected cash flows from operating activities of Trust's proposed subsidiaries comprising of

1. Jaipur-Mahua Tollway Limited (JMTL);
2. Mahua Bharatpur Expressways Limited (MBEL);
3. Western UP Tollway Limited (WUPTL);
4. Andhra Pradesh Expressway Limited (APEL)
5. Ghaziabad Aligarh Expressway Private Limited (GAEPL);
6. Nelamangala Devihalli Expressway Private Limited (NDEPL);
7. Farakka-Raiganj Highways Limited (FRHL);
8. DA Toll Road Private Limited (DTRPL);
9. Walayar Vaddakencherry Expressways Private Limited (WVEPL);
10. Hazaribagh Tollway Limited (HTL);
11. Jhansi-Lalitpur Tollway Limited (JLTL);
12. Jhansi-Vigakhet Tollway Limited (JVTL);
13. Lucknow-Raebareli Tollway Limited (LRTL);
14. Kotwa-Muzaffarpur Tollway Limited (KMTL);
15. Madurai-Kanyakumari Tollway Limited (MKTL);
16. Kanyakumari-Etturavattam Tollway Limited (KETL);
17. Salaipudhur-Madurai Tollway Limited (SMTL); and
18. Nanguneri-Kanyakumari Tollway Limited (NKTL).

b) Basis of preparation of Projection Information

The statements of projection of revenue from operations and projection of cash flows from operating activities of the proposed subsidiaries as stated in Note a) above and the Proposed Trust Group for the financial years ending March 31, 2024, 2025 and 2026 along with the underlying assumptions and other explanatory information (the "Projection Information") have been compiled by the Investment Manager to the Trust solely for the purpose of inclusion in the Placement Memorandum and Final Placement Memorandum (collectively, the "Offer Documents") in connection with the proposed private placement of the units of the Trust. Therefore, the Projection Information should not be used or relied upon for any purpose other than described above.

The Projection Information have been prepared based on the accounting policies used for preparation of the historical Special Purpose Combined Financial Statements of the Proposed Trust Group as required by the Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended including circulars and guidelines issued thereunder ("InvIT Regulations"), which are prepared in accordance with recognition and measurement principles of Indian Accounting Standards ("Ind AS") as defined in Rule

2(1)(a) of the Companies (Indian Accounting Standards) Rules, 2015, as amended prescribed under Section 133 of the Companies Act, 2013 read with InvIT Regulations and the Guidance Note on Combined and Carve- Out Financial Statements issued by the Institute of Chartered Accountants of India. Projected cash flow from operating activities have been calculated using the direct method under Ind AS 7 - Statement of Cash Flows and is computed by deducting the projected operating expenses and income taxes from the projected revenue from operations and adjusted for projected non-cash expenses (if any). Projected cash flow from operating activities do not include any items pertaining to financing or investing in nature.

The Projection Information have been derived assuming post Issue capital structure and corporate structure of the Trust Group being in existence on or before March 31, 2023, and that the net proceeds will be infused in the SPVs to replace existing bank debts, Sponsor Sub Debts, and Unsecured loans and Advances.

The Projection Information are presented in Indian Rupees which is also the functional currency of the Proposed Trust Group. All values are rounded to the nearest million, unless otherwise indicated.

The Proposed Trust Group follows March 31st as its accounting year end. Accordingly, the Projection Information are prepared for the financial years ending March 31, 2024, March 31, 2025 and March 31, 2026 ('Projections Period'). However, the assumed date of acquisition (on or before March 31, 2023) may be postponed and accordingly, the actual result in the first financial period of the Trust may be different from the Projections Period in the Projection Information.

It is clarified that the Projection Information have been prepared on the basis of a mixture of best-estimate (i.e., assumptions as to future events which are expected to take place and the actions expected to take place as of the date the information is prepared) and hypothetical assumptions (about future events and actions which may or may not necessarily take place).

The Projection Information contain forecasts and projections that relate to future events including hypothetical assumptions, which are, by their nature, subject to significant risks and uncertainties. Events and circumstances may not occur as expected. Even if the events anticipated under the hypothetical assumptions described in the Projection Information occur, actual results are still likely to be different from those stated in the Projection Information since other anticipated events frequently do not occur as expected and the variation may be material. The actual results may therefore differ materially from those forecasted and projected.

During filing the Draft Placement Memorandum (DPM), the Projection Information as at and for the years ending March 31, 2023, 2024 and 2025 of the Proposed Trust Group prepared by the Investment Manager included financial information of the Trust and its proposed subsidiaries comprising of WUPTL, APEL, JMTL, MBEL, FRHL, DATR, N.A.M. Expressway Limited (NAMEL), GAEPL, WVEPL, NDEPL, HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL in connection with the proposed private placement of units.

Due to certain commercial considerations, the Investment Manager concluded that NAMEL will not be part of the Proposed Trust Group in connection with the proposed private placement of units at this stage and therefore, the Projection Information as at and for the years ending March 31, 2024, 2025 and 2026 prepared by the Investment Manager does not include financial information of NAMEL for the purpose of inclusion in the Offer Documents.

Accordingly, the Projection Information as at and for the years ending March 31, 2024, 2025 and 2026 of the Proposed Trust Group comprise of the projected financial information of the Trust and its proposed subsidiaries comprising of WUPTL, APEL, JMTL, MBEL, FRHL, DATR, GAEPL, WVEPL, NDEPL, HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL.

These Projection Information has been adopted by the Board of Director of the Investment Manager on October 17, 2022.

c) Impact of COVID 19

The outbreak of Coronavirus ("COVID -19") pandemic globally and in India has caused significant disturbance and slowdown of economic activities.

The Investment Manager has assessed the possible impact of COVID 19 and resulting future uncertainties on various aspects of its business operations and financial position based on the information available including discussions with various stakeholders, views from experts and industry participants, forecasts by various agencies and organizations, and market estimates, etc.

Basis above, Investment Manager has made assumptions of future cash flows for the SPVs and the Proposed Trust Group which indicates no major change in the financial performance as estimated prior to COVID-19 impact. However, the extent to which the COVID-19 pandemic will impact the Proposed Trust Group in future years will depend on future developments such as the extent, spread severity, government actions etc. which are uncertain as of date.

Due to the nature of the pandemic, the Proposed Trust Group will continue to monitor developments to identify significant uncertainties in future periods, if any and shall take necessary action based on how the situation evolves.

d) Significant assumptions

The Projection Information have been prepared based on the significant assumptions including hypothetical assumptions summarised below. The Investment Manager considers the assumptions to be appropriate and reasonable as at the date of the reporting. However, the investors should consider these assumptions as well as the Projection Information and make their own assessment of the future performance of the Trust.

The Investment Manager has obtained reports from a third-party traffic consultant expert ("Steer Davies Gleave India Private Limited") ("Traffic Consultant") in assessment of the assumptions, market fundamentals, industry drivers and outlook amongst other things for the preparation of the Projection Information. The assumptions used in the Projection Information by the Investment Manager are substantially in line with the information and assumptions as per the analysis of Traffic Consultant.

The projections of the Proposed Trust Group have been prepared by combining the projections of revenue from operations and cash flows from operating activities of the Trust and SPVs, eliminating transactions between the Trust and SPVs and after considering the following:

i Revenue from operations:

The SPVs' revenue from operations primarily consists of income from toll collection, construction income and annuity from National Highways Authority of India (NHAI).

Toll income:

The base data for the projections for toll income is based on the actual traffic data (adjusted for the impact of Covid 19 in FY 2022) and tariff rates for the financial year 2021-22. Key variables for toll revenue growth are traffic growth, the wholesale price index ('WPI') which are based on Management estimates and details of the assumptions are as set forth below:

Project	FY 2023-24	FY 2024-25	FY 2025-26
	Average Traffic growth rate (including diversions)		
JMTL	10.54%	10.54%	10.54%
MBEL	7.17%	7.17%	7.17%
WUPTL	6.30%	6.30%	6.30%
GAEPL	6.75%	6.75%	6.75%
FRHL	6.04%	6.04%	6.04%
NDEPL	7.80%	7.80%	7.80%
WVEPL	6.10%	6.10%	6.10%
DATRL	5.42%	5.42%	5.42%
HTL	6.50%	6.50%	6.50%
JLTL	5.80%	5.80%	5.80%
JVTL	5.70%	5.70%	5.70%
KMTL	6.00%	6.00%	6.00%
LRTL	7.20%	7.20%	7.20%
MKTL	7.30%	7.30%	7.30%
KETL	6.60%	6.60%	6.60%
SMTL	6.60%	6.60%	6.60%
NKTL	7.20%	7.20%	7.20%

WPI assumptions	WPI (December)	WPI (March)	WPI (Financial Year)
FY 2022-23	12.56%	13.55%	12.13%
FY 2023-24	5.65%	5.65%	5.65%
FY 2024-25	5.37%	5.37%	5.37%
FY 2025-26	5.52%	5.52%	5.52%

Construction income:

All the Project SPVs are operational, and except in case of GAEPL, no major capital expenditure is expected and accordingly considered for arriving at construction income. Contract revenue associated with the construction of road is derived at cost of work expected to be performed on the contract plus proportionate margin (assumed at 0%), where required, using the percentage of completion method. Percentage of completion is the proportion of cost of work performed to-date, to the total estimated contract costs. Percentage of completion is determined based on the proportion of actual cost incurred to the total estimated cost of the project. The percentage of completion method is applied on a cumulative basis in each accounting period to the current estimates of contract revenue and contract costs. Contract cost include projected costs that relate directly to the specific contract and allocated cost that are attributable to the Construction of the road.

The cost of construction assumed is based on requirements as per the respective concession agreements and in line with management estimates based on current market practice. It is assumed that the construction will be completed within the estimated timelines considered for the propose of these projections. The details of construction income assumed is as follows:

SPV	FY 2023-24	FY 2024-25	FY 2025-26
GAEPL	1,984.30	-	-

Annuity Income from NHAI - APEL:

APEL has right to receive fixed annuity payments from NHAI during the concession period and has adopted financial asset model as prescribed by Appendix to Ind AS 115 "Revenue from Contracts with Customers" "Service Concession Arrangements". The key inputs of the financial asset model comprises of revenue inflows (annuity), projected expenses to earn the revenue, estimations on cost to build and maintain the asset, interest obligations based on financing pattern and other operational efficiencies. These inputs are based on circumstances existing and management judgement / assumption on the future expectations based on current situations. Judgements includes estimates on changes in interest rates, cost inflation, government policy changes, etc. which are reviewed periodically by the management.

ii Operating and maintenance cost

The operating and maintenance cost includes routine, periodic/major maintenance, manpower costs and operational expenses, including, but not limited to, road and site work expenses, employee benefit expenses and other operating and maintenance costs.

Those costs are projected based on management estimates in line with the technical report (the "Technical Report") provided by the technical consultant for each of the Project SPVs

The projected operating and maintenance cost corresponds with the projected traffic and is primarily based on the currently available information on actual operating and maintenance cost associated with the operation of the Project SPVs.

Based on the concession agreements, the potential periodic / major maintenance cost is provided for in the Statement of profit and loss for each year, and in the year of actual expenditure the same is adjusted against the provision created for the same. The projections do not envisage any unanticipated expenses which may be incurred due to any unforeseen circumstances.

Details of assumptions are as follows:

Particulars	Description
Operational Expenditure	• O&M expenses: Escalation at 1.4 times of WPI of respective year; • Insurance escalation at WPI; • PM fees: Minimum Threshold limit INR 433 Million escalation @ 7% or 1.55% of revenue higher (details in the InvIT expenses section)
Routine Maintenance (RM)	• Escalation at WPI for Non bitumen expenses (65% of the cost). No escalations for the bitumen cost. • RM savings during year of Major maintenance: 50% • RM savings during Defect Liability Period: 25%
Major Maintenance Expenditure	

	• Escalation at WPI for Non bitumen expenses (65% of the cost). No escalations considered for the bitumen cost, bitumen cost has been considered based on average historical bitumen costs for maintenance expenditure in FY 2023-24, FY 2024-25 and FY2025-26.

The summary of projections of operation and maintenance cost is given below:

Particulars	FY 2023-24	FY 2024-25	FY2025-26
Cube Highways Trust (Combined)			
Operational Expenditure	3,865.21	4,170.72	4483.80
Routine Maintenance	512.58	683.98	724.36
Major Maintenance Expenditure	2,888.00	512.28	623.87
JMTL			
Operational Expenditure	287.47	313.06	334.87
Routine Maintenance	32.03	49.83	68.83
Major Maintenance Expenditure	607.53	-	-
MBEL			
Operational Expenditure	210.38	227.88	245.34
Routine Maintenance	16.99	26.44	36.52
Major Maintenance Expenditure	725.19	-	-
WUPTL			
Operational Expenditure	244.31	263.76	284.16
Routine Maintenance	36.52	37.88	19.62
Major Maintenance Expenditure	-	-	623.87
APEL			
Operational Expenditure	129.75	137.62	146.55
Routine Maintenance	16.85	17.48	27.16
Major Maintenance Expenditure	493.91	512.28	-
GAEPL			
Operational Expenditure	356.05	384.98	413.97
Routine Maintenance	33.14	91.65	94.95
Major Maintenance Expenditure	1,061.37	-	-
NDEPL			
Operational Expenditure	232.72	251.50	270.69
Routine Maintenance	32.27	44.62	46.23
Major Maintenance Expenditure	-	-	-
FRHL			
Operational Expenditure	320.79	346.59	373.81
Routine Maintenance	45.15	62.44	64.68
Major Maintenance Expenditure	-	-	-
DATRL			
Operational Expenditure	685.55	735.79	787.66
Routine Maintenance	101.39	140.22	145.26
Major Maintenance Expenditure	-	-	-

Cube Highways Trust
Projection Information
(All amounts in ₹ million unless otherwise stated)

Particulars	FY 2023-24	FY 2024-25	FY2025-26
WVEPL			
Operational Expenditure	167.30	180.38	194.02
Routine Maintenance	22.59	31.24	32.36
Major Maintenance Expenditure	-	-	-
HTL			
Operational Expenditure	113.94	123.53	133.60
Routine Maintenance	-	-	-
Major Maintenance Expenditure	-	-	-
JLTL			
Operational Expenditure	94.91	102.78	111.17
Routine Maintenance	-	-	
Major Maintenance Expenditure	-	-	
JVTL			
Operational Expenditure	82.36	89.03	96.19
Routine Maintenance	-	-	
Major Maintenance Expenditure	-	-	
LKTL			
Operational Expenditure	108.19	117.24	127.00
Routine Maintenance	-	-	
Major Maintenance Expenditure	-	-	
KMTL			
Operational Expenditure	207.43	223.76	240.98
Routine Maintenance	42.92	44.52	46.12
Major Maintenance Expenditure	-	-	
MKTL			
Operational Expenditure	172.35	186.15	200.59
Routine Maintenance	29.58	30.68	31.79
Major Maintenance Expenditure	-	-	
KETL			
Operational Expenditure	159.15	171.39	184.19
Routine Maintenance	36.10	37.44	38.79
Major Maintenance Expenditure	-	-	
SMTL			
Operational Expenditure	147.01	158.35	170.28
Routine Maintenance	35.74	37.07	38.41
Major Maintenance Expenditure	-	-	
NKTL			
Operational Expenditure	145.55	156.93	168.73
Routine Maintenance	31.31	32.47	33.64
Major Maintenance Expenditure	-	-	

iii InvIT expenses

The Trust expenses are mainly projected based on the terms and conditions of the relevant agreements and / or based on Management's experience and judgement. The nature for the Trust expenses are described below:

i) Investment manager fee

The Investment Manager is entitled to Management Fees shall be calculated annually and shall be the higher of:

(a) 0.94% of the consolidated revenue of the Project SPVs;

OR

(b) INR 190 million (For Base Year FY2023-24), subject to an escalation of 7% per annum.

Applicable taxes shall be charged over and above the Investment Manager Fee.

ii) Project manager fee

The Project Manager is entitled to a Project Manager fee to be calculated @ 1.55% per annum (subject to floor of INR 433 million (FY23) escalated by 7.0% p,a. , exclusive of applicable taxes, of the consolidated gross toll revenue of the Trust at the end of the reporting period.

iii) **Other InvIT expenses:** These include the other operating expenses of the InvIT. It is escalating at the rate of 1.4 times of WPI of respective year.

iv Taxes

Current income tax is measured at the amount expected to be recovered from, or paid to, the taxation authorities. The tax rates and tax laws used to compute the amount are those that are enacted or substantively enacted at the reporting date in India where the Trust Group operates and generates taxable income.

Certain SPVs are eligible for deduction under section 80IA of the Income Tax Act, 1961 for ten consecutive years. The tax is calculated under MAT provisions of Section 115JB of the Income Tax Act, 1961 based on the book profits of the Project SPVs. Minimum Alternate Tax (MAT) paid in accordance with the tax laws, which gives future economic benefits in the form of adjustment to future income tax liability, is considered as an asset if there is convincing evidence that the entity will pay normal income tax.

The Trust will receive interest and dividend income from the SPVs which is considered exempt under the Income Tax Act, 1961. Hence, no income tax expense/cash flow is assumed during the projection period (except income tax on treasury income). The transaction of receipt of interest income will be eliminated in the Consolidated Statement of Profit and Loss and in the Consolidated Statement of Cashflows.

v Changes in working capital

The entire collection of tolls is in cash and routine expenses are in cash or a credit period is available. In these cases, the effective working capital deployed is relatively small or negative in certain instances. Further we believe the working capital is stable and not expected to vary drastically over a period. Hence, changes in working capital are not significant and no impact of that has been considered in the projected cash flows.

vi Other assumptions

a) The initial portfolio of SPVs remains unchanged through the Projection Period.
b) No further assets are acquired or divested during the Projection Period.
c) It has been assumed that no outflow on account of any litigation related matters including current pending litigations/contingent liabilities is expected to become due during the Projection Period.
d) There will be no material change in taxation legislation or other applicable legislation.
e) It has been assumed that no liability or liquidated damages on account of default in concession agreement shall devolve upon the Project SPVs during the Projections Period.
f) The relevant tax exemptions, tax remissions, and preferential tax treatments granted remain valid and applicable and that the terms and conditions thereto are complied with.
g) The Projections are based on assumptions and are subject to several factors. Investors should be aware that future events, including actual traffic growth rates, cannot be predicted with any certainty and there may be deviations from the figures projected in the Projection Information.
h) The Projections have been prepared based on the Traffic Report's for traffic volume growth rates.
i) No gain or loss has been considered on account of changes in foreign exchange rates.

For and on behalf of Board of Directors of Cube Highways Fund Advisors Private Limited in its capacity as an Investment Manager of Cube Highways Trust

Harikishan Koppula Reddy
Director
DIN: 01386693
Place: Mumbai
Date: 17.10.2022

MATERIAL CONTRACTS AND DOCUMENTS FOR INSPECTION

The following contracts, which are or may be deemed material have been entered or are to be entered into in due course. These contracts and also the documents for inspection referred to hereunder, may be inspected by Eligible Investors at the principal place of business of the Trust, from 10:00 A.M. to 5:00 P.M., on all Working Days from the date of filing the Placement Memorandum until the date of listing of the Ordinary Units pursuant to this Offer. Any of the contracts or documents mentioned in this Final Placement Memorandum may be amended or modified at any time if so required in the interest of the Trust or if required by the other parties, without reference to the Unitholders, subject to compliance with applicable law and the InvIT Documents.

1. Amended and Restated Trust Deed entered into between the Settlor, Sponsors and the Trustee dated July 8, 2022.

2. SEBI registration certificate for the Trust bearing number IN/InvIT/22-23/0022 dated April 5, 2022 as an infrastructure investment trust.

3. Amended and restated investment management agreement entered into between the Trustee (acting on behalf of the Trust), the Investment Manager and the Initial Portfolio Assets dated December 16, 2022.

4. Project implementation and management agreement entered into between the Trustee (acting on behalf of the Trust), the Investment Manager, the Project Manager, and the Initial Portfolio Assets dated January 2, 2023.

5. Share purchase agreements entered into between the relevant members of the Cube Group, the Investment Manager, the Trustee (acting on behalf of the Trust) and each of the Initial Portfolio Assets, each dated March 30, 2023.

6. Claims management agreement between Cube Infrastructure Investment Company Pte. Ltd., Cube Highways and Infrastructure Pte. Ltd. the Investment Manager, the Trustee (acting on behalf of the Trust) and Western UP Tollway Limited dated January 2, 2023, as amended and restated on April 1, 2023.

7. Final approvals dated (i) September 29, 2022 to FRHL and NDEPL; (ii) October 19, 2022, to JMTL and MBEL; (iii) October 28, 2022 to GAEPL; (iv) November 11, 2022 to HTL, JLTL, JVTL, KETL, KMTL, LRTL, MKTL, NKTL and SMTL; (v) December 6, 2022 to WVEPL; (vi) January 11, 2023 to APEL; (vii) January 20, 2023 to WUPTL; and (viii) March 22, 2023 to DATRPL issued by the NHAI in relation to the transfer of aforesaid Project SPVs to the Trust and other related matters.

8. Placement Agreement entered into among the Investment Manager, the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Sponsors, the Project Manager, the Selling Unitholders and the Placement Agents, dated July 20, 2022, as amended and restated on March 22, 2023.

9. Cash Escrow Agreement entered into among the Investment Manager, the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Selling Unitholders, the Placement Agents and the Escrow Collection Bank, dated March 29, 2023.

10. Unit Escrow Agreement entered into among the Investment Manager, the Trustee (acting on behalf of, and in its capacity as a trustee to, the Trust), the Selling Unitholders and the Unit Escrow Agent, dated March 29, 2023.

11. Agreement dated July 8, 2022, between NSDL, the Investment Manager (on behalf of the Trust), and the Registrar.

12. Agreement dated September 28, 2022 between CDSL, the Investment Manager (on behalf of the Trust) and the Registrar.

13. Certified copies of the updated Memorandum and Articles of Association of the Investment Manager as amended from time to time.

14. Board resolutions of the Investment Manager dated July 11, 2022 and March 22, 2023, authorising this Offer, taking on record the Offer for Sale by the Selling Unitholders and other incidental matters in relation to the Offer.

15. Board resolutions of each of the Selling Unitholders dated December 19, 2022, authorizing the Offer for Sale.

16. The resolution of the Board dated April 2, 2023 approving the Placement Memorandum.

17. The resolution of the Board dated April 17, 2023 approving this Final Placement Memorandum.

18. Consents from the (i) Placement Agents; (ii) Legal counsel to the Trust and the Sponsors as to Indian law; (iii) Legal Counsel to the Placement Agents as to Indian Law; (iv) International Legal Counsel to the Placement Agents; (v) Valuer;

(vi) Registrar; (vii) Compliance Officer of the Trust; (viii) Traffic Study Consultant; (ix) Technical Consultant; (x) Auditors; (xi) CRISIL; (xii) CRISIL Ratings; (xiii) Escrow Collection Bank; and (xiv) the Selling Unitholders.

19. Audited Special Purpose Combined Financial Statements and the report dated January 20, 2023 thereon.

20. Summary financial statements of the Sponsors for financial years ended December 31, 2021, December 31, 2020 and December 31, 2019.

21. Summary financial statements of the Investment Manager for the period ended March 31, 2022.

22. Projections of Revenue from Operations and Cash Flow from Operating Activities and the report dated October 17, 2022 thereon.

23. The statement of tax benefits dated April 3, 2023 from the Auditors.

24. In-principle listing approval dated August 3, 2022 issued by the BSE, extended by way of letters dated December 1, 2022 and March 10, 2023.

25. In-principle listing approval dated September 2, 2022 issued by the NSE, extended by way of letters dated November 3, 2022 and February 2, 2023.

26. Corporate governance policies of the Investment Manager.

27. Shared services agreement entered into between the Investment Manager and the Project Manager dated September 7, 2022.

28. Right of first offer agreement entered into between the Trustee (acting on behalf of the Trust), the Investment Manager, CH-I and CH-III dated January 2, 2023.

29. InvIT loan agreement and financing documents entered into by the Trust in relation to the InvIT Loan dated July 30, 2022, as amended on December 23, 2022.

30. Letter Agreement between CH-I, CH-III, MBEL, Madhucon Infra Limited, the Trust (acting through the Trustee), the Trustee and the Investment Manager dated November 22, 2022.

31. Reimbursement agreement dated September 7, 2022 entered into between the Investment Manager the Sponsors, CH-II, CH-ID and Cube Mobility Investments Pte Ltd. in relation to reimbursement of costs.

32. Concession Agreement dated December 27, 2019 entered into between LRTL and NHAI, as amended or supplemented.

33. Concession Agreement dated December 27, 2019 entered into between JLTL and NHAI, as amended or supplemented.

34. Concession Agreement dated December 27, 2019 entered into between JVTL and NHAI, as amended or supplemented.

35. Concession Agreement dated December 27, 2019 entered into between KMTL and NHAI, as amended or supplemented.

36. Concession Agreement dated December 27, 2019 entered into between HTL and NHAI, as amended or supplemented.

37. Concession Agreement dated December 27, 2019 entered into between MKTL and NHAI, as amended or supplemented.

38. Concession Agreement dated December 27, 2019 entered into between KETL and NHAI, as amended or supplemented.

39. Concession Agreement dated December 27, 2019 entered into between SMTL and NHAI, as amended or supplemented.

40. Concession Agreement dated December 27, 2019 entered into between NKTL and NHAI, as amended or supplemented.

41. Concession Agreement dated September 23, 2005 entered into between JMTL and NHAI, as amended or supplemented.

42. Concession Agreement dated September 9, 2005 entered into between WUPTL and NHAI, as amended or supplemented.

43. Concession Agreement dated October 13, 2005 entered into between MBEL and NHAI, as amended or supplemented.

44. Concession Agreement dated July 16, 2010 entered into between DATRPL and NHAI, as amended or supplemented.

45. Concession Agreement dated July 9, 2007 entered into between Lanco Devihalli Highways Limited and NHAI, endorsed in favour of NDEPL pursuant to the endorsement agreement dated January 11, 2021 entered into between NDEPL and NHAI, and as further amended or supplemented.

46. Concession Agreement dated July 19, 2010 entered into between FRHL and NHAI, as amended or supplemented.

47. Concession Agreement dated September 17, 2012 entered into between WVEPL and NHAI, as amended or supplemented.

48. Concession Agreement dated March 20, 2006 entered into between APEL and NHAI, as amended or supplemented.

49. Concession Agreement dated May 20, 2010 entered into between GAEPL and NHAI, as amended or supplemented.

50. Subordinated Loan Agreement dated December 20, 2022 entered into between APEL and the Trust (acting through the Investment Manager).

51. Facility Agreement dated December 15, 2022 entered into between FRHL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and the Subordinated Loan Agreement dated December 15, 2022 entered into between FRHL and the Trust (acting through the Investment Manager).

52. Subordinated Loan Agreement dated January 16, 2023 entered into between DATRPL and the Trust (acting through the Investment Manager).

53. Subordinated Loan Agreement dated December 20, 2022 entered into between GAEPL and the Trust (acting through the Investment Manager).

54. Facility Agreement dated January 6, 2023 entered into between HTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and the Subordinated Loan Facility Agreement dated January 6, 2023 entered into between HTL and the Trust (acting through the Investment Manager).

55. Facility Agreement dated January 6, 2023 entered into between JLTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and the Subordinated Loan Facility Agreement dated January 6, 2023 entered into between JLTL and the Trust (acting through the Investment Manager).

56. Facility Agreement dated December 12, 2022 entered into between JMTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager), and the Subordinated Loan Agreement dated December 12, 2022 entered into between JMTL and the Trust (acting through the Investment Manager).

57. Facility Agreement dated January 6, 2023 entered into between JVTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between JVTL and the Trust (acting through the Investment Manager).

58. Facility Agreement dated January 6, 2023 entered into between KETL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between KETL and the Trust (acting through the Investment Manager).

59. Facility Agreement dated January 6, 2023 entered into between KMTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between KMTL and the Trust (acting through the Investment Manager).

60. Facility Agreement dated January 6, 2023 entered into between LRTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between LRTL and the Trust (acting through the Investment Manager).

61. Subordinated Loan Facility Agreement dated December 20, 2022 entered into between MBEL and the Trust (acting through the Investment Manager).

62. Facility Agreement dated January 6, 2023 entered into between MKTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between MKTL and the Trust (acting through the Investment Manager).

63. Facility Agreement dated December 12, 2022 entered into between NDEPL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated December 12, 2022 entered into between NDEPL and the Trust (acting through the Investment Manager).

64. Facility Agreement dated January 6, 2023 entered into between NKTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between NKTL and the Trust (acting through the Investment Manager).

65. Facility Agreement dated January 6, 2023 entered into between SMTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 6, 2023 entered into between SMTL and the Trust (acting through the Investment Manager).

66. Facility Agreement dated February 15, 2023 entered into between WUPTL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated February 15, 2023 entered into between WUPTL and the Trust (acting through the Investment Manager).

67. Facility Agreement dated January 3, 2023 entered into between WVEPL, SBICAP Trustee Company Limited and the Trust (acting through the Investment Manager) and Subordinated Loan Facility Agreement dated January 3, 2023 entered into between WVEPL and the Trust (acting through the Investment Manager).

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Jayesh Ramniklal Desai
Independent Director

Date: April 17, 2023
Place: Mumbai

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Upendra Kumar Sinha
Independent Director

Date: April 17, 2023
Place: New Delhi

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Surinder Chawla
Independent Director

Date: April 17, 2023
Place: Potomac, MD (USA)

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Sandeep Lakhanpal
Director

Date: April 17, 2023
Place: New Delhi

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Harikishan Reddy Koppula
Director

Date: April 17, 2023
Place: Hyderabad

DECLARATION

The Investment Manager hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Investment Manager further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways Fund Advisors Private Limited**

Sd/-
Fereshte Dhunjishaw Sethna
Independent Director

Date: April 17, 2023
Place: Mumbai

DECLARATION

Cube Highways and Infrastructure Pte. Ltd ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Kenichi Yoshihara
Director

Date: April 17, 2023
Place: Tokyo, Japan

DECLARATION

Cube Highways and Infrastructure Pte. Ltd. ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Marcus Christopher Hill
Director

Date: April 17, 2023
Place: Abu Dhabi

DECLARATION

Cube Highways and Infrastructure Pte. Ltd. ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Heng Hock Kiong
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure Pte. Ltd. ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Spyros John Mantzavinatos
Director

Date: April 17, 2023
Place: Dubai

DECLARATION

Cube Highways and Infrastructure Pte. Ltd. ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
George Crawford Currie
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure Pte. Ltd. ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Harsh Agrawal
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure Pte. Ltd ("**CH-I**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-I further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure Pte. Ltd.**

Sd/-
Siew Hean Meng
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd ("**CH-III**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-III further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure III Pte. Ltd.**

Sd/-
Marcus Christopher Hill
Director

Date: April 17, 2023
Place: Abu Dhabi

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd ("**CH-III**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-III further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure III Pte. Ltd.**

Sd/-
Heng Hock Kiong
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd ("**CH-III**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-III further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure III Pte. Ltd.**

Sd/-
George Crawford Currie
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd ("**CH-III**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-III further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure III Pte. Ltd.**

Sd/-
Harsh Agrawal
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd ("**CH-III**") hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). CH-III further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For **Cube Highways and Infrastructure III Pte. Ltd.**

Sd/-
Kunal Agarwal
Director

Date: April 17, 2023
Place: Singapore

DECLARATION

The Trustee hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Trustee further certifies that all the statements and disclosures in this Final Placement Memorandum are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

SIGNED BY THE TRUSTEE

Sd/-
For **AXIS TRUSTEE SERVICES LIMITED**
Date: April 17, 2023
Place: Mumbai

DECLARATION

Cube Highways and Infrastructure Pte. Ltd., being a Selling Unitholder hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Selling Unitholder further certifies that all the statements and disclosures in this Final Placement Memorandum in relation to itself and the Ordinary Units offered by it in the Offer for Sale are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For Cube Highways and Infrastructure Pte. Ltd.

Sd/-
George Crawford Currie
Director
Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure II Pte. Ltd., being a Selling Unitholder hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Selling Unitholder further certifies that all the statements and disclosures in this Final Placement Memorandum in relation to itself and the Ordinary Units offered by it in the Offer for Sale are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For Cube Highways and Infrastructure II Pte. Ltd.

Sd/-
George Crawford Currie
Director
Date: April 17, 2023
Place: Singapore

DECLARATION

Cube Highways and Infrastructure III Pte. Ltd., being a Selling Unitholder hereby declares and certifies that all relevant provisions of the InvIT Regulations, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be) have been complied with and no statement made in this Final Placement Memorandum is contrary to the applicable provisions of the InvIT Regulations, the SCRA, SEBI Act and all rules, regulations and guidelines issued by the GoI or SEBI (as the case may be). The Selling Unitholder further certifies that all the statements and disclosures in this Final Placement Memorandum in relation to itself and the Ordinary Units offered by it in the Offer for Sale are material, true, correct, not misleading and adequate in order to enable the Bidders to make an informed decision.

For Cube Highways and Infrastructure III Pte. Ltd.

Sd/-
George Crawford Currie
Director
Date: April 17, 2023
Place: Singapore

ANNEXURE A

VALUATION REPORT

(*The remainder of this page is intentionally left blank*)

Ernst & Young Merchant Banking Services LLP
Registered Valuer
Registration No. IBBI/RV-E/05/2021/155
14th Floor, The Ruby,
29 Senapati Bapat Marg,
Dadar West,
Mumbai - 400 028, India

Tel: +91 22 61920000
Fax: +91 22 61920000
ey.com

13 January 2023

To,
Cube Highways Fund Advisors Private Limited
Unit no. 1901, 19th floor, Tower B, World trade tower,
Plot no. C-1, Sector 16, Noida, UP-201301

Re: Enterprise Valuation of Specified Assets as per SEBI (Infrastructure Investment Trusts) Regulations, 2014, as amended ("SEBI InvIT Regulations")

Dear Sir/Madam,

Ernst & Young Merchant Banking Services LLP ("EYMBSLLP") has been appointed by Cube Highways Fund Advisors Private Limited ("Client" or "you" or "Investment Manager") via engagement letter dated 24 June 2022 and addendum letter dated 21 December 2022 as an independent valuer as per Securities and Exchange Board of India (Infrastructure Investment Trusts) Regulations, 2014, as amended and the circulars, notifications and guidelines issued thereunder ("SEBI InvIT Regulations"), to undertake an independent enterprise valuation of Specified Assets (defined later) ("Specified Assets" or "InvIT Assets" or "SPVs") as on October 31, 2022.

We understand that Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure Pte. III Ltd. ("Sponsors") are the sponsors, Cube Highways Fund Advisors Private Limited is the investment manager and Axis Trustee Services Limited (the "Trustee") is the Trustee to Cube Highways Trust ("Trust" or "InvIT"). The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InvIT Regulations. We have been appointed as an independent valuer to undertake a valuation of InvIT Assets, which will form part of the initial investments of the Trust, in connection with the private placement of units by the Trust (the "Offering").

Our report was prepared solely for the purpose of inclusion as part of the Draft Placement Memorandum and the Final Placement Memorandum ("DPM", and "FPM" respectively) and such other documents as may be required for the Offering and in accordance with the SEBI InvIT Regulations' guidelines requiring an independent valuation. This report should not be used or relied upon for any other purpose.

Cube Highways and Infrastructure Pte. Ltd., Cube Highways and Infrastructure Pte. III Ltd., Cube Highways and Infrastructure II Pte. Ltd., Cube Highways and Infrastructure I-D Pte. Ltd. and Cube Mobility Investments Pte. Ltd. are entities incorporated in Singapore, engaged in operating and managing road assets under concession agreements with NHAI/state authorities. Following is the list of InvIT Assets proposed to be transferred to the InvIT:

1. Jaipur-Mahua Tollway Limited ("JMTL")
2. Mahua Bharatpur Expressways Limited ("MBEL")
3. Western UP Tollway Limited ("WUPTL")
4. Andhra Pradesh Expressway Limited ("APEL")
5. Nelamangala Devihalli Expressway Private Limited ("NDEPL")
6. Farakka-Raiganj Highways Limited ("FRHL")
7. Walayar Vadakkencherry Expressways Private Limited ("WVEPL")
8. DA Toll Road Private Limited ("DATRL")
9. Ghaziabad Aligarh Expressway Private Limited ("GAEPL")
10. Hazaribagh Tollway Limited ("HTL")

11. Jhansi-Lalitpur Tollway Limited ("JLTL")
12. Jhansi-Vigakhet Tollway Limited ("JVTL")
13. Kotwa-Muzaffarpur Tollway Limited ("KMTL")
14. Lucknow-Raebareli Tollway Limited ("LRTL")
15. Madurai-Kanyakumari Tollway Limited ("MKTL")
16. Kanyakumari-Etturavattam Tollway Limited ("KETL")
17. Salaipudhpur-Madurai Tollway Limited ("SMTL")
18. Nanguneri-Kanyakumari Tollway Limited ("NKTL")

Unless otherwise stated, words and expressions defined in the DPM or PM in connection with the Offering have the same meaning in this letter.

EYMBSLLP and the team working on the valuation of InvIT Assets do not have any present or planned future interest in the Trust, the InvIT Assets or the Investment Manager except to the extent of this appointment as an independent valuer and the fee for this Valuation Report ("Report"), which is not contingent upon the values reported herein. The valuation analysis should not be construed as investment advice, specifically, EYMBSLLP does not express any opinion on the suitability or otherwise of entering into any financial or other transaction with the Trust.

Please note that the Report must be read in conjunction with the Statement of limiting conditions contained in Section 4 of this Report. This letter, the Report and the summary of valuation included herein can be provided to Trust's advisors and may be made available for the inspection to the public and with the SEBI, the stock exchanges and any other regulatory and supervisory authority, as may be required in connection with the Transaction and can be reproduced and included in the draft placement memorandum and final placement memorandum proposed to be filed in connection with offering of the units of the Trust.

The valuation conclusion included here in and the Report complies with the SEBI InvIT Regulations and guidelines, circular or notification issued by the Securities and Exchange Board of India ("SEBI") thereunder.

This letter should be read in conjunction with the attached Report.

Yours faithfully,

Navin Vohra
Partner
Membership No. IBBI/RV/05/2018/10206
Ernst & Young Merchant Banking Services LLP
Registration No. IBBI/RV-E/05/2021/155

Date: 13 January 2023
Report No. EYMBS/RV/2023/037

Table of Contents

1.	Executive Summary	4
2.	Valuation Analysis	6
3.	Sources of Information	8
4.	Statement of Limiting Conditions	9
5.	Industry Overview	11
6.	Background of the SPVs	15
7.	Procedures Adopted	35
8.	Valuation Methodology	36
9.	Valuation Assumptions	40
10.	Basis and Premise of Valuation	41
11.	Valuation conclusion	42
12.	Appendices	43

I. Executive Summary

Cube Highways and Infrastructure Pte. Ltd. and Cube Highways and Infrastructure Pte. III Ltd. are the sponsors and Cube Highways Trust ("Trust" or "InvIT") is an Indian Infrastructure Investment Trust ("InvIT") registered under the SEBI InvIT Regulations.

Cube Highways and Infrastructure Pte. Ltd., Cube Highways and Infrastructure Pte. III Ltd., Cube Highways and Infrastructure II Pte. Ltd., Cube Highways and Infrastructure I-D Pte. Ltd. and Cube Mobility Investments Pte. Ltd. are companies incorporated in Singapore, engaged in operating and managing road assets under concession agreements with respective NHAI/state authorities.

Following is the list of InvIT Assets proposed to be transferred to the Trust:

1. Jaipur-Mahua Tollway Limited ("JMTL")
2. Mahua Bharatpur Expressways Limited ("MBEL")
3. Western UP Tollway Limited ("WUPTL")
4. Andhra Pradesh Expressway Limited ("APEL")
5. Nelamangala Devihalli Expressway Private Limited ("NDEPL")
6. Farakka-Raiganj Highways Limited ("FRHL")
7. Walayar Vadakkencherry Expressways Private Limited ("WVEPL")
8. DA Toll Road Private Limited ("DATRL")
9. Ghaziabad Aligarh Expressway Private Limited ("GAEPL")
10. Hazaribagh Tollway Limited ("HTL")
11. Jhansi-Lalitpur Tollway Limited ("JLTL")
12. Jhansi-Vigakhet Tollway Limited ("JVTL")
13. Kotwa-Muzaffarpur Tollway Limited ("KMTL")
14. Lucknow-Raebareli Tollway Limited ("LRTL")
15. Madurai-Kanyakumari Tollway Limited ("MKTL")
16. Kanyakumari-Etturavattam Tollway Limited ("KETL")
17. Salaipudhpur-Madurai Tollway Limited ("SMTL")
18. Nanguneri-Kanyakumari Tollway Limited ("NKTL")

In FY 2021, Cube Mobility Investments Pte. Ltd. acquired tolling rights of 9 operating highway projects from the National Highways Authority of India (NHAI). These roads operate under the Toll-Operate-Transfer (TOT) Model ("TOT Assets"), which grants the right to collect tolls for specified period (Refer Section 6 for details pertaining to terms of concession) on payment of an upfront consideration. These TOT assets are proposed to be transferred to the InvIT and referred to in list above from Sr No. 10 to Sr No.18.

Cube Highways Trust is registered with SEBI as an Infrastructure Investment Trust ("InvIT") in terms of Regulation 6 of the SEBI (Infrastructure Investment Trusts) Regulations, 2014 with the registration number IN/InvIT/22-23/022. Cube Highways Trust ("Trust") proposes to undertake activity as an infrastructure investment trust as permissible in terms of the InvIT Regulations.

Axis Trustee Services Limited ("Trustee" or "ATSL") is acting as a Trustee to the InvIT. Axis Trustee Services Limited is a public company incorporated on May 16, 2008 at Mumbai under the Companies Act, 2013. The Trustee is a trusteeship company, which has been registered with SEBI on January 31, 2014, and has been promoted by and is a wholly owned subsidiary of Axis Bank for providing corporate and other trusteeship services.

Cube Highways Fund Advisors Private Limited ("Investment Manager" or "CHFAPL") is acting as an investment manager of the Trust. CHFAPL is a private limited company incorporated on April 12, 2021 at New Delhi under the Companies Act, 2013.

Cube Highways and Transportation Assets Advisors Private Limited ("Project Manager" or "CHTAAPL") is proposed to act as a Project Manager to the InvIT. CHTAAPL is a private company incorporated on January 1, 2015 under the Companies Act, 2013. CHTAAPL is engaged in management of routine operations and maintenance of the InvIT Assets.

EYMBSLLP has been appointed as an independent valuer to undertake enterprise valuation of InvIT Assets as on October 31, 2022, which will form part of the initial investments of the Trust, in connection with the private placement of units by the Trust (the "Offering").

Our report was prepared solely for the purpose of inclusion as part of the Draft Placement Memorandum and the Final Placement Memorandum ("DPM", and "FPM" respectively) and such other documents as may be required for the Offering and in accordance with the SEBI InvIT Regulations' guidelines requiring an independent valuation ("Purpose"). This report should not be used or relied upon for any other purpose.

EYMBSLLP is appointed to undertake financial valuation only. We are placing reliance on other consultants appointed by the Clients for traffic and other technical inputs. This report is our deliverable for the aforementioned purpose.

EYMBSLLP is a Registered Valuer for securities or financial assets under Section 247 of the Companies Act, 2013 bearing registration number IBBI/RV-E/05/2021/155.

Identity of the Valuer

Name of entity registered	Ernst & Young Merchant Banking Services LLP
Registration Number	IBBI/RV-E/05/2021/155
Registration valid from	01 November 2021

Disclosure of Valuer's Interest or Conflict

EYMBSLLP, Navin Vohra and the team working on the valuation of InVIT Assets do not have any present or planned future interest in the Trust, the InVIT Assets or the Investment Manager except to the extent of this appointment as an independent valuer and the fee for this Valuation Report ("Report"), which is not contingent upon the values reported herein. Accordingly, there is no conflict of interest for carrying out the valuation.

Declaration

- We hereby confirm on behalf of EYMBSLLP that EYMBSLLP is competent to undertake this valuation in terms of SEBI InvIT Regulations.
- We further confirm that EYMBSLLP is independent in terms of the SEBI InvIT Regulations and that this report has been prepared on a fair and unbiased basis in compliance with Regulation 13(1) and Regulation 21 of the SEBI InvIT Regulations.
- We have at least two partners/ directors having experience of 5 years each in the valuation of infrastructure assets.

This Report covers all the disclosures required as per the SEBI InvIT Regulations and the Valuation of the SPVs is impartial, true and fair and in compliance with the SEBI InvIT Regulations.

II. Valuation Analysis

Income approach, specifically Discounted Cash Flow (DCF) method has been considered for arriving at fair value of InvIT Assets as on October 31, 2022. The valuation exercise has been carried out basis the financial projections of each of the InvIT Assets provided to us by the Client Management ("Management"). Free Cash Flow to Firm approach under DCF method has been considered to determine the enterprise value of InvIT Assets. The Enterprise Value has been computed by discounting the free cash flows to the firm (InvIT Assets) from 1 November 2022 until the end of the concession period, using an appropriate Weighted Average Cost of Capital ("WACC").

The Investment Manager has appointed independent consultants to carry out traffic study in April 2022 for estimation of toll revenue and technical study for estimation of operating and maintenance expenses and major maintenance expenses, for each of the InvIT Assets over the concession period. As informed by the Management there has not been a material change in the traffic trend and operating condition of the roads. Hence, forecasts have been prepared by the Management basis these traffic study reports dated April 2022. We have relied upon financial projections, traffic study reports, technical reports provided by independent consultants and other information provided to us for carrying out the valuation of each of the InvIT Assets.

Our valuation is based on various assumptions with respect to the InvIT Assets, including their respective present and future financial condition, business strategies and the environment in which they will operate in the future. These assumptions are based on the information that we have been provided with and our discussions with the Management, and reflect current expectations and views regarding future events, and therefore necessarily involve known and unknown risks and uncertainties.

The summary of valuation of each of the InvIT Assets is presented below:

SPV ***Currency: INR mn***	**Enterprise Value**
JMTL	13,493
MBEL	5,860
WUTPL	4,085
APEL	2,361
NDEPL	6,897
FRHL	28,439
WVEPL	8,392
DATRL	71,224
GAEPL	22,224
HTL	17,550
JLTL	11,824
JVTL	7,877
KMTL	15,832
LRTL	11,569
MKTL	14,860
KETL	8,036
SMTL	9,145
NKTL	9,452
Total	**269,120**

Our views are based on the current economic, market, industry, regulatory, monetary and other conditions and on the information made available to us, as of the date of this Report. Such conditions may change significantly over a relatively short period of time and we assume no responsibility and are not required to update, revise or reaffirm our conclusion set out in this letter to reflect events or developments subsequent to the date of the Report.

III. Sources of Information

The following sources of information have been utilized in conducting the valuation exercise:

- **SPV specific information** – The following information, as provided by the Management, have inter-alia been used in the enterprise valuation of InvIT Assets:
  - Audited financials (balance sheet and profit and loss account along with schedules and notes to accounts including auditors' report but excluding director's report) of InvIT Assets from FY18 to FY22
  - Unaudited financials (balance sheet and profit and loss account along with schedules and notes to accounts including auditors' report but excluding director's report) of InvIT Assets for 7 months ended October 31, 2022
  - Financial projections of each of the InvIT Assets from 1 November 2022 till the end of concession period including underlying assumptions (It includes forecasts of profit and loss statements, balance sheet, cash flow statements and respective underlying assumptions)
  - Concession Agreements entered into between the respective InvIT Assets and NHAI/State authorities
  - Traffic assessment reports and technical assessment reports by independent consultants for each of the InvIT Assets
  - Background information regarding the InvIT Assets provided through emails or during discussions

- Besides the above listing, there may be other information provided by the Management which may not have been perused by EYMBSLLP in any detail, if not considered relevant for the defined scope.

- **Industry and economy information**: EYMBSLLP has relied on publicly available information, proprietary databases subscribed to by EYMBSLLP or its member firms, and discussions with the Management for analyzing the industry and the competitors.
- In addition to the above, EYMBSLLP has also obtained such other information and explanations from the Management as were considered relevant for the purpose of the valuation.

It may be mentioned that the Client has been provided an opportunity to review factual information in our report as part of our standard practice to make sure that factual inaccuracies/omissions/etc. are avoided in our final report.

IV. Statement of Limiting Conditions

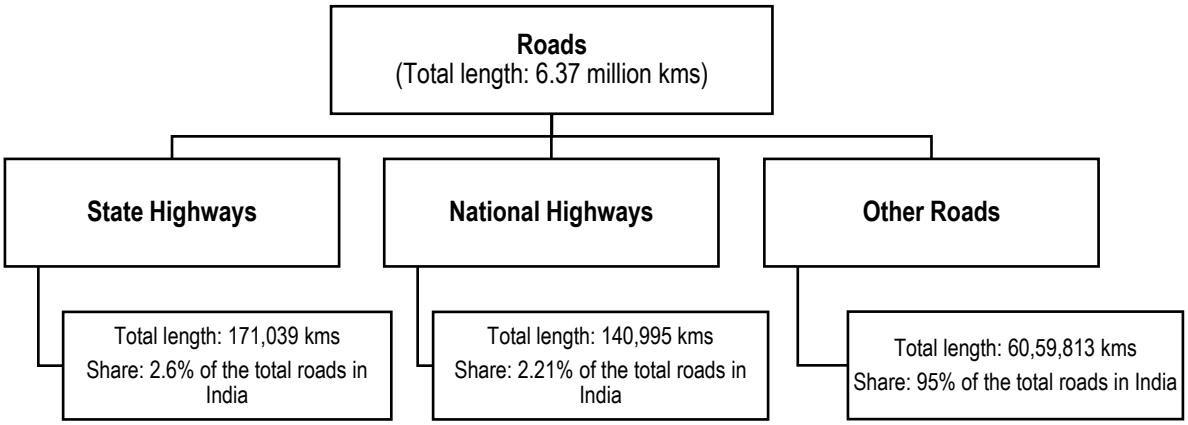
- Provision of valuation opinions and consideration of the issues described herein are areas of our regular valuation practice. The services do not represent accounting, assurance, accounting / tax due diligence, consulting or tax related services that may otherwise be provided by us or our affiliates.
- The estimate of value contained herein are not intended to represent value of the respective InvIT Assets at any time other than the dates specifically mentioned for each valuation result, as per the agreed scope of our engagement and as required under the SEBI InvIT Regulations. Changes in market/industry conditions could result in opinions of value substantially different than those presented.
- The valuation report was prepared for the purpose of the Offering only. Its suitability and applicability of any other use has not been checked by us. It can be used for statutory and regulatory filings in connection with proposed Offering as per the provisions of the SEBI InvIT Regulations.
- The user to which this valuation is addressed should read the basis upon which the valuation has been done and be aware of the potential for later variations in value due to factors that are unforeseen at the valuation date. Due to possible changes in market forces and circumstances, this valuation report can only be regarded as relevant as at the Valuation Date.
- This Report has been prepared for the purposes stated herein and should not be relied upon for any other purpose. Our Client is the only authorized user of this report and is restricted for the purpose indicated in the engagement letter. This restriction does not preclude the Client from providing a copy of the report to third-party advisors whose review would be consistent with the intended use. We do not take any responsibility for the unauthorized use of this report.
- While our work has involved an analysis of financial information and accounting records, our engagement does not include an audit in accordance with generally accepted auditing standards of the client existing business records. Accordingly, we express no audit opinion or any other form of assurance on this information.
- The valuation has been performed based on the unaudited standalone balance sheet provided by Management for 7 months period ended 31 October 2022 and audited financials for earlier years. The management has also confirmed that there has not been any material change in the operations of the Company since the last available financial statements
- In no event shall we be liable for any loss, damages, cost or expenses arising in any way from fraudulent acts, misrepresentations or wilful default on part of the client or companies, their directors, employees or agents.
- The Client and its management/representatives warranted to us that the information they supplied was complete, accurate and true and correct to the best of their knowledge. We have relied upon the representations of the clients, their management and other third parties, if any, concerning the financial data, operational data and other information, except as specifically stated to the contrary in the report. We shall not be liable for any loss, damages, cost or expenses arising from fraudulent acts, misrepresentations, or wilful default on part of the companies, their directors, employee or agents.
- EYMBSLLP is not aware of any contingency, commitment or material issue which could materially affect the Company's economic environment and future performance and therefore, the fair value of the Company.
- We do not provide assurance on the achievability of the results forecast by the management/owners as events and circumstances do not occur as expected; differences between actual and expected results may be material. We express no opinion as to how closely the actual results will correspond to those projected/forecast as the achievement of the forecast results is dependent on actions, plans and assumptions of management.

- The Report assumes that the company/business/asset complies fully with relevant laws and regulations applicable in its area of operations and usage unless otherwise stated, and that the companies/business/assets will be managed in a competent and responsible manner. Further, as specifically stated to the contrary, this report has given no consideration to matters of a legal nature, including issues of legal title and compliance with local laws, and litigations and other contingent liabilities that are not recorded/reflected in the balance sheet/fixed assets register provided to us.
- The valuation analysis and result are governed by concept of materiality.
- It has been assumed that the required and relevant policies and practices have been adopted by Company and would be continued in the future.
- The fee for the Report is not contingent upon the results reported.
- We owe responsibility to only to the client that has appointed us under the terms of the engagement letters. We will not be liable for any losses, claims, damages or liabilities arising out of the actions taken, omissions or advice given by any other person.
- The actual transacted value achieved may be higher or lower than our estimate of value (or value range of value) depending upon the circumstances of the transaction (for example the competitive bidding environment), the nature of the business (for example the purchaser's perception of potential synergies). The knowledge, negotiating ability and motivation of the buyers and sellers will also affect the transaction value achieved.
- We have also relied on data from external sources to conclude the valuation. These sources are believed to be reliable and therefore, we assume no liability for the truth or accuracy of any data, opinions or estimates furnished by others that have been used in this analysis. Where we have relied on data, opinions or estimates from external sources, reasonable care has been taken to ensure that such data has been correctly extracted from those sources and /or reproduced in its proper form and context.

V. Industry Overview

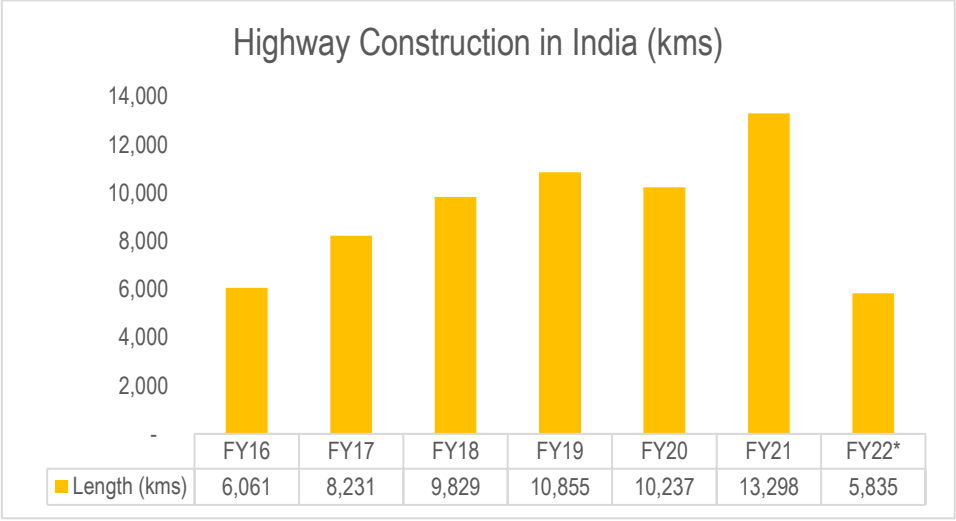
1. Road Network in India

India has the second-largest road network in the world, spanning a total of 5.8 million kilometres (kms). This road network transports 64.5% of all goods in the country and 90% of India's total passenger traffic uses road network to commute.



Source: IBEF Roads Report, August 2022

2. Momentum in expansion of highways



*Note: *Till December 2021*

Highway construction in India increased at 18.1% CAGR between FY16-FY21. The Government aims to construct 65,000 kms of national highways under Bharatmala Pariyojana Project at a cost of Rs. 5.35 lakh crore (US$ 741.51 billion) by 2022.

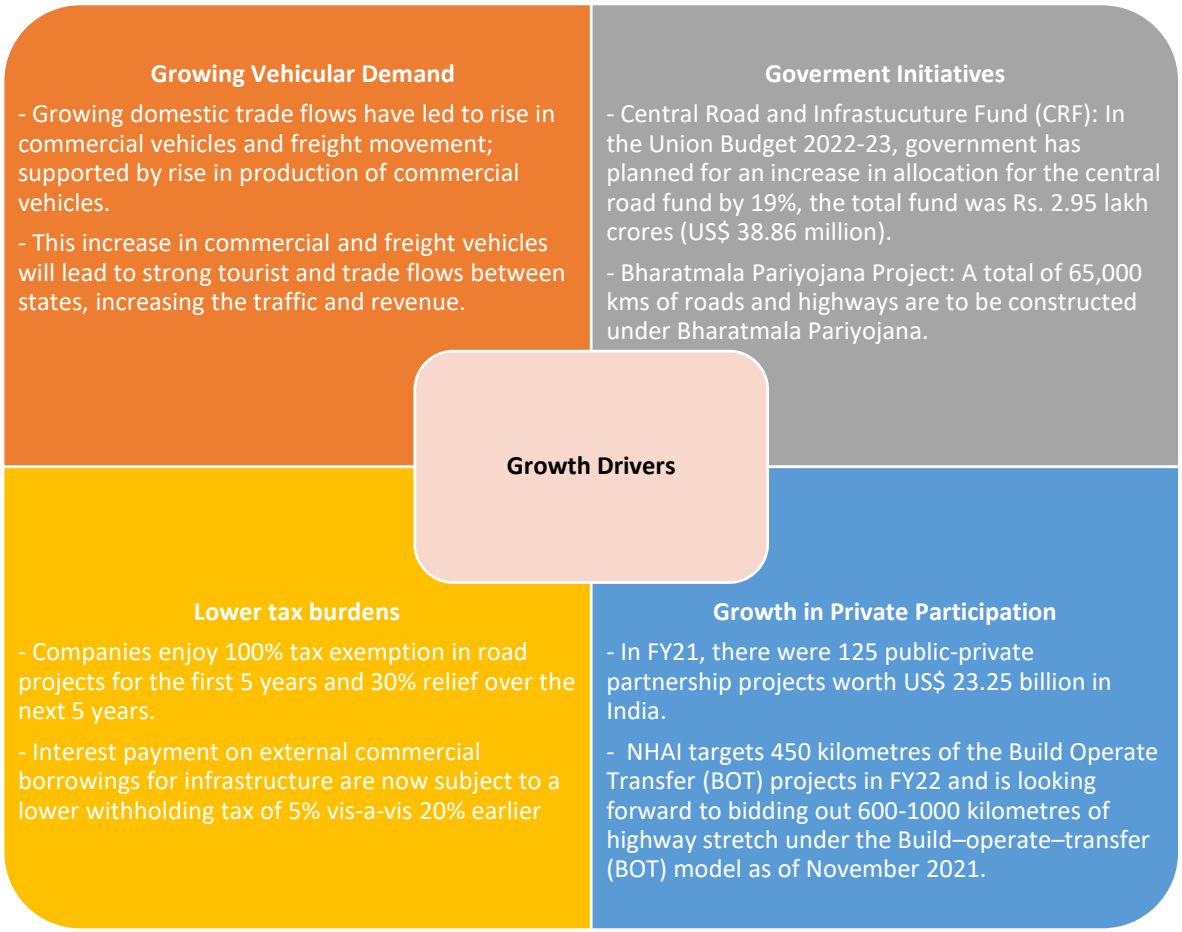
Under the Union Budget 2022-23, the Government of India has allocated Rs.199 lakh crores (US$ 26.04 billion) to the Ministry of Road Transport and Highways ("MoRTH").

The government also plans to spend Rs. 10,565 crore (US$ 1.38 billion) on the Trans-Arunachal Highway and Kaladan Multi-Model Transport Project, as well as other roads development projects such as capital connectivity, district connectivity, connectivity to the international border, and improvement and strengthening of roads in the region of Sikkim.

The Special Accelerated Road Development Programme for the Northeast region (SARDP-NE) is aimed at developing road connectivity between remote areas in the northeast with state capitals and district headquarters. It would facilitate connectivity of 88 district headquarters across states in the Northeast to their nearest national highway.

NHAI is planning to raise Rs. 40,000 crore (US$ 5.72 billion) to monetise its highway assets through Infrastructure Investment Trust (InvIT). In February 2022, it rolled out a plan to construct 5,795 kilometres of highways that will connect 117 districts. The plan is worth Rs. 1 trillion (US$ 13.09 billion).

3. Growth Drivers



4. E-Initiatives

a. BhoomiRashi - Land Acquisition Portal

The Ministry of Road Transport and Highways has launched BhoomiRashi portal to digitize the Land Acquisition notification process and avoid parking of public funds with the Competent Authority for Land Acquisition (CALA).

A key objective of the ministry was to avoid parking of funds in bank accounts and also ensuring transparent real time deposit of funds in the account of the individuals whose land/ property were acquired. The same has successfully been achieved by integrating the payment of compensation with the BhoomiRashi portal via Public Finance Management System (PFMS).

Payments in nearly 17 states, amounting to more than INR 900 Crores have been processed through PFMS, for the Projects executed by MoRTH through State PWDs. This initiative of MoRTH has resulted in a more robust and efficient land acquisition for road construction in the country.

b. E-Tolling (FASTag)

To ensure seamless movement of traffic through fee plazas and increase transparency in collection of user fee using FASTag, the National Electronic Toll Collection (NETC) programme, the flagship initiative of Ministry of Road Transport and Highways, has been implemented on pan-India basis.

As on 31st December 2021, collectively banks have issued over 4.42 crore FASTags with an average daily NETC transaction of 76.62 lakhs; the average daily collection through NETC has increased to Rs. 118.5 crore.

The constant growth and adoption of FASTag by highway users is very encouraging and has helped increase efficiency in toll operations.

5. Gati Shakti-National Master Plan

The Indian government launched Gati Shakti-National Master Plan, which will help lead a holistic and integrated development of infrastructure generating immense employment opportunities in the country.

The aim of the plan is to create a digital platform that would enable 16 ministries to collaborate on integrated planning and coordinated implementation of projects. The plan will also bring together departments such as railways, roads & highways and others and implementation will be done with the help of geo-satellite imaging and Big Data, land and logistics.

India's Gati Shakti program has consolidated a list of 81 high impact projects, out of which road infrastructure projects were the top priority. The major highway projects include the Delhi-Mumbai expressway (1,350 kilometres), Amritsar-Jamnagar expressway (1,257 kilometres) and Saharanpur-Dehradun expressway (210 kilometres). The main aim of this program is a faster approval process which can be done through the Gati shakti portal and digitized the approval process completely.

6. Budgetary Outlays and Future Prospects

In July 2021, the union minister for Road Transport and Highways, Mr. Nitin Gadkari, laid the foundation stone for 16 National Highway projects in Manipur. These projects will cost US$ 556.67 million to build and will cover a total distance of 298 kms. MoRTH allocated Rs. 165 crore (US$ 22 million) under Economic Importance and Inter State Connectivity Scheme (EIC&ISC) for FY22.

In September 2021, the Indian government announced road projects worth Rs. 1 lakh crore (US$ 13.48 billion) to develop road infrastructure in Jammu and Kashmir. The region has also witnessed growth in number of national highways, from 7 in 2014 to 11 in 2021.

MoRTH allocated Rs. 7,270 crore (US$ 980.9 million) for road safety programmes in 14 states that constitute 85% of the total road fatalities in India in September 2021 and has planned to allocate funds worth Rs. 7 trillion (US$ 91.71 billion) by FY24.

In October 2021, the Indian government announced five road projects in Ladakh, measuring 255 kms in length, to boost connectivity in the region. The government also announced a plan to install charging stations every 40 to 60 kilometres on national highways to strengthen wayside amenities; in line with this, ~700 e-vehicle charging stations are expected to be installed by 2023, covering 35,000 to 40,000 kms of national highways.

In December 2021, the government set a highway monetization target of Rs. 2 trillion (US$ 26.20 billion) for the next 3 years. It aims to construct 23 new national highways by 2025.

VI. Background of the SPVs

1. Jaipur-Mahua Tollway Limited ('JMTL')

1.1 JMTL is situated in the state of Rajasthan, connecting Jaipur to Mahua on the east, near the edge of the south-western Uttar Pradesh. It is a 109.09 km toll road which forms a part of the NH 21 in Rajasthan. This is a four-lane road with two toll plazas, namely, Sikandra (TP1) at Km 156.6 (closer to Mahua) and Rajadhok (TP2) at Km 204.7 (closer to Jaipur).

1.2 It caters to following types of strategic movements:

- **Short-distance trips** including tourism and leisure trips between some of the most attractive tourist destinations in India. Such trips are mostly comprising of CJVs which are either local or run between key tourist locations of Agra and Bharatpur at one end and Jaipur on the other.

- **Medium-distance trips** between Rajasthan and Uttar Pradesh connect marble-processing sites of Rajasthan to its consumption sites in Uttar Pradesh. It also transports significant number of manufactured products across the states of UP and Rajasthan.

- **Long-distance trips** between Gujarat and southern Rajasthan, and UP/East India connects ports and industries of western India to major consumption and production centres in North India.

1.3 The toll plazas have been operational since April 2009 (TP1) and September (TP2) 2009. Cube Highways and Infrastructure Pte. Ltd acquired the concession rights in relation to this asset through its SPV, JMTL in FY16. The following table presents a summary of the concession.

Particulars	Details
State	Rajasthan
Employer	NHAI
Highway and lane configuration	NH11 and NH 21 four lane
Toll plazas	TP1: Sikandra TP2: Rajadhok
Length (km) as per concession agreement, Applicable	TP1: 54.73 Km TP2: 54.36 Km
Commencement of operations	TP1: April 2009 TP2: September 2009
Concession period	25 years
Concession end	FY32

1.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

2. Mahua Bharatpur Expressway Limited ('MBEL')

2.1 MBEL is situated in the state of Rajasthan, connecting Mahua to Bharatpur on the east, near the edge of the south-western Uttar Pradesh. It is a 57.3 km toll road which forms a part of the NH 21 in Rajasthan. This is a four-lane road with two toll plazas, namely, Amoli (TP1) at Km 98.5 (closer to Mahua) and Ludhawai (TP2) at Km 64.5 (closer to Bharatpur).

2.2 MBEL caters to following types of strategic movements:

- **Short-distance trips** including tourism and leisure trips between some of the most attractive tourist destinations in India. Such trips are mostly comprising of CJVs which are either local or run between key tourist locations of Agra and Bharatpur at one end and Jaipur on the other.

- **Medium-distance trips** between Rajasthan and Uttar Pradesh connect marble-processing sites of Rajasthan to its consumption sites in Uttar Pradesh. It also transports significant number of manufactured products across the states of UP and Rajasthan.

- **Long-distance trips** between Gujarat and southern Rajasthan, and UP/East India connects ports and industries of western India to major consumption and production centres in North India.

2.3 The toll plazas have been operational since April 2009. Cube Highways and Infrastructure Pte. Ltd acquired the concession rights in relation to this asset through its SPV, MBEL in FY17. The following table presents a summary of the concession.

Particulars	Details
State	Rajasthan
Employer	NHAI
Highway and lane configuration	NH 21 four lane
Toll plazas	TP1: Amoli TP2: Ludhawai
Length (km) as per concession agreement, applicable	TP1: 38.65 Km TP2: 18.65 Km
Commencement of operations	May 2009
Concession period	25 years
Concession end	FY32

2.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

3. Western UP Tollway Limited ("WUPTL")

3.1 Western UP Toll Road is situated in western Uttar Pradesh (UP), connecting the cities of Meerut and Muzaffarnagar. Meerut-Muzaffarnagar Western UP Toll Road is a 77.8-Km four-lane tolled road which forms a part of the NH 334 in Uttar Pradesh. It has one toll plaza, namely, Siwaya (TP1) at Km 76.0, which lies close to Meerut (approximately 10 km from the city).

3.2 WUPTL primarily caters to two different types of strategic movements:

- **Short-distance trips** by locals travelling within the National Capital Region (NCR) for work, leisure or short trips. This region is made up of contiguous urban settlements which are largely co-dependent on each other for exchanging goods and services.

- **Medium-distance trips** on the Meerut-Muzaffarnagar Western UP Toll Road which mostly have one end of their trip in Uttarakhand. This is because it is the primary route connecting Delhi NCR to the popular tourist destinations of Uttarakhand. Increased traffic volumes can be observed closer to weekends, as people from Delhi and nearby areas travel to Uttarakhand for leisure, tourism and business purposes.

3.3 The toll plaza on the Meerut-Muzaffarnagar Western UP Toll Road has been operational since April 2011. Cube Highways and Infrastructure Pte. Ltd acquired the concession rights in relation to this asset through its SPV, WUTPL in FY17. The following table presents a summary of the concession:

Particulars	Details
State	Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 334 four lane
Toll plazas	TP1: Siwaya
Length (km) as per concession agreement, applicable	77.80 Km
Commencement of operations	TP1: October 2011
Concession period	20 years
Concession end	FY27

3.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 20 December 2022

4. Andhra Pradesh Expressway Limited ("APEL")

APEL is an annuity model. The details for AEPL are provided below:

4.1 Summary of details of APEL are as follows:

Parameters	Details
Project Corridor	Kothakota (km.136+077) to Kurnool (Km. 210+699) on NH-44 (NH-7) in the state of Andhra Pradesh under North South Corridor (NHDP Phase II)
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways
Type of concession	BOT (Annuity) Basis.
Concessionaire	M/s Andhra Pradesh Expressway Limited.
Project Road Length	74.6km
Date of Concession Agreement	Mar 2006
Appointed Date	Sep 2006
Concession Period	20 years from the appointed date
Schedule Date of Commercial Operation Date ("**COD**")	Mar 2009
Number of Toll Plaza and Lanes	1 Toll Plaza at Km 200+700 (Pullur) with 6 Lanes (5+1 Lanes) in each direction (Since the asset is under Annuity model, APEL does not receive annuity revenue. APEL receives fixed annuity over the concession period)
End of Concession Period	Sep 2026 (20 years from Appointed Date)

4.2 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 23 December 2022

5. Nelamangala Devihalli Expressway limited ("NDEPL")

5.1 NDEPL is situated in the southern state of Karnataka, connecting the city of Bangalore to Mangalore via NH75. It is one of the three sections making the corridor, the other two being Devihalli-Hassan Tollway Limited (DHTL) and Hassan-Mangalore highway. This project is an 80.26-km toll road which forms a part of NH75 in Karnataka. This is a four-lane road with two toll plazas, namely, Doddakarenahalli/Nelamangala (TP1 closer to Bangalore) and Karbylu (TP2 closer to Devihalli).

5.2 NDEPL is primarily caters to the following different types of movements, by virtue of its strategic location on various corridors:

- **Medium-distance** movements between Bangalore and Mangalore primarily for leisure and tourism. The CJVs contribute around 70% to the total traffic on the project. This is driven by the large number of tourist destinations along the Asset and close to the Asset which drives the car growth.
- **Work and leisure trips** between local cities, towns and villages like Nelamangala, Hassan, tourist spots, and Bangalore city.
- **Petroleum-related traffic**:
  - Between ports and refineries in Mangalore and Kochi, and bottling plants lying on the project, viz HPCL plant at Yediyur and BPCL plant at Solur.
  - Between bottling plants and neighbouring consumption centres like Bangalore.

5.3 The toll plazas have been operational since June 2012. The original concession agreement with respect to Nelamangala Devihalli project was signed between the original concessionaire Lanco Devihalli Highways Limited ("LDHL") and NHAI. LDHL had been operating the project road till December 2020. Subsequently, LDHL was substituted by NDEPL in January 2021 through a lender-led substitution as per the terms of the original concession agreement and an endorsement agreement was entered with NHAI through which the concession was endorsed to NDEPL. NDEPL has been operating the project road since. The following table presents a summary of the concession:

Particulars	Details
State	Karnataka
Employer	NHAI
Highway	NH 75 4-lane
Toll plazas	TP1: Doddakarenahalli TP2: Karbylu
Length (km)	TP1: 40.13 km TP2: 40.13 km
Commencement of operations	TP1: June 2012 TP2: June 2012
Concession period	25 years
Concession end	FY33

5.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 20 December 2022

6. Farakka-Raiganj Highways Limited ('FRHL')

6.1 FRHL is situated in the state of West Bengal, connecting the cities of Farakka and Raiganj where it also passes through another city – Malda - and is located very close to the international border with Bangladesh. It is a 100.05 km toll road which forms a part of NH 12 in West Bengal. It is a four-lane road with two toll plazas, namely, Lakshmipur (TP1) at Km 297.9 (closer to Farakka in the south) and Gazole (TP2) at Km 351.4 (closer to Malda).

6.2 FRHL primarily caters to three different types of strategic movements:

- **Short-distance trips** between Malda and other towns in Malda and Murshidabad districts.
- **Medium-distance trips** between southern and northern parts of West Bengal, including movements between Pakur region, Malda and Bangladesh.
- **Long-distance trips** between South and East India including Kolkata, and Northeast India. Kolkata is the largest urban agglomeration and one of the four older metropolitan cities of India and is both a large attractor and generator of consumption-linked commodities in East and Northeast India.

6.3 The toll plazas on Farakka Raiganj Highway Limited Road have been operational since October 2016. Cube Highways and Infrastructure II Pte. Ltd acquired the concession rights in relation to this asset through its SPV, FRHL in FY21. The following table presents a summary of the concession:

Particulars	Details
State	West Bengal
Employer	NHAI
Highway and lane configuration	NH12 four-lane
Toll plazas	TP1: Lakshmipur TP2: Gazole
Appointed Date	February 2011
Commencement of operations*	October 2016
Concession period	30 years
Concession end	FY42
Tollable length (Km) as per concession agreement, applicable	TP1: 47.67 km TP2: 43.38 km Malda Bypass: 10.8 km

6.4 The pictures of the Asset are shown below

Note: Virtual Site visit conducted by EYMBSLLP personnel on 19 December 2022

7. Walayar Vadakkencherry Expressway Private Limited ("WVEPL")

7.1 WVEPL is situated in the state of Kerala, connecting Walayar, a town located on the Tamil Nadu-Kerala border and Vadakkencherry, a town in the Palakkad district of Kerala. It is a section of the strategic NH 47 which serves as a key entry point to the State from its eastern end. It is a 53.5 km toll road which forms a part of the NH 47, a key highway connecting the city Salem in Tamil Nadu to Kochi in Kerala. It is a four-lane road with one toll plaza, namely, Chullimada Hamlet (Pampampallam) at km 189.4 (closer to Walayar).

7.2 WVEPL primarily caters to three different types of strategic movements:

- **Short-distance trips** undertaken largely by passenger vehicles for work/business trips wherein the movement is predominantly local between Walayar and other areas in the Palakkad district.
- **Medium-distance trips** made by both passenger and goods vehicles covering places such as Ernakulam and Kochi in Kerala, to Erode and Salem in Tamil Nadu.
- **Long-distance trips** predominantly by MAVs catering to Kerala's high demand for consumption goods and cement, from areas lying outside the state such as Chennai, Bangalore, Vijaywada etc.

7.3 The toll plaza has been operational since May 2015. Cube Highways and Infrastructure III Pte. Ltd acquired the concession rights in relation to this asset through its SPV, WVEPL in FY21. The following table presents a summary of the concession.

Particulars	Details
State	Kerala
Employer	NHAI
Highway and lane configuration	NH 544 four lane
Toll plazas	TP1: Pampampallam
Length (km) as per concession agreement, applicable	TP1: 53.5 km
Commencement of operations	October 2015
Concession period	20 years
Concession end	FY38

7.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 23 December 2022

8. DA Toll Road Private Limited ("DATRL")

8.1 DATRL is situated in the state of Delhi, Haryana and Uttar Pradesh connecting the Central National Capital Region (NCR; comprising Delhi state) to Agra in the south, via Palwal and Mathura. It is a 179.5-km toll road which forms a part of the NH 19 (Old NH 2) in Delhi, Haryana and Uttar Pradesh. This was a four-lane road with two toll plazas - TP1 Srinagar (km74 closer to Delhi) and Mahuvan (km164 closer to Agra). DATRL achieved provisional commercial operations date (COD) in May 2022 and the toll plaza at km74 (Srinagar) split into two toll plazas TP1' Prithala (km46) and Kotwan (km94) which became operational in July'22.

8.2 DATRL primarily caters to three different types of strategic movements:

- **East-West long-distance movement** from Kashmir in North India to the India-Bangladesh border. This route originally connected Kabul in Afghanistan to Chittagong in Bangladesh.
- **North-south long-distance movement** connecting the Srinagar in Kashmir (northernmost state) to Kanyakumari in Tamil Nadu (southernmost state in mainland India).
- **Medium-distance movement** as part of being located one of the primary corridors connecting Delhi and Lucknow via Agra.
- **Short-distance inter-urban movement** between towns and cities in and around Delhi, Palwal, Mathura and Agra.

8.3 The toll plaza has been operational since December 2012. Cube Highways and Infrastructure III Pte. Ltd acquired the concession rights in relation to this asset through its SPV, DATRL in FY21. The following table presents a summary of the concession:

Particulars	Details
State	Delhi, Haryana, Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 19 six lane
Toll plazas	Existing/operational • km74, Palwal • km164, Mahuvan Operational (July FY22 onwards) • km46, Prithala • km94, Kotwan • km164, Mahuvan
Length (km) as per concession agreement, applicable	• km74: 89.75 km • km164: 89.75 km Operational (July FY22 onwards) • km46: 47.28 km • km94: 63.22 km • km164: 69.00 km
Commencement of operations	• km74: December 2012 • km164: December 2012
Concession period	26 years
Original Concession end	FY39
Revised Concession end (Due to variation in traffic)	FY42

8.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 21 December 2022

9. Ghaziabad Aligarh Expressway Private Limited ("GAEPL")

9.1 GAEPL is situated in western Uttar Pradesh (UP), connecting the cities of Ghaziabad and Aligarh via Khurja and Bulandshahr. It is a 125.175-km toll road which forms a part of NH 91 in Uttar Pradesh. This is a four-lane road with two toll plazas, namely, Luharli (TP1 closer to Ghaziabad) and Somna (TP2 closer to Aligarh).

9.2 GAEPL primarily caters to three different types of strategic movements:

- Local traffic between cities in western UP, Delhi Central NCR (consisting of Delhi state) and Ghaziabad.
- Trips to the industrial area of Sikandrabad which is located on the Asset and serves as a major attractor/generator of traffic.
- Heavy vehicle traffic originating from the states of Haryana, Punjab and Jammu and Kashmir in the north travelling to states in the east of India including West Bengal, Orissa and the north-eastern states. The asset is part of strategic north – east movement and majority of this traffic appears on Somna toll plaza.

9.3 The toll plazas on the Asset have been operational since June 2015. The following table presents a summary of the concession:

Particulars	Details
State	Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 91 four lane
Toll plazas	• TP1: Luharli • TP2: Somna
Length (km) as per concession agreement, applicable	• TP1: 62.175 km • TP2: 63 km
Commencement of operations	• TP1: June 2015 • TP2: June 2015
Concession period	24 years
Concession end	FY35
Revised Concession end (Due to variation in traffic)	FY40

9.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 21 December 2022

10. Hazaribagh Tollway Limited ("HTL")

10.1 HTL is situated in the state of Jharkhand connecting the Ranchi, the capital of Jharkhand, and Hazaribagh, on the NH20 (old NH 33). It is a 73.79 km long toll road which forms a part of the NH 20 (old NH 33) in Jharkhand. This is a four-lane road with one toll plazas, namely, Pundag (TP1) at Km 100.4.

10.2 HTL primarily caters to three different types of strategic movements:

- **Short-distance trips** including tourism and leisure travel trips between some of the key tourist destinations in Jharkhand. Many CJV users are either local or travel between Ramgarh and Patratu at one end and Ranchi at the other.
- **Medium-distance trips** between Bihar/rest of Jharkhand connecting the mines situated close to the Asset, to industries in Jharkhand. The Asset also transports a significant number of minerals, steel, and related products across the states of Bihar, West Bengal, and Odisha.
- **Long-distance trips** between Bihar/southern West Bengal and southern as well as central states of India.

10.3 The toll plaza has been operational since September 2013. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, HTL in FY21. The following table presents a summary of the concession.

Particulars	Details
State	Jharkhand
Employer	NHAI
Highway and lane configuration	NH 33 (old NH 20),4-lane divided
Toll plazas	TP1: Pundag
Length (km) as per concession agreement, applicable	TP1: 73.79 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51

10.4 The pictures of the Asset are shown below

Note: Virtual Site visit conducted by EYMBSLLP personnel on 23 June 2022

11. Jhansi-Lalitpur Tollway Limited ("JLTL")

11.1 JLTL is situated in the state of Uttar Pradesh, connecting Jhansi and Lalitpur, on the NH 44 (old NH 25 and 26). NH44 caters to the North South movement between Jammu and Kashmir, and Kanyakumari, connecting major centres of economic activity such as Delhi, Nagpur, Hyderabad, Bangalore and Chennai.

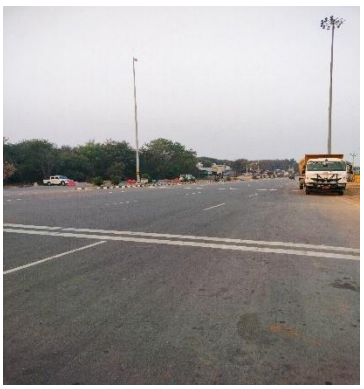
11.2 JLTL primarily caters to three different types of strategic movements:

- **Short-distance trips** including leisure and business travel trips between some of the key tourist towns/cities around the Asset. Many CJV trips are either local or run between Jhansi, Orchha, Talbehat, and Lalitpur.
- **Medium-distance trips and Long distance trips** connecting Gwalior, Delhi-NCR as well as northern regions with Nagpur, Hyderabad, Bangalore, and further southern regions.

11.3 The Assets form a 100.0 Km long toll road which forms a part of NH 44 (old NH 25 and 26) in Uttar Pradesh. It is a four-lane divided road with two toll plazas. Babina (JLTL) is at km 32.100. JLTL is near Jhansi end of the Asset. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, JLTL in FY21.The following table presents a summary of the concession.

Particulars	Details
State	Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 44 (old NH 25 and 26), 4-lane divide
Toll plazas	Babina
Length (km) as per concession agreement, applicable	49.70 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51
Revised Concession end (Due to variation in traffic)	FY46

11.4 The pictures of the Asset are shown below



Note: Site visit conducted by EYMBSLLP personnel on 23 December 2022

12. Jhansi-Vigakhet Tollway Limited ("JVTL")

12.1 JVTL is situated in the state of Uttar Pradesh, connecting Jhansi and Lalitpur, on the NH 44 (old NH 25 and 26). NH44 caters to the North South movement between Jammu and Kashmir, and Kanyakumari, connecting major centres of economic activity such as Delhi, Nagpur, Hyderabad, Bangalore and Chennai.

12.2 JVTL primarily caters to three different types of strategic movements:

- **Short-distance trips** including leisure and business travel trips between some of the key tourist towns/cities around the Asset. Many CJV trips are either local or run between Jhansi, Orchha, Talbehat, and Lalitpur.
- **Medium-distance trips and Long distance trips** connecting Gwalior, Delhi-NCR as well as northern regions with Nagpur, Hyderabad, Bangalore, and further southern regions.

12.3 The Assets form 100.0 Km long toll road which forms a part of NH 44 (old NH 25 and 26) in Uttar Pradesh. It is a four-lane divided road with two toll plazas. Vigakhet (JVTL) at km 85.280. JVTL is near Lalitpur end of the asset. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, JVTL in FY21. The following table presents a summary of the concession:

Particulars	Details
State	Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 44 (old NH 25 and 26), 4-lane divide
Toll plazas	Vigakhet
Length (km) as per concession agreement, applicable	49.30 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51
Revised Concession end (Due to variation in traffic)	FY46

12.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 23 December 2022

13. Kotwa-Muzaffarpur Tollway Private Limited ("KMTL")

13.1 KMTL is situated in the state of Bihar, connecting the two cities of Muzaffarpur and Kotwa in the north western part of Bihar. This Asset is an 80 km toll road which forms part of the NH 27 in Bihar. It is a four-lane road with one toll plaza, namely, Parsoni Khem (TP1) at Km 468 + 700 (closer to Kotwa).

13.2 KMTL primarily caters to three different types of strategic movements:

- **Short-distance trips** made by cars for local movement between places such as Motihari, Chakia, Motipur and other local destinations mostly for work related purpose.
- **Medium-distance trips** made by light and heavy goods vehicles covering places such as Patna in the southern part of the state and Raxaul near the India-Nepal border thereby catering to the heavy movement of trucks between the two countries for trade purpose.
- **Long-distance trips** made by heavy goods vehicles to provide the east-west connectivity between states such as Uttar Pradesh, Uttarakhand and Delhi, and West Bengal and North-eastern states. The Asset also caters to movement of trucks to countries such as Bangladesh and Bhutan.

13.3 The toll plaza on the Asset has been operational since December 2012. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, KMTL in FY21. The following table presents a summary of the concession:

Particulars	Details
State	Bihar
Employer	NHAI
Highway and lane configuration	NH 28 four lane
Toll plazas	Parsoni Khem
Length (km) as per concession agreement, applicable	80 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51
Revised Concession end (Due to variation in traffic)	FY46

13.4 The pictures of the Asset are shown below

Note: Virtual Site visit conducted by EYMBSLLP personnel on 23 June 2022

14. Lucknow-Raebareli Tollway Private Limited ("LRTL")

14.1 LRTL is situated in the state of Uttar Pradesh, connecting the state capital Lucknow to Raebareli in 4the southern-central part of Lucknow. This Asset is a 70 km toll road which forms part of the NH 30 in Uttar Pradesh. It is a four-lane road with one toll plaza, namely, Dakhina Sekhpur (TP1) at Km 42.5 (closer to Lucknow).

14.2 LRTL primarily caters to two different types of strategic movements:

- **Short-distance trips** undertaken majorly by passenger vehicles such as cars for work/business and tourism purpose wherein the movement is predominantly local between Lucknow, Raebareli, Prayagraj, Varanasi and Mirzapur. Further, LCVs cater to the local demand generated by two large consumption centres – Lucknow and Raebareli. Short distance trips made by MAVs feeds into the local consumption demand and also carries significant amount of Cement due to the presence of cement factories (Birla Cement, Dalla Cement) in the vicinity.
- **Long-distance trips** undertaken by heavy trucks between Punjab, Haryana, Uttar Pradesh, West Bengal, and Jharkhand carrying a mix of commodities such as agriculture/grocery items, metal, cement, petroleum and manufacturing items.

14.3 The toll plaza on the Asset has been operational since March 2015. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, LRTL in FY21. The following table presents a summary of the concession

Particulars	Details
State	Uttar Pradesh
Employer	NHAI
Highway and lane configuration	NH 30 four lane
Toll plazas	Dakhina Sekhpur
Length (km) as per concession agreement, applicable	70 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51
Revised Concession end (Due to variation in traffic)	FY46

14.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

15. Madurai-Kanyakumari Tollway Private Limited ("MKTL")

15.1 MKTL is situated in the state of Tamil Nadu, connecting Madurai, northern Tamil Nadu and states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The Asset is a 243-km toll road which lies on NH 44 in Tamil Nadu. It is a four-lane road with four toll plazas.

15.2 MKTL primarily caters to three different types of strategic movements:

- **Long-distance trips** between North India and Southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end.
- **Medium-distance trips** between northern Tamil Nadu including Chennai and southern Karnataka including Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram.
- **Short-distance trips** between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

15.3 The three southern toll plazas (Etturvattam, Salaipudhar and Nanguneri) on the Asset have been operational since FY12 while the northernmost toll plaza (Kappalur) has been operational since FY11. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, MKTL in FY21. The following table presents a summary of the concession

Particulars	Details
State	Tamil Nadu
Employer	NHAI
Highway and lane configuration	NH 44 four lane
Toll plazas	Kappalur
Length (km) as per concession agreement, applicable	52.30 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51
Revised Concession end (Due to variation in traffic)	FY46

15.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

16. Kanyakumari-Etturavattam Tollway Private Limited ("KETL")

16.1 KETL is situated in the state of Tamil Nadu, connecting Madurai, northern Tamil Nadu and states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The Asset is a 243-km toll road which lies on NH 44 in Tamil Nadu. It is a four-lane road with four toll plazas).

16.2 KETL primarily caters to three different types of strategic movements:

- **Long-distance trips** between North India and Southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end.
- **Medium-distance trips** between northern Tamil Nadu including Chennai and southern Karnataka including Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram.
- **Short-distance trips** between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

16.3 The three southern toll plazas (Etturvattam, Salaipudhar and Nanguneri) on the Asset have been operational since FY12 while the northernmost toll plaza (Kappalur) has been operational since FY11. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, KETL in FY21. The following table presents a summary of the concession

Particulars	Details
State	Tamil Nadu
Employer	NHAI
Highway and lane configuration	NH 44 four lane
Toll plazas	Etturvattam
Length (km) as per concession agreement, applicable	64.20 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51

16.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

17. Salaipudhpur-Madurai Tollway Private Limited ("SMTL")

17.1 SMTL is situated in the state of Tamil Nadu, connecting Madurai, northern Tamil Nadu and states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The Asset is a 243-km toll road which lies on NH 44 in Tamil Nadu. It is a four-lane road with four toll plazas).

17.2 SMTL primarily caters to three different types of strategic movements:

- **Long-distance trips** between North India and Southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end.
- **Medium-distance trips** between northern Tamil Nadu including Chennai and southern Karnataka including Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram.
- **Short-distance trips** between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

17.3 The three southern toll plazas (Etturvattam, Salaipudhar and Nanguneri) on the Asset have been operational since FY12 while the northernmost toll plaza (Kappalur) has been operational since FY11. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, SMTL in FY21. The following table presents a summary of the concession

Particulars	Details
State	Tamil Nadu
Employer	NHAI
Highway and lane configuration	NH 44 four lane
Toll plazas	Salaipudhur
Length (km) as per concession agreement, applicable	63.50 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51

17.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

18. Nanguneri-Kanyakumari Tollway Private Limited ("NKTL")

18.1 NKTL is situated in the state of Tamil Nadu, connecting Madurai, northern Tamil Nadu and states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The Asset is a 243-km toll road which lies on NH 44 in Tamil Nadu. It is a four-lane road with four toll plazas).

18.2 NKTL primarily caters to three different types of strategic movements:

- **Long-distance trips** between North India and Southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end.
- **Medium-distance trips** between northern Tamil Nadu including Chennai and southern Karnataka including Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram.
- **Short-distance trips** between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

18.3 The three southern toll plazas (Etturvattam, Salaipudhar and Nanguneri) on the Asset have been operational since FY12 while the northernmost toll plaza (Kappalur) has been operational since FY11. Cube Mobility Investments Pte. Ltd acquired the concession rights in relation to this asset through its SPV, NKTL in FY21. The following table presents a summary of the concession

Particulars	Details
State	Tamil Nadu
Employer	NHAI
Highway and lane configuration	NH 44 four lane
Toll plazas	Nanguneri
Length (km) as per concession agreement, applicable	63.47 km
Commencement of operations	October 2020
Concession period	30 years
Concession end	FY51

18.4 The pictures of the Asset are shown below

Note: Site visit conducted by EYMBSLLP personnel on 22 December 2022

VII. Procedures Adopted

We have carried out the Enterprise Valuation of the InvIT Assets, in accordance with valuation standards as specified / applicable as per SEBI InvIT Regulations, to the extent applicable.

In connection with this analysis, we have adopted the following procedures to carry out the valuation analysis:

- Requested and received financial and qualitative information relating to the InvIT Assets
- Considered the key terms of Concession Agreements;
- Analysis of the Management Projections;
- Considered the Traffic Study Reports and Technical Reports;
- Discussed with the Investment Manager on: Background of the SPVs– business and fundamental factors that affect its earning-generating capacity and historical and expected financial performance
- Analysis of the key economic and industry factors which may affect the valuation of the SPV; Analysis of the information available in public domain/ subscribed databases in respect of the comparable companies/ comparable transactions, as considered relevant by us;
- Conducted site visits to assess the operating condition of the InvIT Assets as per the requirements of SEBI (InvIT Regulations) 2014 (as amended)
- Selection of valuation approach and valuation methodology/(ies), in accordance with SEBI (InvIT Regulations), as considered appropriate and relevant by us;
- Analysis of other publicly available information, as considered relevant by us; and
- Determination of Enterprise Value of the InvIT Assets as on the Valuation date.

VIII. Valuation Methodology

To determine the value of enterprises, three traditional approaches can be considered:

A. Market approach

The market approach measures value based on what other purchasers in the market have paid for assets that can be considered reasonably similar to those being valued.

B. Income approach

The income approach determines the value of a business based on its ability to generate desired economic benefit for the owners. The key objective of the income-based methods is to determine the business value as a function of the economic benefit.

C. Asset approach

The asset approach seeks to determine the business value based on the value of its assets.

Summary of various methods used / not used in this engagement is as given below:

Valuation Methodology	Used	Remarks
Income Approach		
Discounted Cash Flows method	Yes	DCF method is considered to be one of the most scientific methods of valuation. The individual InvIT Assets have definite concession periods and estimable cash flows for the entire length of the concession. We have therefore relied on the DCF method, using the financial projections provided to us.
Market Approach		
Market Price method	No	Not applicable as none of the SPVs are listed
Price of recent Investment method	No	There has been no recent equity investment in the SPVs by a third party
Comparable Companies' multiples method		
Quoted multiples	No	There are no listed companies comparable to the individual SPVs in terms of concession period, type or region
Transaction multiples	No	There were no recent transactions in comparable assets where sufficient information is available in the public domain.
Cost approach		
Net Asset Value method	No	Does not capture the earning capacity of the business and hence NAV would not be representative of fair value

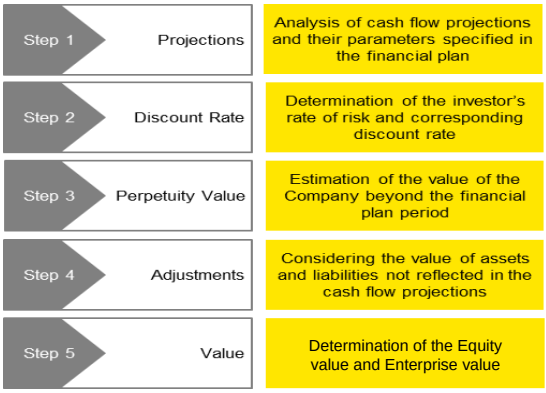
In the case of these SPVs, the Discounted Cash Flow method was considered the most appropriate method for valuation based on the characteristics of the assets being valued (as mentioned above).

Discounted Cash Flow method

Income Based Approach

- Taking into consideration the specifics of the InvIT Assets and the business environment, we have used the discounted cash flow (DCF) method (specifically, the Free Cash Flow to Firm approach) to determine the Enterprise value of the InvIT Assets.
- The profit and loss account forecast covers the remaining concession period of individual InvIT Assets.

DCF Methodology



Calculation of Weighted Average Cost of Capital ("WACC")

Purpose of a discount rate

The application of the income approach requires the determination of an appropriate discount rate at which future cash flows are discounted to their present value as of valuation date.

The discount rate reflects the time value of money and the risk associated with projected future cash flows. It is derived on the basis of the expected return on capital and the price of the best alternative investment. Therefore, the discount rate indicates the minimum required return from the asset being valued if the investor is not to be worse off than he would be if he had invested his money in the next best alternative. The return on this alternative investment must be comparable in terms of dimensions, timing and certainty, with the net cash flows expected to be derived from the subject asset.

To derive the discount rate, the weighted average cost of capital (WACC), which refers to the total capital invested (equity and debt), is used and adjusted for risk premiums or discounts, depending on the asset's specific risk compared to the risk of the overall enterprise. To determine the appropriate WACC it is adequate to consider cost of equity and cost of debt separately.

The derivation of the WACC is based on a group of guideline companies (peer group) which are operating in the same industry/sector as the InvIT Assets (so called "potential acquirers"). To calculate the WACC, cost of equity, cost of debt and the capital structure have to be determined based on market data of the group of "potential acquirers".

Formula for WACC Computation

$$WACC = \frac{E}{E+D} * r_E + \frac{D}{E+D} * r_D * (1 - s)$$

$WACC$	=	Weighted Average Cost of Capital
r_E	=	Cost of Equity
r_D	=	Cost of Debt
E	=	Market Value of Equity
D	=	Market value of interest bearing debt
$E+D$	=	Enterprise Value
s	=	Corporate Tax Rate

Calculation of Cost of equity

For the estimation of the cost of equity, the capital asset pricing model ("CAPM") is applied. According to the CAPM, cost of equity consists of a risk-free interest rate and a risk premium. The risk premium is calculated by multiplying the market risk premium by the beta-factor, a company-specific measure of the systematic risk of an equity investment in a company.

To determine cost of equity, its components risk-free rate and risk premium have to be analyzed.

1. Risk-free rate

The starting point for the calculation of an appropriate equity rate of return is the calculation of the risk-free rate, which corresponds to the minimum return that an investor can expect from an investment "without" risk. This risk-free rate of return is therefore generally derived from the rate of return on a high-quality long-term government bond. The risk-free rate is based on current YTMs of Gilt Bonds with 10-year residual maturity (rounded).

2. Risk premium

i. Market risk premium

According to the CAPM, long-term capital market studies have shown that historically investments in shares have yielded higher returns than investments in low-risk bonds. Market Risk Premium ('MRP') levels of 7% p.a. has been considered based on EYMBSLLP understanding of the expected MRP in India

ii. Beta coefficient

According to the CAPM in arriving at the appropriate risk premium, non-systematic risk, which attaches to the specific enterprise and can therefore generally be eliminated by diversifying, is distinguished from systematic risk. A risk premium will only be required to compensate for systematic risk, which cannot be eliminated by diversification. In practice, systematic risk is measured in terms of the beta coefficient and the market risk premium. The market risk premium is defined as the difference between the expected return on a market portfolio and the risk-free rate. The beta coefficient indicates the risk of the equity of the enterprise that is being valued relative to the average market risk (for stocks), which is represented by the market risk premium. A beta higher than one implies that the systematic risk of the company's stock is higher than the market risk. The risk premium is calculated by multiplying the market risk premium by the enterprise's beta coefficient.

Betas reported in public sources are "leveraged", which means that the additional risk to a stockholder due to the debt financing of the company is incorporated in the corresponding beta coefficient.

We have used the relevered beta (based on a three-year data considering weekly returns) of listed Indian companies that are engaged in primarily in construction and operation of road assets in India.

Formula for Cost of Equity Computation

$$r_E = r_F + b * MRP$$

r_E	=	Cost of equity
r_F	=	Risk-free rate of return
b	=	Beta, a measure of the level of non diversifiable (i.e. systematic) risk associated with company returns
MRP	=	Market equity risk premium

The Summary of WACC computed for each of the InvIT Assets is presented below:

Particulars	Weights	JMTL	MBEL	WUPTL	APEL	NDEPL	FRHL	WVEPL	DATRL	GAEPL
Cost of debt (%)	*50.0*	3.1	3.5	3.3	5.0	3.5	3.3	3.0	2.7	3.7
Cost of equity capital (%)	*50.0*	7.4	7.4	7.3	6.2	7.4	7.3	7.3	7.7	7.3
WACC		**10.5**	**10.8**	**10.7**	**11.2**	**10.8**	**10.6**	**10.3**	**10.4**	**11.0**

Particulars	Weights	HTL	JLTL	JVTL	LRTL	KMTL	MKTL	KETL	SMTL	NKTL
Cost of debt (%)	*50.0*	3.4	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4
Cost of equity capital (%)	*50.0*	7.3	7.2	7.2	7.2	7.3	7.2	7.3	7.3	7.3
WACC		**10.6**	**10.5**	**10.5**	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**

The computed WACC for the InvIT Assets ranges from 10.3% to 11.2%

Detailed WACC Calculation has been provided in Appendix 2

IX. Valuation Assumptions

Key underlying assumptions as provided by the Management are as follows:

- Operating Revenue: Operating revenue for InvIT Assets is projected based on the Traffic Study Reports of independent consultants appointed by Management. The traffic studies were conducted by the independent consultants in April 2022. As informed by the Management there has not been a material change in the traffic trend and operating condition of the roads. Hence, forecasts have been prepared by the Management basis these traffic study reports dated April 2022. APEL is an annuity project with agreed periodical annuities to be received from NHAI. The toll rates for each of the InvIT Assets (except APEL) have been estimated based on forecast of macro-economic factor such as Wholesale Price Index (WPI).

- Routine maintenance: O&M expenses estimated by the Management over the projected period.

- Major Maintenance & Repair Expenses (MMR / Periodic maintenance): Periodic maintenance expenses are costs that are incurred to bring the road asset back to an earlier condition or to keep the road asset operating at its present condition. Similar to O&M expenditure, MMR expenditures have been estimated by the Management over the Concession Period

- Operational Expenditure – Operational expenditure include base operating expenditure, admin expenses, CHTAAPL related expenses, insurance costs, one-time expenses and other miscellaneous expenses. These expenses are estimated by the Management over the Concession Period.

- Depreciation and Amortization: In relation to Build-Operate-Transfer ("BOT") Assets the total project cost and in relation to Toll-Operate-Transfer ("TOT") Assets the concession fee paid to NHAI has been capitalized in the books of the respective SPVs as an intangible asset. The said intangible asset has been amortized on Straight Line Basis over the respective period of concession. Since depreciation and amortization is a non-cash expenditure, it has been added back to arrive at the net cash flows.

- Taxes: Income taxes are estimated considering, as appropriate, brought forward losses, unabsorbed depreciation, MAT credit, tax depreciation/ amortisation policy proposed to be followed by the InvIT Assets and corporate income tax rate of 25.17%/MAT rate of 17.5%.

- Working Capital: Considering the nature of the business of operating toll road projects, the working capital requirement is expected to be Nil for the projected period.

X. Basis and Premise of Valuation

1. Basis of Valuation

Valuation Base means the indication of the type of value being used in an engagement. In the present case, we have determined the fair value of the SPVs at the enterprise level. Fair Value Bases defined as under:

Fair Value

Fair value is the amount for which that an asset could be exchanged between a knowledgeable, willing buyer and a knowledgeable, willing seller in an arm's length transaction as of the date(s) of the valuation.

2. Valuation Date

Valuation Date is the specific date at which the value of the assets to be valued gets estimated or measured. Valuation is time specific and can change with the passage of time inter-alia due to changes in the condition of the asset to be valued and market parameters. Accordingly, valuation of an asset as at a particular date can be different from other date(s).

The Valuation Date considered for the enterprise valuation of the InvIT Assets is 31 October 2022. Our Report does not take account of events or circumstances arising after Valuation Date and we have no responsibility to update the Report for such events or circumstances.

Premise of Value

Premise of Value refers to the conditions and circumstances how an asset is deployed. In the present case, we have determined the fair enterprise value of the SPV on a Going Concern Value defined as under:

Going concern value is the value of a business enterprise that is expected to continue to operate in the future. The intangible elements of going concern value result from factors such as having a trained workforce, an operational plant, the necessary licenses, systems, procedures in place, etc.

XI. Valuation Conclusion

The fair valuation of InvIT Assets as on October 31, 2022 has been carried out basis the Discounted Cash Flow (DCF) method of valuation. We have considered the financial projections of each of the InvIT Assets provided to us by the Management. Free Cash Flow to Firm approach under DCF method has been considered to determine the enterprise value of InvIT Assets. The Enterprise Value has been computed by discounting the free cash flows to the firm (InvIT Assets) from October 31, 2022 until the end of the concession period, using an appropriate Weighted Average Cost of Capital ("WACC").

The Management has appointed independent consultants to carry out traffic study and estimation of toll revenue and technical study for estimation of operating and maintenance expenses and major maintenance expenses, for each of the InvIT Assets over the concession period. We have relied upon Financial Projections, traffic study reports, technical reports provided by independent consultants and other information provided to us for carrying out the valuation of each of the InvIT Assets.

The valuation is based on various assumptions with respect to the InvIT Assets, including their respective present and future financial condition, business strategies and the environment in which they will operate in the future. These assumptions are based on the information that we have been provided with and our discussions with the Management, and reflect current expectations and views regarding future events, and therefore necessarily involve known and unknown risks and uncertainties.

The summary of valuation of each of the InvIT Assets is presented below:

SPV ***Currency: INR mn***	**Enterprise Value**
JMTL	13,493
MBEL	5,860
WUPTL	4,085
APEL	2,361
NDEPL	6,897
FRHL	28,439
WVEPL	8,392
DATRL	71,224
GAEPL	22,224
HTL	17,550
JLTL	11,824
JVTL	7,877
KMTL	15,832
LRTL	11,569
MKTL	14,860
KETL	8,036
SMTL	9,145
NKTL	9,452
Total	**269,120**

Our views are based on the current economic, market, industry, regulatory, monetary and other conditions and on the information made available to us, as of the date of this Report. Such conditions may change significantly over a relatively short period of time and we assume no responsibility and are not required to update, revise or reaffirm our conclusion set out in this letter to reflect events or developments subsequent to the date of the Report.

Building a better working world

Appendices

1. Discounted Cash flow workings for InvIT Assets as at 31 October 2022

1.1 JMTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31	Jul31
Number of months		5	12	12	12	12	12	12	12	12	3
Net sales		**1,149**	**2,647**	**3,059**	**3,240**	**3,571**	**3,957**	**4,344**	**4,766**	**5,190**	**1,446**
Operating expenses		(276)	(651)	(653)	(694)	(720)	(711)	(737)	(1,029)	(1,038)	(121)
EBITDA		**873**	**1,996**	**2,406**	**2,547**	**2,850**	**3,246**	**3,607**	**3,738**	**4,153**	**1,325**
Depreciation and amortisation		(126)	(318)	(368)	(390)	(429)	(476)	(523)	(573)	(624)	(341)
EBIT		**747**	**1,678**	**2,038**	**2,157**	**2,421**	**2,770**	**3,085**	**3,165**	**3,528**	**984**
Tax expense		(99)	(293)	(356)	(377)	(423)	(484)	(539)	(553)	(617)	(287)
Debt free net income		**648**	**1,384**	**1,682**	**1,780**	**1,998**	**2,286**	**2,546**	**2,611**	**2,912**	**697**
Add: Depreciation and amortisation		126	318	368	390	429	476	523	573	624	341
Add: Major Maintenance provision		150	331	290	290	290	290	290	534	534	-
Less: Major Maintenance Expense		(880)	(608)	-	-	-	(768)	(681)	-	(1,069)	-
Debt free cash flow		**44**	**1,427**	**2,340**	**2,460**	**2,717**	**2,283**	**2,677**	**3,719**	**3,002**	**1,038**
Discount rate (%)		10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49	10.49
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.68	0.61	0.55	0.50	0.45	0.41
Present value debt free cash flow		**43**	**1,302**	**1,933**	**1,839**	**1,839**	**1,398**	**1,484**	**1,866**	**1,363**	**427**
Present value for explicit period	13,493										
Enterprise value	**13,493**										

1.2 MBEL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31	Jun31
Number of months		5	12	12	12	12	12	12	12	12	3
Net sales		**548**	**1,220**	**1,395**	**1,548**	**1,707**	**1,897**	**2,084**	**2,284**	**2,486**	**616**
Operating expenses		(206)	(399)	(388)	(415)	(434)	(453)	(452)	(656)	(666)	(79)
EBITDA		**342**	**821**	**1,007**	**1,133**	**1,273**	**1,444**	**1,632**	**1,628**	**1,820**	**538**
Depreciation and amortisation		(64)	(158)	(181)	(201)	(221)	(246)	(270)	(296)	(322)	(166)
EBIT		**278**	**663**	**826**	**932**	**1,052**	**1,199**	**1,362**	**1,332**	**1,498**	**372**
Tax expense		(36)	(116)	(144)	(163)	(184)	(209)	(238)	(233)	(262)	(65)
Debt free net income		**242**	**547**	**682**	**769**	**868**	**989**	**1,124**	**1,099**	**1,236**	**307**
Add: Depreciation and amortisation		64	158	181	201	221	246	270	296	322	166
Add: Provision for major maintenance		96	171	133	133	133	133	133	309	309	-
Less: Major Maintenance Expense		-	(725)	-	-	-	-	(667)	-	(617)	-
Debt free cash flow		**402**	**152**	**996**	**1,103**	**1,223**	**1,368**	**861**	**1,704**	**1,249**	**473**
Discount rate (%)		10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82	10.82
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.60	0.54	0.49	0.44	0.40
Present value debt free cash flow		**394**	**138**	**818**	**818**	**818**	**826**	**469**	**837**	**554**	**189**
Present value for explicit period	5,860										
Enterprise value	**5,860**										

1.3 WUPTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Jun26
Number of months		5	12	12	12	3
Net sales		**675**	**1,751**	**1,938**	**2,156**	**561**
Operating expenses		(201)	(437)	(458)	(460)	(70)
EBITDA		**474**	**1,314**	**1,480**	**1,696**	**491**
Depreciation and amortisation		(174)	(611)	(677)	(753)	(421)
EBIT		**300**	**703**	**804**	**944**	**70**
Tax expense		(52)	(123)	(140)	(165)	(12)
Debt free net income		**248**	**580**	**663**	**779**	**58**
Add: Depreciation and amortisation		174	611	677	753	421
Add: Provision for major maintenance expenses		89	156	156	156	-
Less: Major Maintenance Expense		-	-	-	(624)	-
Debt free cash flow		**511**	**1,347**	**1,496**	**1,063**	**479**
Discount rate (%)		10.68	10.68	10.68	10.68	10.68
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.70
Present value debt free cash flow		**500**	**1,228**	**1,232**	**791**	**334**
Present value for explicit period	4,085					
Enterprise value	**4,085**					

1.4 APEL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Sep26
Number of months		5	12	12	12	6
Net sales		**565**	**1,130**	**1,130**	**1,130**	**565**
Operating expenses		(279)	(398)	(407)	(174)	(97)
EBITDA		**286**	**732**	**724**	**957**	**468**
Depreciation and amortisation		-	-	-	-	-
EBIT		**286**	**732**	**724**	**957**	**468**
Tax expense		-	-	-	-	-
Debt free net income		**286**	**732**	**724**	**957**	**468**
Add: Depreciation and amortisation		-	-	-	-	-
Add: Provision for Major maintenance expenses		252	252	252	-	-
Less: Major Maintenance Expense		-	(494)	(512)	-	-
Debt free cash flow		**537**	**490**	**463**	**957**	**468**
Discount rate (%)		11.15	11.15	11.15	11.15	11.15
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.73	0.66
Present value debt free cash flow		**526**	**445**	**378**	**703**	**309**
Present value for explicit period	2,361					
Enterprise value	**2,361**					

1.5 NDEPL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31	Mar32	Feb33
Number of months		5	12	12	12	12	12	12	12	12	12	10
Net sales		**443**	**1,126**	**1,273**	**1,423**	**1,586**	**1,760**	**1,944**	**2,169**	**2,378**	**2,622**	**2,536**
Operating expenses		(318)	(410)	(442)	(462)	(459)	(479)	(535)	(570)	(593)	(590)	(553)
EBITDA		**125**	**715**	**832**	**960**	**1,126**	**1,280**	**1,408**	**1,599**	**1,784**	**2,032**	**1,983**
Depreciation and amortisation		(83)	(269)	(269)	(269)	(269)	(269)	(269)	(269)	(269)	(269)	(235)
EBIT		**42**	**447**	**563**	**692**	**858**	**1,012**	**1,140**	**1,330**	**1,516**	**1,763**	**1,749**
Tax expense		(4)	(78)	(99)	(121)	(150)	(177)	(199)	(233)	(265)	(308)	(306)
Debt free net income		**38**	**369**	**465**	**571**	**708**	**835**	**940**	**1,098**	**1,251**	**1,455**	**1,443**
Add: Depreciation and amortisation		83	269	269	269	269	269	269	269	269	269	235
Add: Provision for Major Maintenance Expense		245	145	145	145	145	145	169	169	169	169	169
Less: Major Maintenance Expense		-	-	-	-	(504)	(223)	-	-	-	(585)	(258)
Debt free cash flow		**367**	**783**	**879**	**985**	**617**	**1,026**	**1,378**	**1,535**	**1,688**	**1,307**	**1,588**
Discount rate (%)		10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84	10.84
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.60	0.54	0.49	0.44	0.40	0.36
Present value debt free cash flow		**359**	**712**	**721**	**729**	**413**	**619**	**749**	**753**	**747**	**522**	**572**
Present value for explicit period	6,897											
Enterprise value	**6,897**											

1.6 FRHL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**1,019**	**2,563**	**2,841**	**3,169**	**3,467**	**3,803**	**4,186**	**4,610**	**5,066**
Operating expenses		(152)	(596)	(640)	(669)	(698)	(727)	(721)	(751)	(785)
EBITDA		**867**	**1,966**	**2,201**	**2,499**	**2,769**	**3,076**	**3,465**	**3,859**	**4,282**
Depreciation and amortisation		(7)	(336)	(336)	(336)	(336)	(336)	(336)	(336)	(336)
EBIT		**859**	**1,630**	**1,865**	**2,163**	**2,433**	**2,740**	**3,129**	**3,523**	**3,946**
Tax expense		(114)	(285)	(424)	(627)	(425)	(479)	(547)	(616)	(690)
Debt free net income		**745**	**1,345**	**1,440**	**1,536**	**2,007**	**2,261**	**2,582**	**2,907**	**3,256**
Add: Depreciation and amortisation		7	336	336	336	336	336	336	336	336
Less: Additional Capex		-	-	-	-	-	-	-	-	-
Add: Provision for Major Maintenance		74	231	231	231	231	231	231	231	213
Less: Major Maintenance		(56)	-	-	-	-	-	(795)	(819)	-
Debt free cash flow		**771**	**1,912**	**2,007**	**2,103**	**2,574**	**2,828**	**2,354**	**2,655**	**3,806**
Discount rate (%)		10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.75	0.67	0.61	0.55	0.50	0.45
Present value debt free cash flow		**755**	**1,743**	**1,655**	**1,568**	**1,735**	**1,724**	**1,297**	**1,323**	**1,715**
Present value for explicit period	28,439									
Enterprise value	**28,439**									

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41	May41
Number of months	12	12	12	12	12	12	12	12	12	12	1
Net sales	**5,590**	**6,125**	**6,741**	**7,403**	**8,164**	**8,931**	**9,819**	**8,219**	**8,777**	**9,616**	**895**
Operating expenses	(838)	(875)	(915)	(957)	(958)	(1,004)	(1,238)	(1,313)	(1,321)	(1,381)	(93)
EBITDA	**4,752**	**5,250**	**5,826**	**6,446**	**7,206**	**7,927**	**8,581**	**6,906**	**7,456**	**8,235**	**802**
Depreciation and amortisation	(336)	(336)	(336)	(336)	(336)	(336)	(336)	(336)	(336)	(336)	(701)
EBIT	**4,415**	**4,914**	**5,490**	**6,109**	**6,870**	**7,591**	**8,245**	**6,570**	**7,120**	**7,899**	**101**
Tax expense	(772)	(859)	(959)	(1,068)	(1,201)	(1,327)	(1,441)	(1,148)	(1,244)	(1,380)	(18)
Debt free net income	**3,644**	**4,055**	**4,530**	**5,042**	**5,669**	**6,264**	**6,804**	**5,422**	**5,875**	**6,519**	**83**
Add: Depreciation and amortisation	336	336	336	336	336	336	336	336	336	336	701
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-	-
Add: Provision for Major Maintenance	213	213	213	213	213	213	374	374	374	374	-
Less: Major Maintenance	-	-	-	-	(735)	(758)	-	-	(737)	(760)	-
Debt free cash flow	**4,193**	**4,604**	**5,080**	**5,591**	**5,484**	**6,056**	**7,514**	**6,132**	**5,849**	**6,469**	**784**
Discount rate (%)	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59
Present value factor- Mid Year discounting	0.41	0.37	0.33	0.30	0.27	0.25	0.22	0.20	0.18	0.16	0.15
Present value debt free cash flow	**1,709**	**1,697**	**1,692**	**1,684**	**1,494**	**1,492**	**1,674**	**1,235**	**1,065**	**1,065**	**117**

1.7 WVEPL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**312**	**961**	**1,060**	**1,174**	**1,303**	**1,440**	**1,580**	**1,728**
Operating expenses		(237)	(287)	(309)	(324)	(339)	(354)	(351)	(366)
EBITDA		**75**	**674**	**750**	**850**	**964**	**1,087**	**1,229**	**1,362**
Depreciation and amortisation		(75)	(221)	(221)	(221)	(221)	(221)	(221)	(221)
EBIT		**0**	**453**	**529**	**629**	**743**	**866**	**1,008**	**1,141**
Tax expense		(24)	(79)	(93)	(110)	(130)	(151)	(176)	(199)
Debt free net income		**(23)**	**374**	**437**	**519**	**613**	**714**	**832**	**942**
Add: Depreciation and amortisation		75	221	221	221	221	221	221	221
Add Provision for Major maintenance		184	98	98	98	98	98	98	98
Less: Major maintenance outflow		(163)	-	-	-	-	-	(336)	(346)
Debt free cash flow		**72**	**692**	**755**	**838**	**932**	**1,033**	**814**	**914**
Discount rate (%)		10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.68	0.62	0.56	0.51
Present value debt free cash flow		**71**	**632**	**626**	**629**	**634**	**637**	**455**	**463**
Present value for explicit period	8,392								
Enterprise value	**8,392**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Aug37
Number of months	12	12	12	12	12	12	12	5
Net sales	**1,894**	**2,090**	**2,278**	**2,506**	**2,762**	**3,034**	**3,311**	**1,361**
Operating expenses	(426)	(452)	(470)	(490)	(511)	(511)	(533)	(164)
EBITDA	**1,468**	**1,637**	**1,808**	**2,017**	**2,251**	**2,523**	**2,779**	**1,197**
Depreciation and amortisation	(221)	(221)	(221)	(221)	(221)	(221)	(221)	(525)
EBIT	**1,247**	**1,416**	**1,587**	**1,796**	**2,030**	**2,302**	**2,558**	**672**
Tax expense	(218)	(248)	(277)	(314)	(524)	(578)	(648)	(200)
Debt free net income	**1,029**	**1,169**	**1,309**	**1,482**	**1,506**	**1,724**	**1,909**	**472**
Add: Depreciation and amortisation	221	221	221	221	221	221	221	525
Add Provision for Major maintenance	132	132	132	132	132	132	132	-
Less: Major maintenance outflow	-	-	-	-	-	(456)	(470)	-
Debt free cash flow	**1,382**	**1,522**	**1,663**	**1,835**	**1,859**	**1,621**	**1,793**	**997**
Discount rate (%)	10.33	10.33	10.33	10.33	10.33	10.33	10.33	10.33
Present value factor- Mid Year discounting	0.46	0.42	0.38	0.34	0.31	0.28	0.25	0.24
Present value debt free cash flow	**635**	**633**	**627**	**627**	**576**	**455**	**456**	**237**

1.8 DATRL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**2,947**	**6,377**	**6,887**	**7,546**	**8,338**	**9,336**	**10,323**	**11,431**	**12,708**
Operating expenses		(3,419)	(1,123)	(1,212)	(1,269)	(1,326)	(1,383)	(1,361)	(1,419)	(1,656)
EBITDA		**(471)**	**5,255**	**5,675**	**6,277**	**7,012**	**7,954**	**8,962**	**10,012**	**11,053**
Depreciation and amortisation		(486)	(1,280)	(1,279)	(1,279)	(1,279)	(1,280)	(1,279)	(1,279)	(1,279)
EBIT		**(957)**	**3,975**	**4,396**	**4,998**	**5,733**	**6,674**	**7,683**	**8,733**	**9,774**
Tax expense		(71)	(695)	(1,199)	(1,865)	(2,122)	(2,451)	(1,686)	(1,941)	(2,579)
Debt free net income		**(1,028)**	**3,280**	**3,197**	**3,133**	**3,611**	**4,223**	**5,997**	**6,793**	**7,194**
Add: Depreciation and amortisation		486	1,280	1,279	1,279	1,279	1,280	1,279	1,279	1,279
Add: Provision for Major maintenance		2,938	336	336	336	336	336	336	336	469
Less: Payment to seller		(2,590)	-	-	-	-	-	-	-	-
Less: Additional Capex		-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense		(481)	-	-	-	-	-	(1,323)	(1,362)	-
Debt free cash flow		**(674)**	**4,896**	**4,812**	**4,748**	**5,226**	**5,839**	**6,289**	**7,045**	**8,943**
Discount rate (%)		10.39	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.68	0.61	0.56	0.50	0.46
Present value debt free cash flow		**(661)**	**4,471**	**3,981**	**3,558**	**3,547**	**3,590**	**3,503**	**3,554**	**4,087**
Present value for explicit period	71,224									
Enterprise value	**71,224**									

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41	May41
Number of months	12	12	12	12	12	12	12	12	12	12	2
Net sales	**14,122**	**15,605**	**17,277**	**19,085**	**21,201**	**23,372**	**25,837**	**28,478**	**31,547**	**34,674**	**5,174**
Operating expenses	(1,773)	(1,853)	(1,939)	(2,030)	(2,031)	(2,132)	(1,825)	(1,996)	(2,127)	(2,264)	(327)
EBITDA	**12,348**	**13,752**	**15,338**	**17,055**	**19,170**	**21,239**	**24,012**	**26,481**	**29,419**	**32,410**	**4,848**
Depreciation and amortisation	(1,280)	(1,279)	(1,279)	(1,279)	(1,280)	(1,279)	(1,279)	(1,279)	(1,280)	(1,279)	(2,025)
EBIT	**11,068**	**12,473**	**14,059**	**15,776**	**17,890**	**19,960**	**22,733**	**25,202**	**28,139**	**31,131**	**2,823**
Tax expense	(2,905)	(3,259)	(3,658)	(4,090)	(4,215)	(4,723)	(5,723)	(6,344)	(7,084)	(7,836)	(712)
Debt free net income	**8,163**	**9,215**	**10,401**	**11,686**	**13,675**	**15,237**	**17,010**	**18,858**	**21,056**	**23,295**	**2,111**
Add: Depreciation and amortisation	1,280	1,279	1,279	1,279	1,280	1,279	1,279	1,279	1,280	1,279	2,025
Add: Provision for Major maintenance	469	469	469	469	469	469	-	-	-	-	-
Less: Payment to seller	-	-	-	-	-	-	-	-	-	-	-
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	(1,618)	(1,668)	-	-	-	-	-
Debt free cash flow	**9,913**	**10,963**	**12,150**	**13,435**	**13,806**	**15,318**	**18,289**	**20,137**	**22,336**	**24,574**	**4,136**
Discount rate (%)	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40	10.40
Present value factor- Mid Year discounting	0.41	0.37	0.34	0.31	0.28	0.25	0.23	0.21	0.19	0.17	0.15
Present value debt free cash flow	**4,103**	**4,111**	**4,126**	**4,133**	**3,847**	**3,867**	**4,182**	**4,171**	**4,190**	**4,176**	**637**

1.9 GAEPL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**1,147**	**2,890**	**3,231**	**3,545**	**3,871**	**4,266**	**4,665**	**5,114**
Operating expenses		(221)	(517)	(604)	(636)	(669)	(701)	(682)	(716)
EBITDA		**925**	**2,373**	**2,627**	**2,909**	**3,203**	**3,565**	**3,983**	**4,398**
Depreciation and amortisation		(85)	(587)	(656)	(720)	(786)	(866)	(947)	(1,038)
EBIT		**840**	**1,787**	**1,971**	**2,189**	**2,417**	**2,699**	**3,036**	**3,360**
Tax expense		(147)	(312)	(344)	(383)	(422)	(472)	(530)	(587)
Debt free net income		**693**	**1,475**	**1,627**	**1,807**	**1,995**	**2,228**	**2,505**	**2,773**
Add: Depreciation and amortisation		85	587	656	720	786	866	947	1,038
Add: Provision for major maintenance		128	128	128	128	128	128	128	128
Less: Initial capex			(862)						
Less: Additional Capex		(3,969)	(2,808)	-	-	-	-	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	(994)	(1,024)
Debt free cash flow		**(3,063)**	**(1,482)**	**2,410**	**2,654**	**2,908**	**3,221**	**2,586**	**2,915**
Discount rate (%)		11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.66	0.60	0.54	0.49
Present value debt free cash flow		**(2,997)**	**(1,347)**	**1,973**	**1,957**	**1,932**	**1,927**	**1,394**	**1,416**
Present value for explicit period	22,224								
Enterprise value	**22,224**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Jun39
Number of months	12	12	12	12	12	12	12	12	12	3
Net sales	**5,610**	**6,143**	**6,708**	**7,339**	**8,022**	**8,799**	**9,579**	**10,457**	**11,437**	**2,764**
Operating expenses	(1,006)	(1,072)	(1,112)	(1,156)	(1,202)	(1,187)	(1,236)	(969)	(1,062)	(248)
EBITDA	**4,604**	**5,071**	**5,596**	**6,183**	**6,820**	**7,612**	**8,342**	**9,488**	**10,375**	**2,515**
Depreciation and amortisation	(1,139)	(1,247)	(1,361)	(1,489)	(1,628)	(1,786)	(1,944)	(2,122)	(2,321)	(801)
EBIT	**3,465**	**3,824**	**4,234**	**4,693**	**5,192**	**5,826**	**6,398**	**7,366**	**8,054**	**1,714**
Tax expense	(605)	(668)	(740)	(820)	(907)	(1,018)	(1,118)	(1,287)	(1,407)	(679)
Debt free net income	**2,860**	**3,156**	**3,494**	**3,873**	**4,285**	**4,808**	**5,280**	**6,079**	**6,647**	**1,035**
Add: Depreciation and amortisation	1,139	1,247	1,361	1,489	1,628	1,786	1,944	2,122	2,321	801
Add: Provision for major maintenance	355	355	355	355	355	355	355	-	-	-
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	-	(1,223)	(1,261)	-	-	-
Debt free cash flow	**4,353**	**4,758**	**5,211**	**5,718**	**6,268**	**5,725**	**6,318**	**8,201**	**8,968**	**1,836**
Discount rate (%)	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01	11.01
Present value factor- Mid Year discounting	0.44	0.39	0.36	0.32	0.29	0.26	0.23	0.21	0.19	0.17
Present value debt free cash flow	**1,904**	**1,875**	**1,850**	**1,828**	**1,806**	**1,486**	**1,477**	**1,727**	**1,701**	**314**

Building a better working world

1.10 HTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**440**	**1,063**	**1,182**	**1,318**	**1,475**	**1,637**	**1,808**	**2,008**	**2,224**
Operating expenses		(59)	(114)	(124)	(134)	(144)	(154)	(741)	(732)	(750)
EBITDA		**381**	**949**	**1,058**	**1,184**	**1,331**	**1,483**	**1,068**	**1,276**	**1,474**
Depreciation and amortisation		(137)	(337)	(337)	(337)	(337)	(337)	(391)	(345)	(345)
EBIT		**244**	**612**	**722**	**847**	**994**	**1,146**	**676**	**931**	**1,130**
Tax expense		-	-	-	-	-	-	(214)	(298)	(164)
Debt free net income		**244**	**612**	**722**	**847**	**994**	**1,146**	**462**	**633**	**966**
Add: Depreciation and amortisation		137	337	337	337	337	337	391	345	345
Add: Provision for major maintenance		-	-	-	-	-	-	438	438	438
Less: Initial capex		(593)								
Less: Additional Capex		-	-	-	-	-	-	(221)	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	-	(257)	(1,057)
Debt free cash flow		**(212)**	**949**	**1,058**	**1,184**	**1,331**	**1,483**	**1,070**	**1,159**	**692**
Discount rate (%)		10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.61	0.55	0.50	0.45
Present value debt free cash flow		**(207)**	**865**	**872**	**882**	**896**	**902**	**588**	**576**	**311**
Present value for explicit period	17,550									
Enterprise value	**17,550**									

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41
Number of months	12	12	12	12	12	12	12	12	12	12
Net sales	**2,466**	**2,718**	**2,998**	**3,320**	**3,657**	**4,043**	**3,340**	**3,522**	**3,723**	**6,039**
Operating expenses	(496)	(531)	(552)	(576)	(600)	(627)	(601)	(625)	(651)	(769)
EBITDA	**1,969**	**2,187**	**2,445**	**2,744**	**3,057**	**3,417**	**2,738**	**2,896**	**3,072**	**5,269**
Depreciation and amortisation	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(345)
EBIT	**1,625**	**1,843**	**2,101**	**2,399**	**2,712**	**3,072**	**2,394**	**2,552**	**2,727**	**4,925**
Tax expense	(495)	(560)	(632)	(713)	(796)	(889)	(721)	(762)	(808)	(1,362)
Debt free net income	**1,129**	**1,283**	**1,469**	**1,687**	**1,917**	**2,183**	**1,673**	**1,790**	**1,920**	**3,563**
Add: Depreciation and amortisation	345	345	345	345	345	345	345	345	345	345
Add: Provision for major maintenance	152	152	152	152	152	152	152	152	152	152
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	-	-	-	-	-	-
Debt free cash flow	**1,626**	**1,779**	**1,965**	**2,183**	**2,413**	**2,679**	**2,169**	**2,286**	**2,416**	**4,059**
Discount rate (%)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting	0.41	0.37	0.33	0.30	0.27	0.24	0.22	0.20	0.18	0.16
Present value debt free cash flow	**660**	**653**	**652**	**655**	**654**	**656**	**480**	**457**	**437**	**664**

Currency: ₹ mn	Mar42	Mar43	Mar44	Mar45	Mar46	Mar47	Mar48	Mar49	Mar50	Oct50
Number of months	12	12	12	12	12	12	12	12	12	7
Net sales	**6,622**	**7,292**	**8,028**	**8,788**	**9,668**	**10,603**	**11,662**	**12,767**	**13,953**	**8,437**
Operating expenses	(806)	(845)	(888)	(903)	(1,380)	(1,461)	(1,517)	(1,576)	(1,570)	(616)
EBITDA	**5,816**	**6,446**	**7,141**	**7,885**	**8,289**	**9,142**	**10,145**	**11,191**	**12,384**	**7,821**
Depreciation and amortisation	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(345)	(328)
EBIT	**5,471**	**6,102**	**6,796**	**7,540**	**7,944**	**8,798**	**9,800**	**10,847**	**12,039**	**7,493**
Tax expense	(1,500)	(1,659)	(1,834)	(1,487)	(2,225)	(2,440)	(2,692)	(2,956)	(2,561)	(1,968)
Debt free net income	**3,971**	**4,442**	**4,961**	**6,053**	**5,719**	**6,358**	**7,108**	**7,891**	**9,478**	**5,525**
Add: Depreciation and amortisation	345	345	345	345	345	345	345	345	345	328
Add: Provision for major maintenance	152	152	152	152	552	552	552	552	552	-
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	(2,126)	-	-	-	-	(2,759)	-
Debt free cash flow	**4,468**	**4,939**	**5,458**	**4,424**	**6,616**	**7,254**	**8,004**	**8,788**	**7,615**	**5,853**
Discount rate (%)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06
Present value debt free cash flow	**660**	**660**	**659**	**483**	**653**	**647**	**645**	**640**	**501**	**348**

1.11 JLTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**313**	**872**	**962**	**1,072**	**1,193**	**1,325**	**1,465**	**1,621**	**1,796**
Operating expenses		(48)	(95)	(103)	(111)	(120)	(489)	(502)	(496)	(325)
EBITDA		**265**	**777**	**859**	**961**	**1,073**	**835**	**963**	**1,125**	**1,471**
Depreciation and amortisation		(79)	(199)	(199)	(199)	(199)	(208)	(201)	(201)	(201)
EBIT		**186**	**578**	**660**	**762**	**874**	**627**	**762**	**924**	**1,270**
Tax expense		-	-	-	(130)	(201)	(225)	(270)	(117)	(367)
Debt free net income		**186**	**578**	**660**	**632**	**673**	**403**	**492**	**808**	**904**
Add: Depreciation and amortisation		79	199	199	199	199	208	201	201	201
Less: Additional capex		-	-	-	-	-	(35)	-	-	-
Less: Initial Capex		(207)								
Add: Provision for major maintenance		-	-	-	-	-	271	271	271	76
Less: Major Maintenance Expense		-	-	-	-	-	-	-	(812)	-
Debt free cash flow		**58**	**777**	**859**	**831**	**872**	**846**	**963**	**467**	**1,180**
Discount rate (%)		10.55	10.55	10.55	10.55	10.55	10.55	10.55	10.55	10.55
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.68	0.61	0.55	0.50	0.45
Present value debt free cash flow		**56**	**709**	**709**	**620**	**589**	**517**	**532**	**233**	**534**
Present value for explicit period	11,824									
Enterprise value	**11,824**									

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40
Number of months	12	12	12	12	12	12	12	12	12
Net sales	**1,984**	**2,180**	**2,404**	**2,650**	**2,932**	**3,226**	**3,548**	**3,905**	**4,306**
Operating expenses	(350)	(365)	(382)	(400)	(419)	(415)	(470)	(505)	(530)
EBITDA	**1,634**	**1,814**	**2,022**	**2,250**	**2,513**	**2,811**	**3,078**	**3,399**	**3,776**
Depreciation and amortisation	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)
EBIT	**1,434**	**1,614**	**1,821**	**2,049**	**2,312**	**2,610**	**2,877**	**3,199**	**3,575**
Tax expense	(414)	(463)	(519)	(578)	(646)	(589)	(796)	(878)	(973)
Debt free net income	**1,020**	**1,151**	**1,303**	**1,471**	**1,666**	**2,022**	**2,081**	**2,321**	**2,602**
Add: Depreciation and amortisation	201	201	201	201	201	201	201	201	201
Less: Additional capex	-	-	-	-	-	-	-	-	-
Less: Initial Capex									
Add: Provision for major maintenance	76	76	76	76	76	76	98	98	98
Less: Major Maintenance Expense	-	-	-	-	-	(532)	-	-	-
Debt free cash flow	**1,297**	**1,427**	**1,579**	**1,747**	**1,943**	**1,766**	**2,379**	**2,619**	**2,900**
Discount rate (%)	10.55	10.55	10.55	10.55	10.55	10.55	10.55	10.55	10.55
Present value factor- Mid Year discounting	0.41	0.37	0.33	0.30	0.27	0.25	0.22	0.20	0.18
Present value debt free cash flow	**530**	**528**	**528**	**529**	**532**	**437**	**533**	**531**	**532**

Currency: ₹ mn	Mar41	Mar42	Mar43	Mar44	Mar45	Oct45
Number of months	12	12	12	12	12	5
Net sales	**4,723**	**5,180**	**5,696**	**6,277**	**5,162**	**3,120**
Operating expenses	(555)	(583)	(612)	(644)	(584)	(285)
EBITDA	**4,167**	**4,598**	**5,083**	**5,633**	**4,578**	**2,836**
Depreciation and amortisation	(201)	(201)	(201)	(201)	(201)	(191)
EBIT	**3,967**	**4,397**	**4,883**	**5,432**	**4,377**	**2,645**
Tax expense	(1,072)	(1,181)	(1,304)	(1,442)	(979)	(712)
Debt free net income	**2,894**	**3,216**	**3,579**	**3,990**	**3,398**	**1,932**
Add: Depreciation and amortisation	201	201	201	201	201	191
Less: Additional capex	-	-	-	-	-	-
Less: Initial Capex						
Add: Provision for major maintenance	98	98	98	98	98	-
Less: Major Maintenance Expense	-	-	-	-	(784)	-
Debt free cash flow	**3,193**	**3,514**	**3,878**	**4,289**	**2,913**	**2,123**
Discount rate (%)	10.55	10.55	10.55	10.55	10.55	10.55
Present value factor- Mid Year discounting	0.17	0.15	0.14	0.12	0.11	0.10
Present value debt free cash flow	**529**	**527**	**526**	**526**	**323**	**213**

1.12 JVTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**218**	**615**	**675**	**754**	**841**	**932**	**1,029**	**1,141**
Operating expenses		(40)	(82)	(89)	(96)	(103)	(428)	(423)	(435)
EBITDA		**179**	**533**	**586**	**658**	**738**	**505**	**605**	**706**
Depreciation and amortisation		(49)	(125)	(125)	(125)	(125)	(135)	(126)	(126)
EBIT		**130**	**408**	**461**	**533**	**613**	**370**	**479**	**579**
Tax expense		-	-	(28)	(107)	(142)	(151)	(133)	(92)
Debt free net income		**130**	**408**	**433**	**426**	**471**	**219**	**346**	**488**
Add: Depreciation and amortisation		49	125	125	125	125	135	126	126
Less: Initial capex		(324)							
Less: Additional Capex		-	-	-	-	-	(39)	-	-
Add: Provision for major maintenance		-	-	-	-	-	235	235	235
Less: Major Maintenance Expense		-	-	-	-	-	-	(207)	(498)
Debt free cash flow		**(145)**	**533**	**558**	**551**	**596**	**549**	**500**	**351**
Discount rate (%)		10.53	10.53	10.53	10.53	10.53	10.53	10.53	10.53
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.68	0.61	0.55	0.50
Present value debt free cash flow		**(142)**	**486**	**460**	**411**	**402**	**336**	**276**	**176**
Present value for explicit period	7,877								
Enterprise value	**7,877**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39
Number of months	12	12	12	12	12	12	12	12	12
Net sales	**1,261**	**1,393**	**1,529**	**1,688**	**1,861**	**2,055**	**2,262**	**2,487**	**2,733**
Operating expenses	(285)	(306)	(319)	(334)	(349)	(366)	(363)	(411)	(440)
EBITDA	**976**	**1,087**	**1,209**	**1,354**	**1,512**	**1,689**	**1,898**	**2,077**	**2,293**
Depreciation and amortisation	(126)	(126)	(126)	(126)	(126)	(126)	(126)	(126)	(126)
EBIT	**850**	**960**	**1,083**	**1,227**	**1,385**	**1,563**	**1,772**	**1,950**	**2,166**
Tax expense	(247)	(279)	(313)	(351)	(392)	(438)	(377)	(542)	(597)
Debt free net income	**602**	**681**	**770**	**876**	**993**	**1,124**	**1,395**	**1,408**	**1,569**
Add: Depreciation and amortisation	126	126	126	126	126	126	126	126	126
Less: Initial capex									
Less: Additional Capex	-	-	-	-	-	-	-	-	-
Add: Provision for major maintenance	65	65	65	65	65	65	65	85	85
Less: Major Maintenance Expense	-	-	-	-	-	-	(457)	-	-
Debt free cash flow	**794**	**873**	**962**	**1,068**	**1,185**	**1,316**	**1,130**	**1,619**	**1,781**
Discount rate (%)	10.53	10.53	10.53	10.53	10.53	10.53	10.53	10.53	10.53
Present value factor- Mid Year discounting	0.45	0.41	0.37	0.34	0.30	0.27	0.25	0.22	0.20
Present value debt free cash flow	**359**	**357**	**356**	**358**	**359**	**361**	**280**	**364**	**362**

Currency: ₹ mn	Mar40	Mar41	Mar42	Mar43	Mar44	Mar45	Oct45
Number of months	12	12	12	12	12	12	7
Net sales	**3,018**	**3,309**	**3,636**	**3,994**	**4,405**	**4,818**	**2,915**
Operating expenses	(461)	(483)	(507)	(532)	(559)	(562)	(286)
EBITDA	**2,556**	**2,826**	**3,129**	**3,462**	**3,846**	**4,256**	**2,629**
Depreciation and amortisation	(126)	(126)	(126)	(126)	(126)	(126)	(118)
EBIT	**2,430**	**2,700**	**3,003**	**3,336**	**3,720**	**4,130**	**2,511**
Tax expense	(664)	(732)	(809)	(893)	(989)	(921)	(661)
Debt free net income	**1,766**	**1,968**	**2,194**	**2,443**	**2,730**	**3,209**	**1,850**
Add: Depreciation and amortisation	126	126	126	126	126	126	118
Less: Initial capex							
Less: Additional Capex	-	-	-	-	-	-	-
Add: Provision for major maintenance	85	85	85	85	85	85	-
Less: Major Maintenance Expense	-	-	-	-	-	(681)	-
Debt free cash flow	**1,977**	**2,179**	**2,406**	**2,655**	**2,942**	**2,740**	**1,968**
Discount rate (%)	10.53	10.53	10.53	10.53	10.53	10.53	10.53
Present value factor- Mid Year discounting	0.18	0.17	0.15	0.14	0.12	0.11	0.10
Present value debt free cash flow	**363**	**362**	**362**	**361**	**362**	**305**	**198**

1.13 KMTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**487**	**1,199**	**1,329**	**1,490**	**1,657**	**1,842**	**2,031**	**2,248**
Operating expenses		(226)	(368)	(386)	(405)	(423)	(442)	(436)	(567)
EBITDA		**261**	**831**	**944**	**1,086**	**1,234**	**1,400**	**1,595**	**1,681**
Depreciation and amortisation		(147)	(346)	(346)	(346)	(346)	(346)	(346)	(346)
EBIT		**113**	**485**	**597**	**740**	**888**	**1,054**	**1,249**	**1,335**
Tax expense		-	-	-	-	-	(239)	(124)	(425)
Debt free net income		**113**	**485**	**597**	**740**	**888**	**815**	**1,125**	**910**
Add: Depreciation and amortisation		147	346	346	346	346	346	346	346
Less: Initial capex		(62)							
Less: Additional Capex		-	-	-	-	-	-	-	-
Add: Provision for major maintenance		117	117	117	117	117	117	117	217
Less: Major Maintenance Expense		-	-	-	-	-	-	(939)	-
Debt free cash flow		**316**	**949**	**1,061**	**1,203**	**1,351**	**1,278**	**649**	**1,473**
Discount rate (%)		10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.75	0.67	0.61	0.55	0.50
Present value debt free cash flow		**310**	**865**	**875**	**897**	**911**	**779**	**358**	**734**
Present value for explicit period	15,832								
Enterprise value	**15,832**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39
Number of months	12	12	12	12	12	12	12	12	12
Net sales	**2,482**	**2,758**	**3,022**	**3,340**	**3,689**	**4,064**	**4,474**	**4,917**	**4,071**
Operating expenses	(601)	(623)	(646)	(671)	(698)	(695)	(831)	(879)	(854)
EBITDA	**1,881**	**2,135**	**2,376**	**2,669**	**2,991**	**3,370**	**3,643**	**4,038**	**3,217**
Depreciation and amortisation	(346)	(346)	(346)	(346)	(346)	(346)	(346)	(346)	(346)
EBIT	**1,534**	**1,788**	**2,030**	**2,322**	**2,645**	**3,023**	**3,297**	**3,692**	**2,871**
Tax expense	(488)	(562)	(630)	(710)	(795)	(511)	(988)	(1,089)	(884)
Debt free net income	**1,046**	**1,226**	**1,399**	**1,613**	**1,850**	**2,512**	**2,309**	**2,603**	**1,987**
Add: Depreciation and amortisation	346	346	346	346	346	346	346	346	346
Less: Initial capex									
Less: Additional Capex	-	-	-	-	-	-	-	-	-
Add: Provision for major maintenance	217	217	217	217	217	217	309	309	309
Less: Major Maintenance Expense	-	-	-	-	-	(1,518)	-	-	-
Debt free cash flow	**1,609**	**1,789**	**1,962**	**2,176**	**2,413**	**1,557**	**2,964**	**3,257**	**2,642**
Discount rate (%)	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59	10.59
Present value factor- Mid Year discounting	0.45	0.41	0.37	0.33	0.30	0.27	0.25	0.22	0.20
Present value debt free cash flow	**725**	**729**	**723**	**725**	**727**	**424**	**731**	**726**	**532**

Currency: ₹ mn	Mar40	Mar41	Mar42	Mar43	Mar44	Mar45	Oct45
Number of months	12	12	12	12	12	12	7
Net sales	**4,298**	**4,510**	**7,199**	**7,996**	**8,814**	**9,657**	**5,835**
Operating expenses	(883)	(913)	(1,050)	(1,096)	(1,144)	(1,165)	(517)
EBITDA	**3,414**	**3,597**	**6,149**	**6,900**	**7,670**	**8,492**	**5,318**
Depreciation and amortisation	(346)	(346)	(346)	(346)	(346)	(346)	(312)
EBIT	**3,068**	**3,251**	**5,802**	**6,554**	**7,323**	**8,146**	**5,006**
Tax expense	(934)	(981)	(1,624)	(1,814)	(2,008)	(1,515)	(1,336)
Debt free net income	**2,134**	**2,270**	**4,179**	**4,741**	**5,316**	**6,631**	**3,669**
Add: Depreciation and amortisation	346	346	346	346	346	346	312
Less: Initial capex							
Less: Additional Capex	-	-	-	-	-	-	-
Add: Provision for major maintenance	309	309	309	309	309	309	-
Less: Major Maintenance Expense	-	-	-	-	-	(2,778)	-
Debt free cash flow	**2,789**	**2,925**	**4,833**	**5,395**	**5,971**	**4,507**	**3,982**
Discount rate (%)	10.59	10.59	10.59	10.59	10.59	10.59	10.59
Present value factor- Mid Year discounting	0.18	0.16	0.15	0.13	0.12	0.11	0.10
Present value debt free cash flow	**508**	**482**	**720**	**727**	**728**	**497**	**397**

1.14 LRTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**401**	**852**	**948**	**1,074**	**1,199**	**1,338**	**1,481**	**1,654**
Operating expenses		(56)	(108)	(117)	(127)	(137)	(146)	(156)	(752)
EBITDA		**345**	**744**	**831**	**947**	**1,062**	**1,191**	**1,324**	**902**
Depreciation and amortisation		(87)	(207)	(207)	(207)	(207)	(207)	(207)	(364)
EBIT		**258**	**537**	**624**	**740**	**855**	**984**	**1,117**	**538**
Tax expense		-	-	-	(69)	(194)	(245)	(292)	(279)
Debt free net income		**258**	**537**	**624**	**670**	**662**	**740**	**825**	**259**
Add: Depreciation and amortisation		87	207	207	207	207	207	207	364
Less: Initial capex		(387)							
Less: Additional Capex		-	-	-	-	-	-	-	(463)
Add: Provision for major maintenance		-	-	-	-	-	-	-	445
Less: Major Maintenance Expense		-	-	-	-	-	-	-	-
Debt free cash flow		**(42)**	**744**	**831**	**877**	**869**	**947**	**1,032**	**605**
Discount rate (%)		10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
Present value factor- Mid Year discounting		0.98	0.91	0.83	0.75	0.67	0.61	0.55	0.50
Present value debt free cash flow		**(41)**	**678**	**686**	**655**	**586**	**578**	**570**	**302**
Present value for explicit period	11,569								
Enterprise value	**11,569**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39
Number of months	12	12	12	12	12	12	12	12	12
Net sales	**1,829**	**2,043**	**2,247**	**2,497**	**2,766**	**3,067**	**3,404**	**2,831**	**3,000**
Operating expenses	(745)	(763)	(510)	(544)	(566)	(590)	(615)	(595)	(619)
EBITDA	**1,084**	**1,280**	**1,736**	**1,953**	**2,200**	**2,477**	**2,789**	**2,236**	**2,381**
Depreciation and amortisation	(227)	(227)	(227)	(227)	(227)	(227)	(227)	(227)	(227)
EBIT	**857**	**1,053**	**1,510**	**1,727**	**1,973**	**2,250**	**2,562**	**2,009**	**2,154**
Tax expense	(274)	(130)	(452)	(513)	(580)	(653)	(735)	(597)	(636)
Debt free net income	**583**	**923**	**1,057**	**1,213**	**1,393**	**1,597**	**1,827**	**1,412**	**1,519**
Add: Depreciation and amortisation	227	227	227	227	227	227	227	227	227
Less: Initial capex									
Less: Additional Capex	-	-	-	-	-	-	-	-	-
Add: Provision for major maintenance	445	445	161	161	161	161	161	161	161
Less: Major Maintenance Expense	(261)	(1,074)	-	-	-	-	-	-	-
Debt free cash flow	**994**	**520**	**1,445**	**1,601**	**1,781**	**1,984**	**2,215**	**1,799**	**1,906**
Discount rate (%)	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
Present value factor- Mid Year discounting	0.45	0.41	0.37	0.33	0.30	0.27	0.25	0.22	0.20
Present value debt free cash flow	**449**	**213**	**534**	**535**	**539**	**543**	**548**	**403**	**386**

Currency: ₹ mn	Mar40	Mar41	Mar42	Mar43	Mar44	Mar45	Oct45
Number of months	12	12	12	12	12	12	7
Net sales	**3,186**	**5,211**	**5,746**	**6,335**	**7,022**	**7,766**	**4,734**
Operating expenses	(644)	(752)	(788)	(825)	(866)	(884)	(438)
EBITDA	**2,543**	**4,458**	**4,958**	**5,510**	**6,156**	**6,882**	**4,296**
Depreciation and amortisation	(227)	(227)	(227)	(227)	(227)	(227)	(201)
EBIT	**2,316**	**4,232**	**4,732**	**5,283**	**5,929**	**6,655**	**4,095**
Tax expense	(677)	(1,160)	(1,287)	(1,426)	(1,589)	(1,245)	(1,079)
Debt free net income	**1,638**	**3,071**	**3,445**	**3,857**	**4,340**	**5,410**	**3,016**
Add: Depreciation and amortisation	227	227	227	227	227	227	201
Less: Initial capex							
Less: Additional Capex	-	-	-	-	-	-	-
Add: Provision for major maintenance	161	161	161	161	161	161	-
Less: Major Maintenance Expense	-	-	-	-	-	(2,093)	-
Debt free cash flow	**2,026**	**3,459**	**3,833**	**4,245**	**4,728**	**3,705**	**3,217**
Discount rate (%)	10.56	10.56	10.56	10.56	10.56	10.56	10.56
Present value factor- Mid Year discounting	0.18	0.17	0.15	0.14	0.12	0.11	0.10
Present value debt free cash flow	**371**	**573**	**574**	**575**	**579**	**411**	**323**

1.15 MKTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**413**	**1,089**	**1,213**	**1,358**	**1,499**	**1,253**	**1,321**	**1,395**
Operating expenses		(165)	(281)	(296)	(312)	(327)	(318)	(331)	(345)
EBITDA		**247**	**807**	**917**	**1,046**	**1,172**	**935**	**989**	**1,050**
Depreciation and amortisation		(121)	(312)	(312)	(312)	(312)	(312)	(312)	(312)
EBIT		**126**	**496**	**605**	**735**	**860**	**623**	**678**	**738**
Tax expense		-	-	-	-	-	(155)	(207)	(238)
Debt free net income		**126**	**496**	**605**	**735**	**860**	**468**	**470**	**500**
Add: Depreciation and amortisation		121	312	312	312	312	312	312	312
Add: Provision for major maintenance		79	79	79	79	79	79	79	79
Less: Initial capex		(225)							
Less: Additional Capex		-	-	-	-	-	-	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	-	-
Debt free cash flow		**102**	**887**	**996**	**1,126**	**1,251**	**859**	**862**	**891**
Discount rate (%)		10.58	10.58	10.58	10.58	10.58	10.58	10.58	10.58
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.75	0.67	0.61	0.55	0.50
Present value debt free cash flow		**100**	**809**	**822**	**839**	**844**	**524**	**475**	**445**
Present value for explicit period	14,860								
Enterprise value	**14,860**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39
Number of months	12	12	12	12	12	12	12	12	12
Net sales	**2,298**	**2,537**	**2,783**	**3,061**	**3,383**	**3,710**	**4,107**	**4,518**	**4,948**
Operating expenses	(403)	(422)	(442)	(463)	(500)	(494)	(687)	(730)	(759)
EBITDA	**1,895**	**2,115**	**2,341**	**2,598**	**2,883**	**3,216**	**3,421**	**3,788**	**4,189**
Depreciation and amortisation	(312)	(312)	(312)	(312)	(312)	(312)	(312)	(312)	(312)
EBIT	**1,583**	**1,803**	**2,029**	**2,286**	**2,572**	**2,904**	**3,109**	**3,477**	**3,877**
Tax expense	(462)	(526)	(590)	(659)	(735)	(521)	(913)	(1,007)	(1,109)
Debt free net income	**1,121**	**1,277**	**1,439**	**1,627**	**1,837**	**2,383**	**2,196**	**2,470**	**2,768**
Add: Depreciation and amortisation	312	312	312	312	312	312	312	312	312
Add: Provision for major maintenance	79	79	79	79	79	79	231	231	231
Less: Initial capex									
Less: Additional Capex	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	-	(1,192)	-	-	-
Debt free cash flow	**1,512**	**1,668**	**1,831**	**2,018**	**2,228**	**1,582**	**2,739**	**3,012**	**3,311**
Discount rate (%)	10.58	10.58	10.58	10.58	10.58	10.58	10.58	10.58	10.58
Present value factor- Mid Year discounting	0.45	0.41	0.37	0.33	0.30	0.27	0.25	0.22	0.20
Present value debt free cash flow	**682**	**680**	**675**	**673**	**672**	**432**	**675**	**672**	**668**

Currency: ₹ mn	Mar40	Mar41	Mar42	Mar43	Mar44	Mar45	Oct45
Number of months	12	12	12	12	12	12	7
Net sales	**5,471**	**5,976**	**6,565**	**7,210**	**7,923**	**8,688**	**5,259**
Operating expenses	(791)	(823)	(859)	(859)	(687)	(749)	(438)
EBITDA	**4,680**	**5,152**	**5,706**	**6,351**	**7,236**	**7,939**	**4,820**
Depreciation and amortisation	(312)	(312)	(312)	(312)	(312)	(312)	(290)
EBIT	**4,369**	**4,841**	**5,395**	**6,039**	**6,924**	**7,627**	**4,531**
Tax expense	(1,234)	(1,353)	(1,493)	(1,249)	(1,821)	(1,998)	(1,211)
Debt free net income	**3,135**	**3,488**	**3,901**	**4,791**	**5,104**	**5,629**	**3,319**
Add: Depreciation and amortisation	312	312	312	312	312	312	290
Add: Provision for major maintenance	231	231	231	231	-	-	-
Less: Initial capex							
Less: Additional Capex	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	(1,617)	-	-	-
Debt free cash flow	**3,678**	**4,030**	**4,444**	**3,716**	**5,415**	**5,941**	**3,609**
Discount rate (%)	10.58	10.58	10.58	10.58	10.58	10.58	10.58
Present value factor- Mid Year discounting	0.18	0.16	0.15	0.13	0.12	0.11	0.10
Present value debt free cash flow	**671**	**665**	**663**	**501**	**660**	**655**	**360**

1.16 KETL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30
Number of months		5	12	12	12	12	12	12	12
Net sales		**240**	**628**	**688**	**765**	**847**	**932**	**1,024**	**1,126**
Operating expenses		(192)	(285)	(299)	(313)	(327)	(341)	(334)	(434)
EBITDA		**48**	**342**	**389**	**452**	**520**	**591**	**690**	**692**
Depreciation and amortisation		(81)	(204)	(204)	(204)	(204)	(204)	(204)	(204)
EBIT		**(32)**	**138**	**185**	**247**	**315**	**387**	**486**	**488**
Tax expense		-	-	-	-	-	-	-	-
Debt free net income		**(32)**	**138**	**185**	**247**	**315**	**387**	**486**	**488**
Add: Depreciation and amortisation		81	204	204	204	204	204	204	204
Add: Provision for major maintenance		90	90	90	90	90	90	90	165
Less: Initial capex		(381)							
Less: Additional Capex		-	-	-	-	-	-	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	(721)	-
Debt free cash flow		**(243)**	**432**	**479**	**542**	**610**	**681**	**59**	**857**
Discount rate (%)		10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.61	0.55	0.50
Present value debt free cash flow		**(238)**	**394**	**395**	**403**	**410**	**414**	**33**	**426**
Present value for explicit period	8,036								
Enterprise value	**8,036**								

Currency: ₹ mn	Mar31	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41
Number of months	12	12	12	12	12	12	12	12	12	12	12
Net sales	**1,248**	**1,371**	**1,488**	**1,648**	**1,799**	**1,981**	**2,150**	**2,363**	**2,585**	**2,818**	**3,075**
Operating expenses	(461)	(477)	(494)	(512)	(531)	(525)	(551)	(587)	(611)	(636)	(663)
EBITDA	**788**	**894**	**995**	**1,136**	**1,268**	**1,457**	**1,599**	**1,776**	**1,974**	**2,182**	**2,413**
Depreciation and amortisation	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)
EBIT	**583**	**690**	**791**	**932**	**1,064**	**1,252**	**1,395**	**1,572**	**1,770**	**1,978**	**2,208**
Tax expense	(14)	(245)	(276)	(316)	(352)	(110)	(437)	(483)	(534)	(587)	(646)
Debt free net income	**569**	**444**	**514**	**616**	**712**	**1,142**	**958**	**1,089**	**1,236**	**1,391**	**1,563**
Add: Depreciation and amortisation	204	204	204	204	204	204	204	204	204	204	204
Add: Provision for major maintenance	165	165	165	165	165	165	158	158	158	158	158
Less: Initial capex											
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	-	(1,158)	-	-	-	-	-
Debt free cash flow	**939**	**814**	**884**	**986**	**1,081**	**354**	**1,320**	**1,451**	**1,598**	**1,753**	**1,925**
Discount rate (%)	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting	0.45	0.41	0.37	0.33	0.30	0.27	0.24	0.22	0.20	0.18	0.16
Present value debt free cash flow	**421**	**330**	**324**	**327**	**324**	**96**	**323**	**321**	**319**	**317**	**314**

Currency: ₹ mn	Mar42	Mar43	Mar44	Mar45	Mar46	Mar47	Mar48	Mar49	Mar50	Oct50
Number of months	12	12	12	12	12	12	12	12	12	7
Net sales	**3,362**	**3,671**	**3,027**	**3,153**	**3,293**	**5,216**	**5,724**	**6,239**	**6,803**	**4,085**
Operating expenses	(691)	(689)	(860)	(897)	(927)	(1,048)	(1,089)	(1,133)	(1,151)	(498)
EBITDA	**2,670**	**2,982**	**2,167**	**2,257**	**2,367**	**4,169**	**4,634**	**5,106**	**5,652**	**3,586**
Depreciation and amortisation	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(204)	(181)
EBIT	**2,466**	**2,778**	**1,963**	**2,053**	**2,163**	**3,965**	**4,430**	**4,901**	**5,448**	**3,406**
Tax expense	(711)	(512)	(627)	(649)	(677)	(1,131)	(1,248)	(1,367)	(933)	(902)
Debt free net income	**1,755**	**2,266**	**1,336**	**1,403**	**1,485**	**2,834**	**3,182**	**3,534**	**4,514**	**2,504**
Add: Depreciation and amortisation	204	204	204	204	204	204	204	204	204	181
Add: Provision for major maintenance	158	158	324	324	324	324	324	324	324	-
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	(1,104)	-	-	-	-	-	-	(2,268)	-
Debt free cash flow	**2,117**	**1,524**	**1,864**	**1,931**	**2,014**	**3,362**	**3,710**	**4,063**	**2,774**	**2,684**
Discount rate (%)	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06
Present value debt free cash flow	**312**	**203**	**225**	**210**	**198**	**299**	**298**	**295**	**182**	**159**

1.17 SMTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**242**	**656**	**723**	**808**	**891**	**984**	**1,087**	**1,190**	**1,321**
Operating expenses		(171)	(266)	(278)	(291)	(305)	(318)	(310)	(413)	(438)
EBITDA		**70**	**390**	**444**	**517**	**587**	**666**	**778**	**778**	**883**
Depreciation and amortisation		(79)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)
EBIT		**(9)**	**189**	**243**	**316**	**386**	**465**	**577**	**577**	**682**
Tax expense		-	-	-	-	-	-	-	-	(202)
Debt free net income		**(9)**	**189**	**243**	**316**	**386**	**465**	**577**	**577**	**480**
Add: Depreciation and amortisation		79	201	201	201	201	201	201	201	201
Add: Provision for major maintenance		83	83	83	83	83	83	83	162	162
Less: Initial capex		(138)								
Less: Additional Capex		-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	(662)	-	-
Debt free cash flow		**16**	**473**	**527**	**600**	**669**	**749**	**198**	**940**	**843**
Discount rate (%)		10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.61	0.55	0.50	0.45
Present value debt free cash flow		**15**	**431**	**434**	**447**	**451**	**456**	**109**	**467**	**379**
Present value for explicit period		9,145								
Enterprise value		**9,145**								

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41
Number of months	12	12	12	12	12	12	12	12	12	12
Net sales	**1,447**	**1,586**	**1,748**	**1,908**	**2,093**	**2,291**	**2,507**	**2,740**	**3,010**	**3,292**
Operating expenses	(453)	(469)	(486)	(504)	(497)	(512)	(547)	(569)	(593)	(618)
EBITDA	**994**	**1,116**	**1,261**	**1,404**	**1,596**	**1,779**	**1,960**	**2,171**	**2,417**	**2,674**
Depreciation and amortisation	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)
EBIT	**793**	**915**	**1,060**	**1,203**	**1,394**	**1,578**	**1,759**	**1,970**	**2,216**	**2,473**
Tax expense	(270)	(306)	(347)	(386)	(150)	(479)	(526)	(580)	(643)	(708)
Debt free net income	**522**	**609**	**713**	**818**	**1,244**	**1,098**	**1,233**	**1,389**	**1,573**	**1,765**
Add: Depreciation and amortisation	201	201	201	201	201	201	201	201	201	201
Add: Provision for major maintenance	162	162	162	162	162	145	145	145	145	145
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	(1,135)	-	-	-	-	-
Debt free cash flow	**886**	**972**	**1,077**	**1,181**	**472**	**1,444**	**1,579**	**1,735**	**1,919**	**2,111**
Discount rate (%)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting	0.41	0.37	0.33	0.30	0.27	0.24	0.22	0.20	0.18	0.16
Present value debt free cash flow	**360**	**357**	**357**	**354**	**128**	**354**	**349**	**347**	**347**	**345**

Currency: ₹ mn	Mar42	Mar43	Mar44	Mar45	Mar46	Mar47	Mar48	Mar49	Mar50	Oct50
Number of months	12	12	12	12	12	12	12	12	12	7
Net sales	**3,593**	**3,931**	**4,295**	**4,686**	**5,131**	**4,218**	**4,417**	**4,599**	**7,289**	**4,377**
Operating expenses	(645)	(641)	(862)	(911)	(945)	(919)	(951)	(983)	(1,100)	(455)
EBITDA	**2,947**	**3,290**	**3,433**	**3,775**	**4,186**	**3,298**	**3,466**	**3,615**	**6,189**	**3,922**
Depreciation and amortisation	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(201)	(182)
EBIT	**2,746**	**3,089**	**3,232**	**3,574**	**3,985**	**3,097**	**3,265**	**3,414**	**5,988**	**3,741**
Tax expense	(777)	(609)	(944)	(1,030)	(1,134)	(911)	(953)	(991)	(1,075)	(987)
Debt free net income	**1,969**	**2,480**	**2,288**	**2,544**	**2,851**	**2,186**	**2,312**	**2,424**	**4,913**	**2,754**
Add: Depreciation and amortisation	201	201	201	201	201	201	201	201	201	182
Add: Provision for major maintenance	145	145	320	320	320	320	320	320	320	-
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	(1,014)	-	-	-	-	-	-	(2,240)	-
Debt free cash flow	**2,315**	**1,812**	**2,809**	**3,065**	**3,372**	**2,708**	**2,833**	**2,945**	**3,194**	**2,936**
Discount rate (%)	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64	10.64
Present value factor- Mid Year discounting	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06
Present value debt free cash flow	**342**	**242**	**339**	**334**	**332**	**241**	**228**	**214**	**210**	**175**

1.18 NKTL

Currency: ₹ mn	Notes	Mar23	Mar24	Mar25	Mar26	Mar27	Mar28	Mar29	Mar30	Mar31
Number of months		5	12	12	12	12	12	12	12	12
Net sales		**233**	**655**	**727**	**809**	**898**	**994**	**1,095**	**1,203**	**1,324**
Operating expenses		(165)	(261)	(274)	(287)	(300)	(312)	(307)	(401)	(424)
EBITDA		**68**	**394**	**453**	**522**	**599**	**682**	**788**	**803**	**899**
Depreciation and amortisation		(103)	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)
EBIT		**(36)**	**142**	**202**	**271**	**347**	**430**	**536**	**552**	**648**
Tax expense		-	-	-	-	-	-	-	-	-
Debt free net income		**(36)**	**142**	**202**	**271**	**347**	**430**	**536**	**552**	**648**
Add: Depreciation and amortisation		103	251	251	251	251	251	251	251	251
Add: Provision for major maintenance		84	84	84	84	84	84	84	155	155
Less: Initial capex		(324)								
Less: Additional Capex		-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense		-	-	-	-	-	-	(673)	-	-
Debt free cash flow		**(172)**	**478**	**537**	**607**	**683**	**766**	**199**	**958**	**1,055**
Discount rate (%)		10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting		0.98	0.91	0.82	0.74	0.67	0.61	0.55	0.50	0.45
Present value debt free cash flow		**(168)**	**435**	**443**	**452**	**459**	**466**	**109**	**476**	**473**
Present value for explicit period	9,452									
Enterprise value	**9,452**									

Currency: ₹ mn	Mar32	Mar33	Mar34	Mar35	Mar36	Mar37	Mar38	Mar39	Mar40	Mar41
Number of months	12	12	12	12	12	12	12	12	12	12
Net sales	**1,466**	**1,610**	**1,773**	**1,935**	**2,140**	**2,340**	**2,556**	**2,804**	**3,081**	**3,363**
Operating expenses	(439)	(455)	(472)	(490)	(486)	(548)	(581)	(603)	(627)	(652)
EBITDA	**1,027**	**1,154**	**1,301**	**1,446**	**1,655**	**1,792**	**1,975**	**2,201**	**2,454**	**2,711**
Depreciation and amortisation	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)
EBIT	**775**	**903**	**1,050**	**1,194**	**1,403**	**1,541**	**1,724**	**1,950**	**2,203**	**2,460**
Tax expense	(177)	(311)	(352)	(392)	(174)	(492)	(540)	(598)	(662)	(728)
Debt free net income	**598**	**593**	**698**	**802**	**1,230**	**1,048**	**1,184**	**1,352**	**1,540**	**1,732**
Add: Depreciation and amortisation	251	251	251	251	251	251	251	251	251	251
Add: Provision for major maintenance	155	155	155	155	155	187	187	187	187	187
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	(1,088)	-	-	-	-	-
Debt free cash flow	**1,005**	**999**	**1,104**	**1,209**	**548**	**1,487**	**1,623**	**1,790**	**1,979**	**2,170**
Discount rate (%)	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting	0.41	0.37	0.33	0.30	0.27	0.24	0.22	0.20	0.18	0.16
Present value debt free cash flow	**408**	**366**	**366**	**362**	**148**	**364**	**359**	**358**	**357**	**354**

Currency: ₹ mn	Mar42	Mar43	Mar44	Mar45	Mar46	Mar47	Mar48	Mar49	Mar50	Oct50
Number of months	12	12	12	12	12	12	12	12	12	7
Net sales	**2,757**	**2,888**	**3,033**	**4,935**	**5,388**	**5,903**	**6,494**	**7,042**	**7,730**	**4,651**
Operating expenses	(634)	(658)	(683)	(788)	(823)	(860)	(900)	(965)	(962)	(466)
EBITDA	**2,123**	**2,230**	**2,350**	**4,147**	**4,565**	**5,043**	**5,594**	**6,077**	**6,768**	**4,184**
Depreciation and amortisation	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(251)	(230)
EBIT	**1,872**	**1,979**	**2,098**	**3,896**	**4,314**	**4,792**	**5,343**	**5,826**	**6,517**	**3,954**
Tax expense	(580)	(608)	(638)	(1,091)	(1,196)	(1,316)	(1,455)	(1,577)	(1,092)	(1,053)
Debt free net income	**1,292**	**1,371**	**1,460**	**2,805**	**3,118**	**3,475**	**3,888**	**4,249**	**5,425**	**2,902**
Add: Depreciation and amortisation	251	251	251	251	251	251	251	251	251	230
Add: Provision for major maintenance	187	187	187	187	187	187	187	187	187	-
Less: Initial capex										
Less: Additional Capex	-	-	-	-	-	-	-	-	-	-
Less: Major Maintenance Expense	-	-	-	-	-	-	-	-	(2,617)	-
Debt free cash flow	**1,730**	**1,810**	**1,899**	**3,244**	**3,556**	**3,914**	**4,326**	**4,687**	**3,246**	**3,132**
Discount rate (%)	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65	10.65
Present value factor- Mid Year discounting	0.15	0.13	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.06
Present value debt free cash flow	**255**	**241**	**229**	**353**	**350**	**348**	**348**	**341**	**213**	**186**

2. Detailed WACC Computation

Computation of Cost of Equity

- Based on the parameters mentioned above, the cost of equity for InvIT Assets is computed in the following table:

Particulars	Notes	JMTL	MBEL	WUPTL	APEL*	NDEPL	FRHL	WVEPL	DATRL	GAEPL
Risk-free rate (%)	a	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Beta	b	0.90	0.90	0.90	0.99	0.90	0.90	0.89	0.86	0.90
Equity market risk premium (%)	c	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Additional risk premium (%)	d	1.0	1.0	1.0	(2.0)	1.0	1.0	1.0	2.0	1.0
Cost of equity capital (%)		**14.7**	**14.7**	**14.7**	**12.3**	**14.7**	**14.7**	**14.6**	**15.4**	**14.7**

Particulars	Notes	HTL	JLTL	JVTL	LRTL	KMTL	MKTL	KETL	SMTL	NKTL
Risk-free rate (%)	a	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Beta	b	0.88	0.87	0.87	0.87	0.87	0.87	0.88	0.88	0.88
Equity market risk premium (%)	c	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Additional risk premium (%)	d	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cost of equity capital (%)		**14.5**	**14.5**	**14.5**	**14.5**	**14.5**	**14.5**	**14.5**	**14.5**	**14.5**

Notes:

a. Based on the current YTMs of Government Bonds with 10 years residual maturity (rounded)
b. Please refer the table for Beta working below
c. Based on EYMBSLLP understanding of prevailing market risk premium in India
d. Additional risk premium is considered on account of the operational risk factors such as traffic risk, performance risk, etc

** -We have considered a (2.0) additional risk premium for APEL since it is an annuity project and has no traffic risk*

Computation of Cost of Debt

Particulars	Notes	JMTL	MBEL	WUPTL	APEL	NDEPL	FRHL	WVEPL	DATRL	GAEPL
Debt borrowing rate (%)	e	7.6	8.4	8.2	10.0	8.5	8.0	7.6	7.4	8.9
Expected income tax rate (%)	f	17.5	17.5	18.4	0.0	17.4	18.2	19.9	26.6	17.7
After-tax cost of debt (%)		**6.3**	**6.9**	**6.7**	**10.0**	**7.0**	**6.5**	**6.1**	**5.4**	**7.3**

Particulars	Notes	HTL	JLTL	JVTL	LRTL	KMTL	MKTL	KETL	SMTL	NKTL
Debt borrowing rate (%)	e	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7	8.7
Expected income tax rate (%)	f	22.5	23.9	24.2	23.8	23.3	23.4	22.3	22.5	22.3
After-tax cost of debt (%)		**6.7**	**6.6**	**6.6**	**6.6**	**6.7**	**6.7**	**6.8**	**6.7**	**6.8**

e. Based on existing borrowing cost of external debt as specified in the provisional financial statement for year ended 31 October 2022
f. Based on effective tax rate of respective SPV's

Calculation of Beta

a. Calculation of unlevered beta

Currency: ₹ mn	Equity beta(g)	Net debt	Enterprise value	Debt-equity ratio based on 3 year average	Debt-EV ratio based on 3 year average	Effective tax rate (%)	Unlevered beta based on 3 year debt-equity
Ashoka Buildcon Limited	1.7	31,134	54,264	215.3	68.3	25.2	0.63
MEP Infrastructure Developers Limited	1.8	19,593	22,409	581.6	85.3	25.2	0.33
IRB Infrastructure Developers Limited	1.4	1,16,972	2,59,565	224.7	69.2	25.2	0.54
Bharat Road Network Limited	1.0	13,652	17,448	339.4	77.2	25.2	0.29
Dilip Buildcon Limited	1.2	46,584	78,633	104.2	51.0	25.2	0.68
Average	**1.4**			**293.0**	**70.2**		**0.49**

Source: Capital IQ

b. Calculation of relevered beta

Currency: ₹ mn	JMTL	MBEL	WUPTL	APEL	NDEPL	FRHL	WVEPL	DATRL	GAEPL
Ashoka Buildcon Limited	1.15	1.15	1.15	1.26	1.15	1.15	1.14	1.10	1.2
MEP Infrastructure Developers Limited	0.60	0.60	0.60	0.66	0.60	0.60	0.59	0.57	0.6
IRB Infrastructure Developers Limited	0.98	0.98	0.98	1.07	0.98	0.97	0.96	0.93	1.0
Bharat Road Network Limited	0.53	0.53	0.53	0.58	0.53	0.53	0.53	0.51	0.5
Dilip Buildcon Limited	1.24	1.24	1.23	1.36	1.24	1.23	1.22	1.18	1.2
Average	**0.90**	**0.90**	**0.90**	**0.99**	**0.90**	**0.90**	**0.89**	**0.86**	**0.90**

Currency: ₹ mn	HTL	JLTL	JVTL	LRTL	KMTL	MKTL	KETL	SMTL	NKTL
Ashoka Buildcon Limited	1.12	1.11	1.11	1.11	1.12	1.12	1.12	1.12	1.12
MEP Infrastructure Developers Limited	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
IRB Infrastructure Developers Limited	0.95	0.94	0.94	0.94	0.95	0.95	0.95	0.95	0.95
Bharat Road Network Limited	0.52	0.51	0.51	0.51	0.52	0.52	0.52	0.52	0.52
Dilip Buildcon Limited	1.20	1.19	1.19	1.20	1.20	1.20	1.21	1.20	1.21
Average	**0.88**	**0.87**	**0.87**	**0.87**	**0.87**	**0.87**	**0.88**	**0.88**	**0.88**

Calculation of WACC

The debt equity ratio of 50:50 is considered for the InvIT Assets basis the average debt to equity structure of the said assets over the concession period

Particulars	Weights	JMTL	MBEL	WUPTL	APEL	NDEPL	FRHL	WVEPL	DATRL	GAEPL
Cost of debt (%)	*50.0*	3.1	3.5	3.3	5.0	3.5	3.3	3.0	2.7	3.7
Cost of equity capital (%)	*50.0*	7.4	7.4	7.3	6.2	7.4	7.3	7.3	7.7	7.3
WACC		**10.5**	**10.8**	**10.7**	**11.2**	**10.8**	**10.6**	**10.3**	**10.4**	**11.0**

Particulars	Weights	HTL	JLTL	JVTL	LRTL	KMTL	MKTL	KETL	SMTL	NKTL
Cost of debt (%)	*50.0*	3.4	3.3	3.3	3.3	3.3	3.3	3.4	3.4	3.4
Cost of equity capital (%)	*50.0*	7.3	7.2	7.2	7.2	7.3	7.2	7.3	7.3	7.3
WACC		**10.6**	**10.5**	**10.5**	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**	**10.6**

The computed WACC for the InvIT assets ranges from 10.3% to 11.2%

3. Details of major repairs for each of the SPVs

A. Historical period major repairs:

The historical major maintenance expenses for all the InvIT Assets are shown in the table below:

SPVs / Major repairs (INR million)	FY17	FY18	FY19	FY20	FY21	FY22	7MFY23
JMTL	-	526	89	724	-	-	-
MBEL	-	-	379	470	-	-	-
WUPTL	722	18	-	-	336	169	-
NDEPL	-	-	-	-	-	607	392
FRHL	-	-	-	-	-	819	1,116
WVEPL	-	-	-	-	-	42	593
GAEPL	-	-	-	-	-	-	-
DATRL	-	-	-	-	-	115	2,458
APEL	-	-	-	741	-	-	-
HTL	-	-	-	-	-	-	-
JLTL	-	-	-	-	-	-	-
JVTL	-	-	-	-	-	-	-
KMTL	-	-	-	-	-	-	-
LRTL	-	-	-	-	-	-	-
MKTL	-	-	-	-	-	-	-
KETL	-	-	-	-	-	-	-
SMTL	-	-	-	-	-	-	-
NKTL	-	-	-	-	-	-	-

B. Estimates of the major repairs to be carried out in the forecast period:

The forecasted major maintenance expenses for all the InvIT Assets are shown in the tables below:

SPVs / Major repairs (INR million)	5MFY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
JMTL	880	608	-	-	-	768	681	-	1,069
MBEL	-	725	-	-	-	-	667	-	617
WUPTL	-	-	-	624	-	-	-	-	-
NDEPL	-	-	-	-	504	223	-	-	-
FRHL	56	-	-	-	-	-	795	819	-
WVEPL	163	-	-	-	-	-	336	346	-
GAEPL	-	-	-	-	-	-	994	1,024	-
DATRL	481	-	-	-	-	-	1,323	1,362	-
APEL	-	494	512	-	-	-	-	-	-
HTL	-	-	-	-	-	-	-	257	1,057
JLTL	-	-	-	-	-	-	-	812	-
JVTL	-	-	-	-	-	-	207	498	-
KMTL	-	-	-	-	-	-	939	-	-
LRTL	-	-	-	-	-	-	-	-	261
MKTL	-	-	-	-	-	-	-	-	-
KETL	-	-	-	-	-	-	721	-	-
SMTL	-	-	-	-	-	-	662	-	-
NKTL	-	-	-	-	-	-	673	-	-

SPVs / Major repairs (INR million)	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	FY41
JMTL	-	-	-	-	-	-	-	-	-	-
MBEL	-	-	-	-	-	-	-	-	-	-
WUPTL	-	-	-	-	-	-	-	-	-	-
NDEPL	585	258	-	-	-	-	-	-	-	-
FRHL	-	-	-	-	735	758	-	-	737	760
WVEPL	-	-	-	-	456	470	-	-	-	-
GAEPL	-	-	-	-	1,223	1,261	-	-	-	-
DATRL	-	-	-	-	1,618	1,668	-	-	-	-
APEL	-	-	-	-	-	-	-	-	-	-
HTL	-	-	-	-	-	-	-	-	-	-
JLTL	-	-	-	-	-	532	-	-	-	-
JVTL	-	-	-	-	-	457	-	-	-	-
KMTL	-	-	-	-	1518	-	-	-	-	-
LRTL	1074	-	-	-	-	-	-	-	-	-
MKTL	-	-	-	-	1192	-	-	-	-	-
KETL	-	-	-	-	1158	-	-	-	-	-
SMTL	-	-	-	-	1135	-	-	-	-	-
NKTL	-	-	-	-	1088	-	-	-	-	-

SPVs / Major repairs (INR million)	FY42	FY43	FY44	FY45	FY46	FY47	FY48	FY49	FY50	FY51
JMTL	-	-	-	-	-	-	-	-	-	-
MBEL	-	-	-	-	-	-	-	-	-	-
WUPTL	-	-	-	-	-	-	-	-	-	-
NDEPL	-	-	-	-	-	-	-	-	-	-
FRHL	-	-	-	-	-	-	-	-	-	-
WVEPL	-	-	-	-	-	-	-	-	-	-
GAEPL	-	-	-	-	-	-	-	-	-	-
DATRL	-	-	-	-	-	-	-	-	-	-
APEL	-	-	-	-	-	-	-	-	-	-
HTL	-	-	-	2,126	-	-	-	-	2,759	-
JLTL	-	-	-	784	-	-	-	-	-	-
JVTL	-	-	-	681	-	-	-	-	-	-
KMTL	-	-	-	2778	-	-	-	-	-	-
LRTL	-	-	-	2093	-	-	-	-	-	-
MKTL	1,617	-	-	-	-	-	-	-	-	-
KETL	-	1104	-	-	-	-	-	-	2,268	-
SMTL	-	1014	-	-	-	-	-	-	2,240	-
NKTL	-	-	-	-	-	-	-	-	2,617	-

C. Historical and forecasted expenses relating to the initial capital expenditures for TOT assets:

SPVs / Capex (INR million)	FY22	7MFY23	5MFY23
HTL	43	42	593
JLTL	190	116	207
JVTL	113	17	324
KETL	1213	61	381
KMTL	1455	72	62
LRTL	147	17	387
MKTL	1061	92	225
NKTL	945	52	324
SMTL	1082	151	138

4A. Disclosures regarding list of one-time sanctions/approvals which are obtained or pending and

4B. Disclosures regarding list of up to date/overdue periodic clearances

The disclosures regarding list of one-time sanctions/approvals which are obtained or pending and list of up to date/overdue periodic clearances for the InvIT Assets are shown in the below table.

4.1 JMTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Certificate of completion - Dated 09-03-2015	Independent consultant	Active
2	Environmental clearance dated August 1, 2006	-	Active
3	No-objection certificate for obtaining an environmental clearance dated May 6, 2006	RSPCB	Active
4	Consent to establish	RSPCB	Active
5	Certificate of Importer Exporter Code	GOI	Active
6	Renewed license under the Contract Labour (R&A) Act, 1970	GOI	Active

4.2 MBEL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Certificate of completion Dated- 13-09-2009	Independent Consultant	Active
2	Consent under the Section 25 and Section 26 of the Water (Prevention and Control of Pollution) Act, 1974 and Section 21(4) of the Air (Prevention and Control of Pollution) Act, 1981	RSPCB	Active
3	Renewed certificate of registration	GOI	Active
4	Registration certificate under Section 7(3) of the Buildings and Other Construction Workers (Regulation of Employment and Condition of Service) Act, 1996	NA	Active

4.3 WUPTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Certificate of completion UNI/D-06/O&M-IC/NH-58/2016-17/1075 -Dated-02-06-2016	Independent Consultant	Active
2	Authorisation under the Hazardous and Other Wastes	UPPCB	Active
3	Consent dated February 3, 2019 under Sections 25 and 26 of the Water (Prevention and Control of Pollution) Act, 1974 for the disposal of its industrial effluents through the effluence treatment plant for irrigation/ or to the river through drains, and discharge of domestic effluents through septic tanks	UPPCB	Active
4	Consent dated February 3, 2019 under Sections 21 and Section 22 of the Air (Prevention and Control of Pollution) Act, 1981, for the emission of air pollutants from the diesel generator installed at the Toll Plazas by the Company	UPPCB	Active
5	No-objection certificate dated December 7, 2018 for extraction of ground water at NH-58, village Walidpur	CGWA, GOI	Active

6	No-objection certificate dated December 7, 2018 for extraction of ground water at NH-58, village Pachenda Kalan	CGWA, GOI	Active
7	Renewed certificate of Registration under the Contract Labour (Regulation and Abolition) Act, 1970	Regional Labour Commissioner, GOI	Active

4.4 NDEPL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Approval bearing reference no. NHAI/CGM(F)/SBI/2020 dated September 18, 2020 for substitution of Concessionaire i.e. Lanco Devihalli Highways Limited by Cube Highways and Infrastructure Pte Ltd.	NHAI	Active
2	Environment Clearance for upgradation of existing 2 lane road from Nelamangala to Bommanhalli dated March 13, 2007	GOI	Active
3	Provisional certificate of completion dated June 23, 2012	IE	Active

4.5 FRHL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Environment clearance for widening and strengthening of existing 2 lane to 4/6 lane from Farakka to Raiganj dated September 16, 2008	Ministry of Environment & Forests	Active
2	No Objection Certificates No. PG/DOES/342 and PG/DOES/343 dated March 16, 2018	Government of West Bengal	Active
3	Consent to Operate dated May 4, 2017	West Bengal Pollution Control Board	Active
4	Labour License No. 46/L(80)/2017-E,3 dated March 6, 2017	Ministry of Labour and Employment	Active
5	Certificate of registration dated March 6, 2017	Ministry of Labour and Employment	Active
6	Certificate of completion dated March 25, 2022 issued by the independent engineer	IE	Active

4.6 WVEPL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Completion certificate APL/W-V/NS-2/02/2015-16/47 Dated- 31-10-2015	Independent Consultant	Active
2	Environment Clearance dated September 15, 2008 for widening and strengthening of 4/6 laning	Ministry of Environment and Forests	Active

4.7 DATRL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Environment clearance dated July 23, 2012 for widening and improvement to six-laning	Ministry of Environment & Forests	Active
2	Forest clearance stage-I approval dated May 8, 2012	Ministry of Environment & Forests	Active
3	Forest clearance stage-I approval dated June 21, 2012	Ministry of Environment & Forests	Active
4	Forest clearance stage-II approval dated April 16, 2013	Ministry of Environment & Forests	Active
5	Forest clearance stage-II approval dated August 23, 2013	Ministry of Environment & Forests	Active
6	In-principle approval dated January 7, 2020 for harmonious substitution of existing shareholders of DATRPL with CH-III	NHAI	Active

7	g. Final approval dated November 17, 2020 for harmonious substitution of existing shareholders of DATRPL with CH-III.	NHAI	Active
8	Provisional certificate of completion dated May 20, 2022 issued by the independent engineer	IE	Active

4.8 APEL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Provisional Completion Certificate AA/APEL/504/09-10/1491Dated- 04-01-2010	Independent Consultant	Active
2	Environment clearance dated May 19, 2006 for upgrading existing 2 lane to 4 lane	Ministry of Environment and Forest	Active
3	Certificate of registration dated November 24, 2021 issued by Labour Department Telangana Shops and Establishments Act, 1988	Government of Telangana	Active
4	Certificate of registration of establishment dated June 4, 2019 issued by Labour Department	Government of National Capital Territory of Delhi	Active
5	Certificate of registration dated June 12, 2017 issued by Labour Department	Government of Telangana	Active

4.9 GAEPL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Environmental clearance dated March 3, 2009	Ministry of Environment and Forest	Active
2	Registration certificate of shop or commercial establishment	Labour Department, Uttar Pradesh	Active
3	Completion certificate dated April 23, 2022	IE	Active
4	Forest clearance dated March 30, 2012	Ministry of Environment and Forest	Active

4.10 HTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active
2	Environment clearance dated February 19, 2007	Ministry of Environment & Forests	Active

4.11 JLTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active
2	Environment clearance dated January 17, 2007	Ministry of Environment & Forests	Active

4.12 JVTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active
2	Environment clearance dated February 19, 2007	Ministry of Environment & Forests	Active

4.13 KMTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	No-objection certificate for ground water abstraction with NOC number CGWA/NOC/INF/ORIG/2021/13127 valid from September 29, 2021 to September 27, 2026	Government of India	Active
2	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active

4.14 LRTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active
2	Environment clearance dated July 10, 2012	Ministry of Environment & Forests	Active

4.15 MKTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated July 31, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active

4.16 KETL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated October 15, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active

4.17 SMTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Registration certificate dated October 28, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active

4.18 NKTL

Sr. No.	Description of permit	Issuing Authority	Current Status
1	Renewal of consent to operate for NKTL from Tamil Nadu Pollution Control Board for authorising the occupier to operate the industrial plant in the air pollution control area as notified by the government and to make discharge of emission from stack/chimneys.	Tamil Nadu Pollution Control Board	Active
2	Registration certificate dated October 28, 2020 issued by Department of Labour	Government of National Capital Territory of Delhi	Active

5 Details of on-going litigations

I. Litigation and Regulatory Actions against the Trust and its Associates

As at the date of this Placement Memorandum, there are no outstanding criminal litigation, non-ordinary course regulatory actions or material civil litigation against the Trust and its Associates, except as disclosed in this section.

II. Litigation involving the Initial Portfolio Assets

Material civil proceedings filed against the Initial Portfolio Assets

DATRPL

(i) VKR Projects Private Limited ("**Plaintiff**") has filed a commercial suit against DATRPL ("**Defendant**") before the High Court of Judicature at Bombay ("**Bombay High Court**") in relation to a letter of intent issued by the Defendant wherein the Defendant sought the services of the Plaintiff in the laying and shifting of electricity cables in a specific section of the Defendant's project highway ("**Service**"). Due to a delay in the completion of the Service, the Defendant refused to pay an amount of ₹ 4,193.32 million. The Plaintiff has claimed that the aforesaid delay was due to the delay in handing over of the complete project site by the Defendant and accordingly, the Plaintiff has filed the present suit before the Bombay High Court. The Plaintiff has prayed for, amongst other things, the Bombay High Court to (i) direct the Defendant to pay an amount of ₹ 4,193.32 million to the Plaintiff, along with statutory taxes and an interest at the rate of 18% per annum up to the date of realization of such amount, (ii) order the specific performance of the terms of letter of intent, and (iii) direct the Defendant to deposit a sum of ₹ 277.28 million with the Bombay High Court. The matter is currently pending.

Others

(i). Certain persons ("**Petitioners**") have filed separate cases against some of the Initial Portfolio Assets before various civil and consumer courts, amongst other things, (i) alleging excess collection of toll; (ii) challenging acquisition of land used for the Initial Portfolio Assets; and (iii) challenging certain encroachment notices served upon the Petitioners. These matters are currently pending.

(ii). Certain persons have filed separate labour cases against some of the Initial Portfolio Assets before various civil and labour courts in relation to, amongst other things, wrongful termination of employment, increase in salaries and demands of bonus. These matters are currently pending.

Material civil proceedings filed by the Initial Portfolio Assets

WUPTL

(i). WUPTL ("**Claimant**") has initiated arbitration proceedings against NHAI ("**Respondent**") before the Indian Council of Arbitration, New Delhi ("**ICA**"). The Claimant had entered into a concession agreement dated September 9, 2005 with the Respondent ("**Concession Agreement**"). Due to change in law by way of an order of Supreme Court dated October 9, 2015 and the notification issued by National Green Tribunal dated February 18, 2016, (i)

environmental compensation charges were to be levied on all light and heavy duty commercial vehicles entering New Delhi; (ii) commercial vehicles were prohibited from entering into New Delhi if not destined to New Delhi; and (iii) transportation of mining materials in Yamunanagar and Saharanpur districts was prohibited. The Claimant has alleged that these events led to substantial reduction in the commercial traffic on the project highway causing toll revenue losses to the Claimant. In accordance with the terms of the Concession Agreement, the Claimant sought compensation from the Respondent for the losses incurred due to 'change in law' event which was refused by the Respondent. Accordingly, the Claimant had initiated arbitration proceedings, and sought compensation of ₹ 666.00 million along with interest. However, the arbitration proceedings were kept in abeyance in order to pursue amicable settlement before the Conciliation Committee of Independent Experts. The matter is currently pending.

Criminal Proceedings involving the Initial Portfolio Assets

DATRPL

(i). The State of Haryana has initiated criminal proceedings against the project manager of DATRPL before the Chief Judicial Magistrate, Faridabad ("**CJM Court**"). A first information report was filed against DATRPL under sections 279, 337, 338 and 304A of the Indian Penal Code, 1860, as amended, in relation to the death of the son of Manoj Kumar Wadhwa in a road accident allegedly due to potholes on the road forming part of DATRPL's project. The matter is currently pending before the CJM Court.

(ii). Giriraj Kishore ("**Complainant**") has initiated criminal proceedings against Rajesh Madan and the Team Leader of U.R.S. Scale Wilson Pvt. Ltd. ("**Respondents**") before the Court of Judicial Magistrate, Chhata, Mathura ("**CJM Court**"). A First Information Report ("**FIR**") was filed by the Complainant under Section 430 of the Indian Penal Code, 1860 ("**IPC**"), as amended, against the Respondents in relation to the project assets of DATRPL for intentionally not constructing a drain near Complainant's land despite multiple reminders which has led to the collapse of Complainant's boundary wall and has also destroyed the crops planted in Complainant's land. The CJM took cognizance of the complaint on April 6, 2022 under Section 432 of the IPC. The matter is currently pending.

MBEL

(i). The Labour Enforcement Officer ("**Plaintiff**") has filed two separate cases against MBEL (erstwhile Madhucon Agra Jaipur Expressway Limited) before the Civil Court, Bair District, Bharatpur ("**Civil Court**") alleging non-compliance under Sections 23 and 24 of the Contract Labour (Regulation and Abolition) Act, 1970. The Plaintiff has also filed another case before Civil Court under Section 22 of the Minimum Wages Act, 1948 for non-payment of minimum wage to a worker as stipulated under the aforesaid Act. The matters are currently pending.

(ii). Uttam Sharma ("**Complainant**") has filed a criminal complaint against the erstwhile directors and certain employees of MBEL ("**Accused Persons**") before the court of Additional Chief Judicial Magistrate, Bharatpur ("**ACJM Court**"). The complaint was filed under section 418 and 420 of the Indian Penal Code, 1860 for charging excess toll fees from the commuters using the project highway. The ACJM Court took cognizance of the complaint on October 29, 2014 and issued a bailable warrant of arrest against the Accused Persons ("**Warrant**"). Aggrieved by the Warrant, the erstwhile directors of MBEL have filed a revision petition before the sessions court. The matter is currently pending.

(iii). Certain persons ("**Complainants**") have filed claims before certain courts and tribunals including the Motor Accident Claim Tribunal and the Lok Adalat claiming compensation due to accidents that occurred on the Project assets. These matters are currently pending.

Regulatory Proceedings involving Initial Portfolio Assets

(i). The office of the Registration and Stamps Department, Government of Telangana has issued notices to APEL and KMC Constructions Limited ("**KMC**") in relation to the inadequate stamping of the EPC contract entered into between APEL and KMC. APEL is contesting the aforesaid notices.

(ii). 2 of our Initial Portfolio Assets (being, GAEPL and WUPTL) have received notices from the office of the Collector, Aligarh and the office of the Additional District Magistrate (Finance Revenue), Meerut, respectively, in relation to the stamping of the concession agreements entered into by such Initial Portfolio Assets. The Collector, Aligarh has lao passed an order in this regard. The relevant Initial Portfolio Assets are contesting the aforesaid notices and the order before various authorities and while these matters are currently pending, in accordance with the share purchase agreement through which the Cube Group acquired these Initial Portfolio Assets, the erstwhile sellers are obligated to indemnify, defend and hold harmless the Initial Portfolio Assets in relation to any payment of deficient stamp duty on the concession agreements.

Claims against Initial Portfolio Assets

TOT SPVs

(i). NHAI had, by way of its letter dated October 19, 2020 to the TOT SPVs, notified October 20, 2020 as the 'Appointed Date' under respective concession agreements and also noted that there was a delay by the TOT SPVs in the completion of the conditions precedent set out in their respective concession agreements, thereby entitling NHAI to levy liquidated damages on the Project SPVs. Subsequently, by way of its letter dated November 18, 2020, NHAI levied a claim of net liquidated damages of ₹ 83.70 million on the TOT SPVs rejecting their contentions of delay due to a force majeure event. The TOT SPVs had intimated NHAI of the occurrence of 'force majeure' events and sought deferment of the 'Appointed Date' pursuant to correspondences dated March 28, 2020, July 9, 2020 and August 10, 2020 and contested the claims on liquidated damages pursuant to its letters dated October 28, 2020 and November 27, 2020. NHAI has, by way of its letter dated November 18, 2020, agreed to grant the benefit of 'Force Majeure' for the period between March 24, 2020 to April 19, 2020 and declined to extend the benefit for any period thereafter. NHAI imposed liquidated damages on the TOT SPVs for delay in completion of its conditions precedent and also conceded delay on its part in publication of the fee notification. NHAI has sent three reminders by way of letters dated January 15, 2021, February 5, 2021 and February 26, 2021 to the TOT SPVs to pay the damages for an amount of ₹ 83.70 million to NHAI. NHAI has also stated in the aforementioned letter that the Project SPVs are required to pay interest at a rate equal to 5% above the bank rate and interest as per the relevant concession agreements. The TOT SPVs *vide* a letter dated July 19, 2021 agreed, under protest, that they are liable to pay a penalty of only ₹ 41.60 million in light of the delay being only for the period of 135 days as opposed to different period of delays for each TOT SPV. The letter also stated that in light of the Atma Nirbhar guidelines dated June 3, 2020, the TOT SPVs is eligible for a grace period of six months for completion of all its

obligations. The TOT SPVs *vide* letters dated April 12, 2022, have requested NHAI for revised calculation of damages and being penalized only for an amount of ₹ 39.80 million as the full and final amount payable as such damages. Further, the TOT SPVs, *vide* letters dated June 27, 2022, have stated that since NHAI never invoked force majeure provisions in terms of the relevant concession agreements and the outbreak of Covid-19 did not affect its obligations in relation to other projects, it is not entitled to take any action against the TOT SPVs in this regard.

APEL

(i). The regional office of NHAI, Hyderabad *vide* its letter dated May 12, 2022, has raised a claim of ₹ 77.20 million in relation to a negative change of scope proposal by APEL. Additionally, it has requested the General Manager, NHAI (Telangana) to execute a settlement agreement between NHAI and APEL so that that both the parties do not raise any claims against each other in respect of positive or negative change of scope in future. The claim is currently pending.

(ii). The regional office of NHAI, Hyderabad *vide* its letter dated September 9, 2022 has raised a claim of approximately ₹7.97 million in relation to a default in rectifying certain defects in the APEL Project Highway as recommended by the independent engineer, *vide* letter dated September 2, 2022. APEL has, *vide* letters dated September 6, 2022 and September 10, 2022, disputed such claim and has requested NHAI to hold the same and provide it time to submit a detailed justification. The claim is currently pending.

JMTL

(i). The independent engineer has issued a notice dated August 26, 2021 providing an opportunity to cure the defects and deficiencies in terms of operation and maintenance obligations under the JMTL Concession Agreement. JMTL, in its response dated September 4, 2021, has stated that it has taken efforts to restrict the unauthorized median cut by way of closure or by providing alternate viable solutions to the relevant authorities and has requested for withdrawal of the notice.

(ii). The independent engineer has issued a notice dated October 7, 2021, providing an opportunity to cure the defects and deficiencies in relation to failure to replace a metal beam crash barrier in terms of operation and maintenance obligations under the JMTL Concession Agreement. JMTL, in its response dated October 13, 2021, has submitted a compliance report for rectification of MBCB.

(iii). The independent engineer has imposed a penalty of ₹ 1.07 million vide letter dated October 22, 2021 for delay in painting of median kerb. JMTL, in its response dated October 26, 2021, stated that work was delayed due to consistent rains which severely affected the work progress and quality of work and has requested or extension for the completion of the work. Further, vide its letter dated November 17, 2021, JMTL stated that the work has been completed in totality and requested for withdrawal of notice and waiver of penalty.

(iv). The independent engineer has issued a notice dated October 27, 2021, providing an opportunity to cure the defects and deficiencies in relation to rectifying the service road in terms of operation and maintenance obligations under the JMTL Concession Agreement. JMTL, in its response dated November 1, 2021, has submitted that the rectifications has been carried out.

(v). The independent engineer has issued a notice dated March 9, 2022, providing an opportunity to cure the defects and deficiencies in relation to dumping encroachment bolder waste material dump in right of way of the project highway in terms of operation and maintenance obligations under the JMTL Concession Agreement. JMTL, in its response dated March 14, 2022, has stated that the observations have been complied with and has requested for withdrawal of notice.

LRTL

(i). The NHAI, through a letter dated August 19, 2021, has issued notice to LRTL for submission of negative change of scope for de-scoping of a proposed vehicle underpass. The independent engineer, *vide* letter dated August 24, 2021, issued notice to LRTL for submission of the relevant proposal. LRTL, in its response dated December 7, 2021 has submitted detailed proposal of estimate for negative change of scope. The independent engineer has provided certain observations in relation to the responses submitted by LRTL which has been complied with by LRTL as stated in the letter dated February 9, 2022. The independent engineer *vide* letter dated August 18, 2022 has submitted, for perusal and approval by the NHAI, a negative change of scope proposal, as submitted by LRTL, of a proposed vehicle underpass of approximately ₹ 536.17 million. In this regard, LRTL is required to pay 80% of the descoped amount, amounting to ₹ 428.93 million to NHAI. The claim is currently pending.

MBEL

(i). The independent engineer has imposed a penalty of ₹ 0.98 million *vide* letter dated May 1, 2019 for failure to take necessary steps to remove encroachment at the site. MBEL has objected to the claim *vide l*etter dated October 22, 2020 stating that the norms and guidelines were followed and executed and continuous efforts are being taken to clear the encroachments in the affected area.

(ii). The independent engineer has issued notice dated January 5, 2022 providing an opportunity to cure the defects and deficiencies in terms of operation and maintenance obligations under the MBEL Concession Agreement. MBEL, in its response dated January 6, 2022 has stated that the pavement defect rectification is under process and therefore, it is not in non-compliance of the relevant obligations under the MBEL Concession Agreement.

DATRPL

(i). NHAI *vide* letter dated September 1, 2022 has imposed a sum of ₹ 16.7 million on DATRPL on account of non-illumination of street lights on Project Highway on the recommendation of the independent engineer. The claim is currently pending.

GAEPL

(i). NHAI *vide* letter dated September 1, 2022 has notified GAEPL to deposit an amount of approximately ₹17.44 million as damages for breach of maintenance obligation under the Concession Agreement. GAEPL has submitted its response to NHAI, *vide*, letter dated September 10, 2022, delineating the remedial measures undertaken by GAEPL to fulfil its operation and maintenance obligations. GAEPL has submitted that there was no breach of maintenance obligation and accordingly there is no default as alleged by the independent engineer. The claim is currently pending.

NDEPL

(i). The independent engineer has imposed a penalty of ₹ 2.43 million vide letter dated November 5, 2021 for failure in conducting the required test at the major bridges in terms of the provision of the NDEPL Concession Agreement.

(ii). The independent engineer has imposed a penalty of ₹ 1.15 million vide letter dated November 5, 2021 for not rectifying the defects as notified by the independent engineer for the month of April 2021, within the stipulated time period in terms of the NDEPL Concession Agreement.

(iii). The independent engineer has imposed a penalty of ₹ 41.19 million vide letter dated July 5, 2022 for not carrying out periodical maintenance work (for instance, repair of shoulder, studs, road marking and BC overlay) for the period of January 2021 to May 2022. NDEPL has objected to the claim and has requested NHAI to direct the independent engineer to recalculate the penalty amount. The claim is currently pending with NHAI.

WVEPL

(i). The independent engineer has imposed a penalty of ₹ 3.82 million *vide* letter dated February 24, 2022 for delay in rectification of defects and deficiencies of road and bridge operations in operations and maintenance in terms of the WVEPL Concession Agreement. WVEPL has objected to the claim *vide* letter dated March 4, 2022 stating that all defects and deficiencies were rectified within the stipulated time period and has requested the independent engineer to waive off the damages. The claim is currently pending.

III. Litigation involving the Sponsors and their associates (including common associates of the Sponsors, the Project Manager and the Investment Manager)

i. ICICI Bank Limited (**"Plaintiff"**) filed a commercial suit before High Court of Bombay (**"High Court"**) against State Bank of India and Dena Bank (**"Original Defendants"**) seeking an injunction against them from exercising the right of substitution of Lanco Devihalli Highways Limited (**"LDHL"**) with any selectee. Since CH-I (**"Defendant"**) was shortlisted as the selectee for substituting LDHL with an SPV held by it or its associate, it was impleaded as a defendant in the said commercial suit by an order dated February 11, 2019. The High Court by way of its order dated February 18, 2019 stated that CH-I was required to pay transaction consideration after the Original Defendants have granted no objection. Pursuant to the aforesaid order, the transaction was closed and supplementary concession agreement was executed by NDEPL. While CH-I continues to be a party to the said suit, the outstanding issue is with reference to the distribution of consideration. Thus, CH-I has filed an application for removal of its name as a defendant to the suit. The matter is currently pending.

ii. CH-II (**"Plaintiff"**) has filed a commercial suit before the High Court of Bombay (**"High Court"**) against IL&FS Transportation Networks Limited (**"ITNL"**), Infrastructure Leasing and financial Services Limited (**"IL&FS"**) and Chenani Nashri Tunnelway Limited (**"CNTL"**) (collectively, referred to as **"Defendants"**) seeking, inter alia, (a) specific performance of the share purchase agreement (**"SPA"**) executed between the Plaintiff and the Defendants in relation to transfer of 100% shareholding of ITNL in CNTL to the Plaintiff; (b) mandatory injunction against the Defendants to extend the long stop date (as defined in the SPA) up to ninety days after receipt of all approvals and fulfilment of all conditions. The Hon'ble Bombay High Court passed an

interim order dated September 14, 2021 directing the Plaintiff to file an application before the National Company Law Tribunal, Mumbai (**"NCLT"**). Subsequently, the Plaintiff filed an application before the NCLT. The Plaintiff also approached the Bombay High Court seeking injunction to restrain the Defendants from divesting, disposing of, transferring, alienating, or creating any other interests in the shares of CNTL otherwise than under the SPA. The High Court in its order dated November 25, 2021 recorded that any decision at the behest of IL&FS and ITNL cannot prejudice any rights and contentions of Plaintiff. The matter is currently pending before the NCLT.

iii. N. Vijaya Kumar (**"Petitioner"**) has filed a writ petition against KNR Tirumala Infra Private Limited (**"Respondent"**) before the High Court of Andhra Pradesh at Amaravathi (**"High Court"**) seeking a writ of mandamus. The Petitioner prays for declaration of the act of permanently covering up Mungilipattu Kaluva water channel a natural spring stream channel by the Respondent as illegal, improper and unconstitutional. The Petitioner also seeks relief to direct the Respondent to restore Mungilipattu Kaluva water channel by constructing proper drainage systems to ensure the free flow of the water channel. The petition is currently pending and is at the stage of admission

Note- The Management do not expect any liabilities to arise out of these litigations, and hence we have not factored any impact of these in our valuation.

.

IV. Ongoing Litigations for Direct Tax

Sl No	SPV	Assessment Year (AY)	Forum where dispute is currently pending	Amount Involved (millions)- Income/additions made by the department	Remarks
1	JMTL	2013-14	271(1)(c)	Penalty proceedings- Not Yet assessed by the department	No tax outflow on account of additions made by the AO. SPV has merits to get the order in favour.
2	JMTL	2016-17	154	21.2	Demand was raised by the department on account of wrongly set off of carried forward losses. SPV is not required to pay any demand.
3	JMTL	2017-18	ITAT	21.8	Arm's length price i.e. interest rate on debentures issued to Associate enterprises calculated by the department is less that the interest rate considered by the SPV. SPV has merits to get the order in favour
4	JMTL	2017-18	270A	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
5	JMTL	2018-19	154	-	Demand of Rs. 0.91 lacs was raised by the department on account of wrong calculation of interest under section 244A. SPV is not required to pay any demand.
6	MBEL	2010-11	CIT(A)	521.0	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
7	MBEL	2010-11	271(1)(c)	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
8	MBEL	2011-12	CIT(A)	346.4	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
9	MBEL	2011-12	271(1)(c)	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
10	MBEL	2012-13	CIT(A)	493.9	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.

11	MBEL	2013-14	ITAT	640.0	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
12	MBEL	2014-15	ITAT	294.4	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
13	MBEL	2017-18	ITAT	30.5	Arm's length price i.e. interest rate on debentures issued to Associate enterprises calculated by the department is less that the interest rate considered by the SPV. SPV has merits to get the order in favour
14	MBEL	2017-18	270A	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
15	MBEL	2018-19	270A	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
16	NAMEL	2018-19	270	Penalty proceedings- Rs. 2.5 million	No tax outflow on account of additions made by the AO. SPV has merits to get the order in favour
17	WUPTL	2017-18	ITAT	105.3	Arm's length price i.e. interest rate on debentures issued to Associate enterprises calculated by the department is less that the interest rate considered by the SPV. SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
18	WUPTL	2017-18	270A	Penalty proceedings- Not Yet assessed by the department	No tax outflow on account of additions made by the AO. SPV has merits to get the order in favour
19	WUPTL	2018-19	ITAT	120.6	Arm's length price i.e. interest rate on debentures issued to Associate enterprises calculated by the department is less that the interest rate considered by the SPV. SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.

20	APEL	2010-11	High Court	857.7	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
21	APEL	2011-12	CIT (A)	675.7	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
22	APEL	2012-13	CIT (A)	508.8	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
23	APEL	2013-14	CIT (A)	299.8	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
24	APEL	2014-15	CIT (A)	197.9	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
25	APEL	2015-16	CIT (A)	111.2	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
26	APEL	2017-18	143(3)	337.4	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
27	APEL	2017-18	270A	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour
28	APEL	2018-19	CIT(A)	493.3	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.
29	APEL	2018-19	270A	Penalty proceedings- Not Yet assessed by the department	SPV has merits to get the order in favour

30	WVEPL	2014-15	CIT(A)	40.1	SPV has merits to get the order in favour.
31	DATR	2017-18	CIT(A)	87.7	SPV has merits to get the order in favour
32	DATR	2020-21	143(3)	329.6	Assessment order was passed on 30 August 2022 wherein returned income has been accepted (clean order). However, erroneous demand of INR 32.96 Cr raised due to incorrect computation. SPV has filed CIT(A) on 28 September 2022.
33	GAEPL	2017-18	CIT(A)	2460.0	SPV is not required to pay any demand even if it does not get favourable order from the Judicial Authorities. Brought forward losses will come down to that extent of disallowance.

Note 1 - On-going regular assessments of various entities are not mentioned above since the specific issues are not picked up by the department

Note 2 - The Management do not expect any liabilities to arise out of these litigations, and hence we have not factored any impact of these in our valuation.

V. Ongoing Litigations for Indirect Tax

Sl No	Entity Name	FY	Pending Before	Regime	Demand (in INR millions)	Issue involved
1	WUPTL	2013-14	Appeal	VAT/ Entry Tax	16.0	SPV has merits to get the order in favour
2	WUPTL	2015-16	Appeal	VAT/ Entry Tax	12.1	SPV has merits to get the order in favour
3	WUPTL	2016-17	Appeal	VAT/ Entry Tax	- (Matter remanded back to re-assessee. AO to issue fresh notice)	During the year assesse has carried out major maintenance work which was outsourced to registered dealer. Required WCT was recovered and deposited with the authority. Hence the same should be exempted. SPV has merits to get the order in favour.
4	WUPTL	2017-18	Re-open	VAT/ Entry Tax	20.7	SPV has merits to get the order in favour
5	WVEPL	2017-18	Company is in process of filling the appeal	GST	1.2	SPV has merits to get the order in favour
6	FRHL	2015-16	Re-open	VAT/ Entry Tax	1.2	SPV has merits to get the order in favour
7	FRHL	2016-17	Appeal	VAT/ Entry Tax	0.2	SPV has merits to get the order in favour
8	GAEPL	2013-14	Appeal	VAT/ Entry Tax	4.9	SPV has merits to get the order in favour
9	GAEPL	2014-15	Appeal	VAT/ Entry Tax	7.8	SPV has merits to get the order in favour
10	GAEPL	2016-17	Appeal	VAT/ Entry Tax	0.3	SPV has merits to get the order in favour
11	GAEPL	2017-18	Appeal	VAT/ Entry Tax	0.2	SPV has merits to get the order in favour

Note 1 - On-going regular assessments of various entities are not mentioned above since the specific issues are not picked up by the department.

Note 2 - The Management do not expect any liabilities to arise out of these litigations, and hence we have not factored any impact of these in our valuation.

6 Other Disclosures

6.A Details of revenue pendencies including local authority rates associated with SPV and compounding charges

As given to understand by the Management, the InvIT Assets do not have material dues including local authority taxes (sum as Municipal Tax, Property Tax, etc.) pending to be payable to the government authorities with respect to the SPVs (InvIT assets)

6.B Vulnerability to natural or induced hazards that may not have been covered in town planning/building control

As given to understand by the Management, the InvIT Assets are not vulnerable to natural or induced hazards which have not been considered in town planning/building control.

6.C The nature of the interest the InvIT holds or proposes to hold in the project, percentage of interest of the InvIT in the project

The InVIT proposes to own 100% interest in the InVIT Assets except for MBEL. In the case of MBEL, the InVIT proposes to own 99.97% interest.

6.D Any other matters which may affect the project or its value

There are no other matters which may affect the project or its value.

ANNEXURE B

TECHNICAL REPORTS

(*The remainder of this page is intentionally left blank*)

TECHNICAL DUE DILIGENCE REPORT

ANDHRA PRADESH EXPRESSWAY LIMITED

Report Number:

ACM-60655667-TDD-AP-001-R0

Date:

June, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Andhra Pradesh Expressway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Andhra Pradesh Expressway Limited (APEL)**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Andhra Pradesh Expressway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset No. 5B,
Aerocity Hospitality District, IGI Airport,
New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 3

1.1 Basis of Preparation 3
1.2 Scope of Works 3
1.3 Overview of the Project 4
1.4 Key Findings 5
1.5 Asset Condition 9
1.6 Toll Plaza and TMS 11
1.7 Change of Scope (COS) 11
1.8 Balance Work 15
1.9 Requirement of O & M and Periodic Maintenance as per Concession Agreement 15
1.10 Insurance 16
1.11 Introduction of Asset 17
1.12 Review of Pavement 19
1.13 Major Maintenance 24
1.14 Operation & Maintenance Works 25
1.15 Major Maintenance Cost 27
1.16 List of Document Reviewed 27

2 PAVEMENT EVALUATION AND TEST 29

2.1 Background 29
2.2 Objectives 29
2.3 Pavement Design 29
2.4 Review of Pavement Design 30
2.5 Survey and Investigations 30
2.6 Roughness Survey using Network Survey Vehicle (NSV) 30
2.7 Test Pit 32
2.8 Core Test 33
2.9 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 34
2.10 Axle Load Survey 35
2.11 Homogeneous Section and Design MSA 36
2.12 Determination of Pavement Major Maintenance 36
2.13 TMS and HTMS 38
2.14 Road Safety Assessment 43

3. CAPEX REQUIREMENT 45

3.2 Immediate Repair & Rehabilitation Work 45
3.3 Balance Work as per Original Scope of Work 45

4. MAJOR MAINTENANCE COST 46

4.1 Major Maintenance Cycle 46
4.2 Major Maintenance Quantity 46
4.3 Unit Rate Analysis 46
4.4 Cost Estimate 48

5. OPERATION AND MAINTENANCE COST 50

5.2 Introduction 50
5.3 Forecast Methodology 50
5.4 Requirement of CA (Schedule L and Concession Agreement) 51
5.5 Routine and Preventive Maintenance 51
5.6 Highway Lighting 51
5.7 HTMS 52
5.8 Corridor Management 52
5.9 Manpower Cost 52
5.10 Office Expenses 52

6. PROJECT ROAD ANALYSIS 54

6.1 Reconnaissance Survey 54
6.2 Road Inventory and Condition Survey 54

6.3 Structure Inventory and Condition Survey 74

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract	FOB	Foot Over Bridge
APEL	Andhra Pradesh Expressway Limited	FWD	Falling Weight Deflectometer
ATMS	Advanced Traffic Management System	GAD	General Arrangement Drawing
BC	Bituminous Concrete	GSB	Granular Sub-base
BHS	Both Hand Side	GST	Goods and Services Tax
BI	Bump Integrator	HSYD	High Yielding Strength Deformed
BOQ	Bill of Quantity	IE	Independent Engineer
BT	Bituminous Top	INR	Indian Rupees
CA	Concession Agreement	IRC	Indian Road Congress
CAPEX	Capital Expenditures	KVA	Kilo-Volt-Ampere
CC	Control Centre	LCV	Light Commercial Vehicle
CCTV	Closed Circuit Television Systems	LED	Light Emitting Diode
CMSA	Cumulative Million Standard Axles	LHS	Left Hand Side
COS	Change of Scope	LIU	Light Interface Units
COD	Commercial Operation Date	LVUP	Light Vehicular Underpass
CUP	Cattle Underpass	MAV	Multi Axle Vehicle
DBM	Dense Bituminous Macadam	MCA	Model Concession Agreement
DG	Diesel Generator	MCW	Main Carriageway
DLC	Dry Lean Concrete	MDS	Metrological Data Station
ECB	Emergency Call Box	MET	Metrological
EPC	Engineering, Procurement, and Construction	MIS	Management Information System
ESAL	Equivalent Standard Axle Load	MJB	Major Bridge
ETC	Electronic Toll Collection	MNB	Minor Bridge
FO	Flyover	MoRTH	Ministry of Road Transport and Highways

MSA	Million Standard Axles
NH	National Highway
NHAI	National Highways Authority of India
NSV	Network Survey Vehicle
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RHS	Right Hand Side
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SR	Service Road
TMS	Toll Management System
VDF	Vehicle Damage Factor
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Andhra Pradesh Expressway Limited ("APEL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Kotakatta - Kurnool Section of NH 7 (New NH 44) on BOT (Annuity) Basis in the State of Telangana and Andhra Pradesh (herein after refer as "the Project") which is being operated by "M/s Andhra Pradesh Expressway Limited" (hereinafter refer as "the Concessionaire or Company or APEL").

1.2 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.

In this report, AECOM provides an overview of the asset based on site survey on Year 2020 from technical perspective, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

- Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

Project Document:

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepare by IE
- Test Report

- Traffic Data

1. Test Report:
   - Axle Load Survey Data with VDF
   - NSV Survey Data
   - FWD Test Report with analysis
   - Test Pit and Core Test Report

Apart from data room, information / data provided thorough email has also reviewed and included in this report.

- Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.3 Overview of the Project

Agreement was signed between National Highways Authority of India (NHAI) and M/s Andhra Pradesh Expressway Limited, a Company promoted and incorporated by M/s IL&FS for "Design, Construction, Development, Finance, Operation and Maintenance of Km 135.469 (End of Proposed Kotakatta Bypass) to Km 211 (Kurnool) on NH-7 (New NH-44) in the State of Andhra Pradesh under North-South Corridor (NHDP Phase II) in BOT (Annuity) Basis" (hereinafter called "the Project" or "the Project Road").
Cube Highways completed the 100% acquisition of the project in Year 2017 and has been operating the project road in the same name as the former Concessionaire i.e. M/s Andhra Pradesh Expressway Limited.

Project Name	4 Laning of Kotakatta (km. 136+077) to Kurnool (Km. 210+699) on NH-44 (NH-7) in the state of Andhra Pradesh under North South Corridor (NHDP Phase II) on BOT (Annuity) Basis.
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways
Concessionaire	M/s Andhra Pradesh Expressway Limited.
Independent Consultant (During Construction)	M/s Aarvee Associates Architects Engineers and Consultants Pvt. Ltd
Independent Consultant (During O & M)	M/s MSV International Inc.
EPC Contractor	M/s KMC Constructions Limited
Project Road Length	74.622 km
Project Cost	Rs. 611 Crores
Annuity	Rs. 56.52 Crores

Date of Concession Agreement	20 Mar 2006
Appointed Date	15 Sep 2006
Concession Period	20 years from the appointed date
Construction Period	910 Days
Schedule Date of COD	15 Mar 2009
Actual Date of COD	30 Sep 2009
Date of Final Completion Certificate	Not Issued
O & M Contractor	1) Routine, Cleaning, Maintenance and Horticulture Work: M/s Inckah Infrastructure Technologies Private Limited 2) Route Patrolling & Incident Management: M/s Inckah Infrastructure Technologies Private Limited 3) Rehabilitation, Overlay and Microsurfacing for Periodic Maintenance: M/s Mark-O-Lines Traffic Controls Private Limited 4) Security Services M/s Perfect security and Allied Services
Number of Toll Plaza and Lanes	1 Toll Plaza at Km 200+700 (Pullur) with 6 Lanes (5+1 Lanes) in each direction (project is under Annuity
End of Concession Period	30 Sep 2026 (20 years from Appointed Date)

Source: IE MPR Sep 2019, O & M Contracts, Concession Agreement

1.4 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (COD)	Project Road entered into the commercial operation after, PCOD was issued on 30 Sep 2009 along with the Punch List Items. However, with works relating to Service Road and Wayside Amenities still balance, Final Completion Certificate has not yet been issued.	🟠
Operation and Maintenance	As per Section XVIII of Concession Agreement, Concessionaire shall maintain project highway in conformity with Maintenance Requirements, the Maintenance Manual or Maintenance Program as the case may be. Concessionaire is fulfilling O & M obligations and there is no adverse comment from IE. As per O & M Inspection Report pursuant to Sub Clause 19.2 of Concession Agreement prepared by IE, Concessionaire is advised to carryout day to day routine maintenance activity no major defects has identified. Some of O & M issued along project corridor are • Missing taps in water tank at Bus Bays • Weeds / grass in median • Damaged KM / Hecto Stone • ROW clearance • Hazard Marker board damaged	🟢

Diligence Area	Findings	Risk
Major Maintenance (MM)	As per Schedule L (Page No L-18), Overlay of required thickness is to be required when surface roughness is exceeding 3000 mm / km or every five (5) yeas, after initial construction whichever is earlier to bring it to less than 2000 mm. Also, renewal coat and structural overlay is required when characteristic deflection exceeds 1.20 mm. As per Sub Clause 4.3.2.3 of Schedule L, renewal / strengthening course to be provided on as required basis (once 5 years). Major maintenance at majority of location was completed and work in progress at balance length while visiting site on Oct 2019. MM cycle for balance concession period shall be 1. Year 2023/24 - MM Cost 97.07 crore with Escalation as on FY 2022.	
Maintenance Manual and Yearly Program	As per Article 18.3 of Concession Agreement, Concessionaire required to submit proposed Programme not later than 45 days before beginning of each accounting year. Concessionaire Maintenance Program for Year 2019/20 has been submitted on 8 Feb 2019.	
Pavement Design	Pavement design was done and approved by Independent Consultant for 15 year of design traffic as per IRC 37-2001 considering 8 % CBR. Key fact of pavement design is as follows: a) Pavement design for 15 years b) Design Traffic 86 MSA till year 2022 c) Total Traffic till year 2026 - 122 MSA Adopted Pavement thickness are BC - 50 mm, DBM - 135 mm, WMM - 250 mm and GSB - 230 mm. Adopted pavement design for MCW is in line with the Schedule-B. Pavement was designed upto 2022 and additional two cycles of overlay (min 40mm BC on each cycle) has provided in year 2014 Year 2019. Further, one cycle of MMR is to be provided before end of Concession Period in year 2023/24, therefore pavement is expected to suffice the requirements till the end of Concession Period. Similarly, for Service/Slip road following Pavement Thickness are adopted: SDBC - 25 mm, BM - 75 mm, WMM – 250 mm, GSB – 150 mm. The pavement design adopted for the Service/Slip road is in line with Schedule-B provision.	
Pavement Condition	With Major Maintenance (Overlay) of the project road currently under progress and nearing completion, the pavement condition of the entire project road is observed to be in Good condition.	
Pavement Condition Survey Test	Concessionaire conducted Roughness Survey and FWD Survey before carrying MMR in Apr 2018. Roughness Survey and BBD / FWD Test after MMR is awaited As on Jan 2020.	
Penalty/Damage	Due to delay in carrying MMR by former Concessionaire in year 2014, IE recommended for Penalty vide letter no. MSV/HYD/NHAI/AP-5/2018/1294 dated 24.02.2018 of amounting to Rs.14,97,64,248/-. As per IE letter, Concessionaire was supposed to complete MMR by 29 Sep 2014 but actually completed in 2 Dec 2015 thereby delay by 428 days. This penalty amount was not settled by former Concessionaire and has to be settled by Concessionaire / Company. As per the recent discussion with the Client, it is understood that this the Authority has deducted the amount from the Annuity payable to the client and the penalty has been settled.	

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td>Change of Scope</td><td>Following COS works have been identified in the project road:
<table>
<tr><th>Sn</th><th>Description of Work</th><th>Amount (INR) incl. GST</th><th>Work Status</th></tr>
<tr><td>1.</td><td>Construction of VUP at Km 207+170 at Venkataramana Colony Junction</td><td>Rs. 19.14 Cr.</td><td>Under Construction / Box Type of Structure Completed and approaches balance.</td></tr>
<tr><td>2.</td><td>Mitigation of Blackspot at 5 Locations:
1) Kondair Bus Stop (TG-011)
2) Itikyalapadu Stage (TG-013)
3) Manopadu X-road (TG-0220
4) Undavelly Stage (TG-031)
5) Vemulla Stage (TG-063)</td><td>Rs.1,98,54,714</td><td>Completed /
Storage Lanes provided at Median Openings</td></tr>
<tr><td>3.</td><td>LVUP at Km 169+550 near Zinkalapalli Junction for Mitigation of Blackspots</td><td>Rs. 9,53,15,851</td><td>Submitted revised drawings are approved vide Lr No. MSV/HYD/AP-5/COS/2019/2518 Dt: 23.07.2019
The RO expressed the revised plan during the review meeting on 06.08.2019 which may increase the cost of VUP about 36 Cr</td></tr>
</table>
COS amount is as per current market rates. However, it is learned from site pending of VUP approach at Km 207+170 is due to non-availability of filling material. It is advised to pay attention towards completion of approach to avoid cost and time overrun.</td><td>●</td></tr>
<tr><td>Balance Work</td><td>Following balance work has noted
a) Construction of 170m of Service Road at Kurnool Stretch (Km. 209+080 to Km. 209+190 LHS and Km. 209+340 to Km. 209+400 LHS)
b) Construction of Wayside Amenities/Rest Area at Km 154+050 RHS on Pebbair Bypass
c) Construction of Wayside Amenities / Rest Area near KM 200 is in progress and it is nearer to completion
The above balance Works were pending due to the unavailability of land. As per AECOM estimate balance work cost excluding Wayside Amenities at KM 200 is 3.19 crore including GST.</td><td>●</td></tr>
<tr><td>Toll Plaza</td><td>There is one toll plaza at KM 200 having 6 + 6 lanes. Flexible pavement has provided at tapper portion and center portion of toll lanes has provided with rigid pavement. Since, the project road is under Annuity, operation of toll plaza is not included in scope of work during Operation and Maintenance period.</td><td>●</td></tr>
<tr><td>HTMS</td><td>Per Schedule C, following equipments are to be installed as HTMS. The status of equipment (as per IE Inspection Report Sep 2019) is as follows:
- Emergency Communication System – 74 nos out of which 4 nos are not working
- Mobile Communication System – Not Provided
- Variable Message System – 14 nos out of which 1 nos not working
- Meteorological Data System – 3 nos all are working condition</td><td>●</td></tr>
</table>

Diligence Area	Findings	Risk
	- Automatic Traffic Counter – cum – classifier – 2 nos in working condition - CCTV – 4 nos and all are in working condition	
Major Issue Identified by IE	Referring to IE Inspection report of Sep 2019, the following issues has flagged: - Water Tanks provided at Bus Shelters, but taps are missing - Weeds / grasses at Median required pruning and grass cutting - KM & HM damaged - ROW Cleaning - Damaged Sign Board - Shoulder Rectification AECOM team also noted above issues during site visit.	
Road Safety	Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement. State Government has identified following Black Spot and remedial measures has provided under COS as follows: - TG 011 (Kondair Bus Stop) – Work completed - Kondair Bus Stop (TG-011) – Work completed - Itikyalapadu Stage (TG-013) – Work completed - Manopadu X-road (TG-022) – Work completed - Undavelly Stage (TG-031) – Work completed - Vemulla Stage (TG-063) – Work completed - Manopad X Junction (TG – 022) – VUP work in progress - Zinkalapalli (TG – 030) – COS issued for LVUP but opposed by Local As per AECOM site visit, following additional measures are recommended to enhance safety for road users: o Provide blinkers at all median opening on both sides o Provide missing median plant to reduce glare affect during night o Antiglare arrangement at narrow median (width less than 2 m) Safety Audit through independent agency (M/s VR Tech) has conducted in the month of Mar 2019. It is recommended to implement suggestion made by the Safety Consultant.	
Geometric Design	The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows: Design Speed – 100 kmph, Minimum Radius 400 m as ruling and 250 m as absolute minimum, K value for Summit Curves 70 and Valley Curves 42 for Stopping Sight Distance. Project road confirms requirement of Schedule D.	
As-Built Drawing	As per provision of Contract Sub Clause 33.2 (iv), the Concessionaire is to deliver relevant records and reports pertaining to the Project Highway and its design, engineering, construction, operation and maintenance including all and all operation and maintenance records and programmes and manuals pertaining thereto and complete As-Built Drawing on the Date of Divestment. Soft copy has provided and found to be in order and site team confirms having of Signed As-Built Drawing at project office at Toll Plaza.	
Handback Requirement	As per Clause 33.2 of Concession Agreement, all project assets including the road, pavement, structure and equipment shall have been renewed and	

Diligence Area	Findings	Risk
	cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in this Agreement. Also following requirements have been specifically stated in the CA: I. All sections of traffic lane shall have a roughness value not more than 2500 mm. II. All Lamps shall be in working condition Also, as per Clause 34.11 of CA, NHAI shall hold a sum equal to 15% of Annuity or higher sum estimated by IE for renewal works shall be retained in Escrow Account provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, no such retention shall be made. 50% of sum retained in accordance to this Clause shall be released from Escrow Account to Concessionaire within 14 days, if it is agreed that no renewal works are required following Second Inspection. AECOM understands that the 40 mm BC provided on MMR cycle on FY 2024 shall suffice this requirement. Similarly, maintenance and replacement of all lamps shall be covered by the annual O&M estimates. Additionally, all other defects and rectification relating to the asset is covered under the O&M and MMR estimate.	

1.5 Asset Condition

In general, the condition of asset is in Good condition at the time of Oct 2019. As per AECOM study, with existing arrangement for Operation and Maintenance and with every 5 years cycle of Major Maintenance (Overlay) cycle, project road will continue to fulfill Level of Service as set forth in Schedule L and O&M Requirement of Concession Agreement except some improvements are required:

a. Safety enhancement
b. Roughness Survey and BBD Survey to be conducted as per frequency stated in Schedule-L.

The summary of asset condition (As of Oct 2019) is tabled as follow:

Sn	Asset	Condition
1	Main Carriageway	Project Road is the 74.622 km long 4 Lane dual carriageway road with paved and earthen shoulder on either carriageway. Typically, the paved width of the MCW is 8.75m except at few GS structure approaches and bridges. With one cycle of MMR already completed in the year 2015 and second cycle currently under progress and near completion by the end of 2019, the pavement condition of the entire project road is Good and expected to fulfill its functional requirements till the end of Concession Period.
2	Service/Slip Road	16.358 km of Service/Slip Road is present in the project road. Like Main Carriageway, the overlay is currently on progress on Service/Slip Road as well. Hence, the overall condition of the service / slip road is good. However, construction of about 170m of Service Road remains balance in the project road on LHS at Km 209+080 to Km. 209+190 and Km 209+340 to Km. 209+400, due to the land issues.
3	Median	Entire project road has Raised median which is generally 4.5m wide except at about 2.5km length in Kurnool where narrow median of

Sn	Asset	Condition
		about 1.5m width is provided. Wider medians of over 10m width and differential carriageway are present in bridge approaches. Plantation along the median is found to be in good condition except 15 km length required pruning / removal of grasses.
4	Median Opening	58 nos. of Median Openings are found on the project road. Most of the medians are found to be provided with Solar Blinkers, Metal Beams and properly placed traffic signs. Shelters lanes has not provided in 10 median opening.
5	Drainage arrangement	Drainage condition in general found in order. RCC lined drains has provided along edge service/slip roads. Median Cut Drains and Median Drain has been arranged to drain out water from the superelevated sections of the project road. Chutes has provided in the high embankment sections.
6	Major and Minor Junctions	8 Major and 48 Minor Junctions were recorded during the site visit. Major junctions are provided with High Mast Lights.
7	Safety Barrier and Guard Stones	46.240 km of Metal Beam Crash barriers was present at carriageway edges at high embankment locations, narrow medians, for protection of ECB, structure approaches and at crossroads at some junctions. Similarly, RCC Crash Barrier/Railings are present in structure approaches, bridges and underpasses. In addition to these, 1473 nos. of Guard Stones are also found in the project road. The condition of these are generally found to be fair.
8	Pedestrian Guard Rail (PGR)	7.818 km of PGR are at the carriageway edges on separators between the Service Road and Main Carriageway. Condition of PGR is generally found to be Fair to Poor condition. About 430m of PGR is found to be missing/damaged condition.
9	Toll Plaza	Single Toll Plaza is present in the project road at Km 200+700 with (5+1) x 2 Lane Configuration. Since, the project is under Operation in BOT (Annuity) Mode, toll collection is not in the Scope of Concessionaire.
10	Highway Lighting and High Mast	Highway Lighting is provided in approaches to GS, Truck Lay-bye and Toll Plaza approaches. About 20 km of Highway Lighting is provided in the project. Additionally, 15 nos. of High Mast Lights are provided at Major Junctions and Toll Plaza locations. Most of the lights provided in the lights are LED and few are mostly found in functional condition.
11	Bus Bays and Bus Shelters	49 Bus bays with shelter are present along the project road. All the bus shelters are made up of concrete and found to be in good condition. All Bus bays are provided with drinking water facility, but taps are missing.
12	Truck Laybys	4 truck lay byes are present in the project road with Lighting and Toilet Blocks on each of them. Rigid Pavement is provided in these truck lay-byes. Overall condition of the truck lay-bye is fair.
13	Wayside Amenities	Two Wayside Amenities Complex (Rest Areas) are to be provided in the project road as per Concession Agreement. Currently, one Wayside Amenities Complex is under construction in the project road at Km 200+100. One more Wayside Amenities Complex to be provided at Km 154+000 in Pebbair Bypass is pending due to land issue.
14	HTMS	ECBs, VMS, CCTV, MET and ATCC has provided in the project road as the part of HTMS as per Schedule C. The condition of HTMS equipment are in order except some minor issues.

Sn	Asset	Condition
15	Traffic Sign and Marking	1609 nos. of Traffic Sign boards are present as per site inventory. The condition of most sign boards was found to be Fair condition. Since the project road is recently overlaid, road marking is currently under progress on the project road.
16	Major Bridge	3 Major Bridges has provided in the project road. Generally, all the bridges were found to be in the good condition except some minor issues in expansion joints and safety barriers.
17	Minor Bridge	37 Minor Bridges has provided in the project road. Generally, the condition of Minor Bridges are found in Fair to Good except few minor issues observed in the expansion joints and bearings of some minor bridges.
18	Flyover/Grade Separators	2 Flyovers has provided in the project road. General condition of the flyover is good.
19	Underpasses	3 nos. PUP, 1 no. CUP and 2 VUPs (incl. 1 no. Under construction) has provided in the project road. All underpasses were found to be in good condition.
21	ROB	1 ROB has provided in the project corridor and is found to be in good condition.
22	Cross Drainage	149 nos. of Culverts have been provided along project road. Except serious damage on the Head Wall of one of the HPC, other culverts were found to be in fair to good condition.

1.6 Toll Plaza and TMS

Toll Plaza of 12 lanes has provided at KM 200.700. Since the project in Annuity mode, tolling is being done by agency appointed by NHAI.

NHAI issued circular on 30 Nov 2017 for installation of Hybrid ETC lane at all toll lane and NHAI shall borne all cost of equipment and O & M cost under COS. Concessionaire has installed Hybrid ETC system at all toll lanes and MSWIM under COS. Existing toll lane configuration with type of equipment is summarized as follows:

Item	TP 1 (Km 200.700)
Total Number of Lane	12
Total number of Regular Lane	10
Total Number of Extra Width Lane	2
Tolling Equipment	
Number of Dedicated ETC Lane	-
Number of Hybrid ETC Lane	12
Number of Reversible Lane	-

Operation and Maintenance of Toll of Toll Plaza and allied systems is not in Scope of Concession Agreement.

1.7 Change of Scope (COS)

As per Article XVIL, Sub Clause 17.1 to 17.4, NHAI may, notwithstanding anything to the contrary contained in the Agreement, require provision of such addition / deletion to the works and services on or about the Project Highway which are beyond the scope of Project as contemplated

by the Agreement. All such changes shall be made by NHAI by an order ("the Change of Scope Order"). The list of COS along with status of COS order is tabled below:

SL.NO	SUBJECT	SUBMITTED BY CONCESSIONAIRE	RECOMMENDED BY IC	APPROVED BY NHAI-PIU	RO- NHAI Approval	Remarks
		REFERENCE	REFERENCE	REFERENCE	REFERENCE	
1	COS Proposal for Installation of WIM	LDHL/Tech/2015-16/0151 Dated 02.02.2016 Rs. 3.22 Cr.	Theme/BLR/O&M/115/NH-58/360 dated 04.02.2016	NHAI/22015/1/10/PIU-HSN/312, dated 29.10.2016 Rs. 3.08 Cr	NHAI/RO-BNG/11018/07/2016-17/1702, dated 28.07.2016 NHAI/RO-BNG/End To End TMS/2016/1676, dated 28.07.2016	Work is in Progress
2	Implementation of dedicated ETC	LDHL/Tech/14-15/9867, Dated 11.10.2014	Theme/BLR/O&M/120/NH-48/2014/49, Dated 13.10.2014	NHAI/14024/1/07/PIU-BNG/2904, Dated 13.10.2014	NHAI/RO-BNG/ETC/2014/2605 Dated 27.10.2014	work completed & Amount Released
3	Implementation of ETC on pan India basis-Segregation traffic island for ETC lanes-Submission of COS Positive proposal under clause 17 of CA	LDHL/Tech/2015-16/0122 dated 09.12.2015 Rs. 6.39 Lakhs	Theme/BLR/O&M/115/NH-48/499 dated 16.06.2016 Rs. 3.65 Lakhs	NHAI/22015/1/10/PIU-HSN/815, dated 22.02.2017	NHAI/RO-BNG/ETC/10/2016/3634, dated 31.01.2017	work completed & Amount Released
4	Submission of COS for Providing Hordings and Dust Bins at Toll Plazas under Swachh Bharat Mission	LDHL/Tech/2016-17/0125, dated 19.09.2016 Rs.6.22 Lakhs	Theme/BLR/O&M/115/NH-48/634 dated 18.11.2016 Rs.6.22 Lakhs	Rs.6.22 Lakhs	NHAI/RO-BNG/23018/01/2016/3452, dated 16.01.2017 Rs.6.22 Lakhs	work completed & Amount Released
5	Construction of New Bus Shelter at Sahukarpalya Village in Project Highway under COS of Clause 17 Of CA	LDHL/Tech/2015-16/009, dated 25.05.2015 Rs.3.25 Lakhs	CEG/KJ/NH-48/2013/1.3/488, dated 12.06.2013 Theme/BLR/O&M/115/NH-48/192 dated 22.06.2015 Rs.2.13 Lakhs	NHAI/14024/01/07/PIU-BNG/50, dated 03.04.2014 Rs.2.13 Lakhs	-----	Work completed but amount not yet received
6	Submission of COS for Providing Toilets under Swachh Bharat Mission	LDHL/Tech/2016-17/0121, dated 14.09.2016	Theme/BLR/O&M/115/NH-48/594 dated 28.09.2016 Rs. 52.52 Lakhs	NHAI/14024/01/07/PIU-BNG/324, dated 24.10.2016 Rs. 52.52 Lakhs	NHAI/RO-BNG/23018/01/2016/2582, dated 19.10.2016 Rs. 52.52 Lakhs	Work is in Progress (2 completed out of 4)

SL.NO	SUBJECT	SUBMITTED BY CONCESSIONAIRE	RECOMMENDED BY IC	APPROVED BY NHAI-PIU	RO- NHAI Approval	Remarks
		REFERENCE	REFERENCE	REFERENCE	REFERENCE	
7	COS proposal for upgrading Cart Track to Service Road from 65+000 to 80+000 (LHS & RHS)	LDHL/Tech/2017-18/0146 & 147, dated 26.09.2017	MSV/NLG/O&M/NHAI/2017-18/21 Dated 29.12.2018 Rs.40 Cr.	NHAI/25011/1/PIU-Hassan/2017/1646 Dated 09.01.2018 Rs.40 Cr.	Pending	Rs.40cr.
8	COS proposal for Service Road & Minor Bridge at CH: 87+230 to 90+400 LHS	email dated 23.09.2017	MSV/NLG/O&M/NHAI/2017-18/46 Dated 07.03.2018 Rs.5.63 Cr.	NHAI/25011/1/PIU-HSN/2017/1981-A, Dated 15.03.2018 Rs.5.63 Cr.	Pending	
9	Enhancement of ETC Infrastructure on all the lanes at Toll Plazas along the National Highways on Hybrid ETC Mode – Revised submission of Positive Change of Scope	LDHL/Tech/2018-19/002, dated 06.04.2018 Rs.2.75 Cr.	MSV/NLG/O&M/NHAI/2017-18/65 Dated 10.04.2018 Rs.2.75 Cr.	Pending	-----	

1.8 Balance Work

Although most of the works as per the Scope of Work has been completed, few works are still balance in the project road. Summary of Balance Works along with their cost estimate is presented in the table below:

Sn	Description of Work	Location	Status	Estimated Cost of Balance Work , INR (in Crores)	Remarks
1	Construction of Service Road at Kurnool Stretch	Km. 209+080 to Km. 209+190 LHS Km. 209+340 to Km. 209+400 LHS	Pending due to land not handed over by NHAI	0.63	
2	Wayside Amenities (Rest Area)	Km 154+050 RHS on Pebbair Bypass	Pending due to land not handed over by NHAI	2.21	Other Rest Area at Km 200+100 is near Completion
		Total (1 & 2)		2.85	
		GST 12%		0.34	
		Grand Total (Rs.)		3.19	

Construction of Way Side Amenities at Km 200+100(LHS) is in progress. The above balance work cost does not include cost of Wayside Amenities at Km 200+100 (LHS) which is currently under construction and nearer to completion.

1.9 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule L, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

1. Ensure the safety of personnel deployed on and users of the project facilities or part thereof
2. Keep the Project Facilities from undue deterioration and wear

3. Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule L elaborates requirement various service factor desirable level and acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (Overlay) is required to be provided at least once in every 5th year (from COD) and in the last year of concession period. Also, overlay is required if Characteristic Deflection is more than 1.20 mm and roughness value exceeded more than 3000 mm / km.

Analyzing the FWD Test Results provided by the client, ongoing overlay at site, estimated design traffic and with the next mandatory cycle of Overlay to be provided no later than FY 2024 (as proposed by AECOM), it is concluded that no additional Structural Overlay apart from MMR Cycles proposed by Consultant will be required to cater the traffic till the end of Concession Period.

1.9.1 Staff Requirement for Operation and Maintenance

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at Toll plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.9.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	Out source
2	Preventive Maintenance	Out source
3	Operation cost of and Administration Building	In House
4	Security Services	Out Source
6	Maintenance of HTMS	Out Source - AMC
7	Highway Lighting	In house
8	Corridor Management	Out Source
9	Major Maintenance	Out Source

1.9.3 Handback Requirement

As per Clause 33.2 of Concession Agreement, all project assets including the road, pavement, structure and equipment shall have been renewed and cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in this Agreement. All sections of traffic lane shall have a roughness value not more than 2500 mm. AECOM understands that the 40 mm BC provided on MMR cycle on FY 2024 shall suffice this requirement. Similarly, all lamps shall be in working condition which is covered under the annual O&M estimates.

Also, as per Clause 34.11 of CA, NHAI shall hold a sum equal to 15% of Annuity or higher sum estimated by IE for renewal works shall be retained in Escrow Account provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, no such retention shall be made. 50% of sum retained in accordance to this Clause shall be released from Escrow Account to Concessionaire within 14 days, if it is agreed that no renewal works are required following Second Inspection.

1.10 Insurance

As per Article XXVII of Concession Agreement, Concessionaire shall obtain and maintain at no cost to NHAI during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Industrial All Risk Insurance Policy Schedule
2	Burglary – Standard Policy Schedule
3	Electronic Equipment Insurance
4	Standard Fire & Special Perils Policy
5	Money Insurance Policy
6	Business Interruption (FIRE) Policy
7	Policy Schedule For Fidelity Guarantee
8	Policy Schedule for Public Liability
9	Policy Schedule for Package Insurance Policy

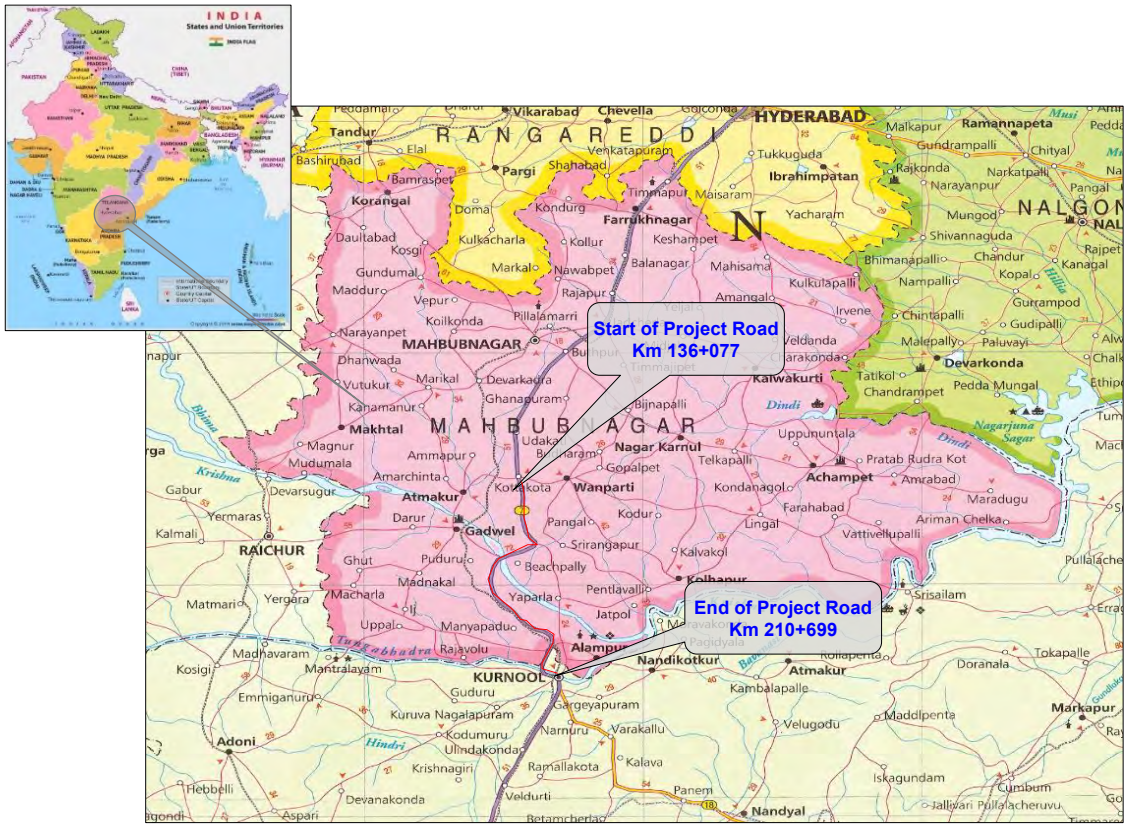
1.11 Introduction of Asset

1.11.1 Project Corridor

National Highway 44 (NH 44) is the longest-running major North-South National Highway in India beginning from Srinagar and terminating in Kanyakumari. It passes through the states of Jammu & Kashmir, Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu. It was formed by fully or partially merging seven national highways, starting with the Jammu-Srinagar National Highway (Old NH 1A) from Srinagar in Jammu & Kashmir, Old NH 1 in Punjab and Haryana ending at Delhi, part of Old NH 2 starting from Delhi and ending at Agra, Old NH 3 from Agra to Gwalior, Old NH 75 and Old NH 26 to Jhansi, and Old NH 7 via Lakhandon, Seoni, Nagpur, Adilabad, Hyderabad, Kurnool, Anantapur, Bangalore, Dharmapuri, Salem , Namakkal , Karur , Dindigul, Madurai and Tirunelveli and finally terminating at Kanyakumari.

The Project Road is Kotakatta - Kurnool section of this highway starting at Kotakatta at Km 136+077 (at the end of Kotakatta Bypass) in the state of Telangana and terminating at Km 210+699 at Kurnool in the state of Andhra Pradesh.

The project corridor is shown in map below:



Location Map

Project Start Point at Km 136+077

Project End Point at Km 211+699

1.11.2 Salient Features of the Project

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	74.720	74.622
Carriageway	4-lane highway with divided carriageway paved width 8.75 m on either side and Service/Slip Road on selected stretches.	4-lane highway with divided carriageway paved width 8.75 m on either side and Service/Slip Road on selected stretches.
Shoulder	1.0 m Earthen shoulder for Main Carriageway.	1.0 m Earthen shoulder for Main Carriageway.
Service Road / Slip Road	5.5 m Width LHS - 2.550 km RHS - 1.950 km 7.0 m Width LHS - 5.756 km RHS - 5.756 km	5.5 m Width LHS - 2.550 km RHS - 1.950 km 7.0 m Width LHS - 5.756 km RHS - 5.756 km 13.5 m Width LHS - 0.970 km RHS - 0.970 km Balance Length: 0.170 km (7.0m wide/LHS)
Major / Minor Junction	Major: 7 Minor: 62	Major: 8 Minor: 48
RCC Drain	-	16.718 km
Median Opening	-	58 nos.
Toll Plaza	1	1
Truck Lay-bys	4	4

Description	As per Schedule B and C	Existing Features
Bus Bays/Shelter	42	49
Highway Lighting	-	20 km (approx. 800 Poles)
High Mast	-	15 nos.
Toilet Blocks	-	At Truck Lay-byes and Toll Plaza
Wayside Amenities	LHS - Km 199+500 RHS - Km 154+000	LHS - Km 200+300 (Under Construction)
Variable Message Sign	At 10 km interval in each direction	12 nos.
Emergency Call Box	At 2 km interval staggered	63 nos.

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	3	3
Minor Bridge	40	37
Pipe, Box & Slab Culverts	157	149
Underpasses	3	PUP - 3 CUP - 1 VUP - 2 (* 1 Under-Construction, COS)
Grade Separator	3	2
ROB/RUB	1	1

1.12 Review of Pavement

1.12.1 Pavement Design

During construction of road, pavement design was carried out for 85 MSA till year 2022 i.e. 15 years. Summary of Pavement Design Report is presented as below:

Pavement Layer	Thickness (mm)	Design Life	MSA	Subgrade CBR %
Bituminous Concrete (BC/AC)	50	15 years (2008 - 2022)	86	8
Dense Bituminous Macadam (DBM)	135			
Wet Mix Macadam (WMM)	250			
Granular Sub-base (GSB)	230			
Selected Subgrade (8% CBR)	500			

The proposed design at the time of construction confirms requirement of Concession Agreement.

1.12.2 Analysis of Existing Pavement Condition

To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

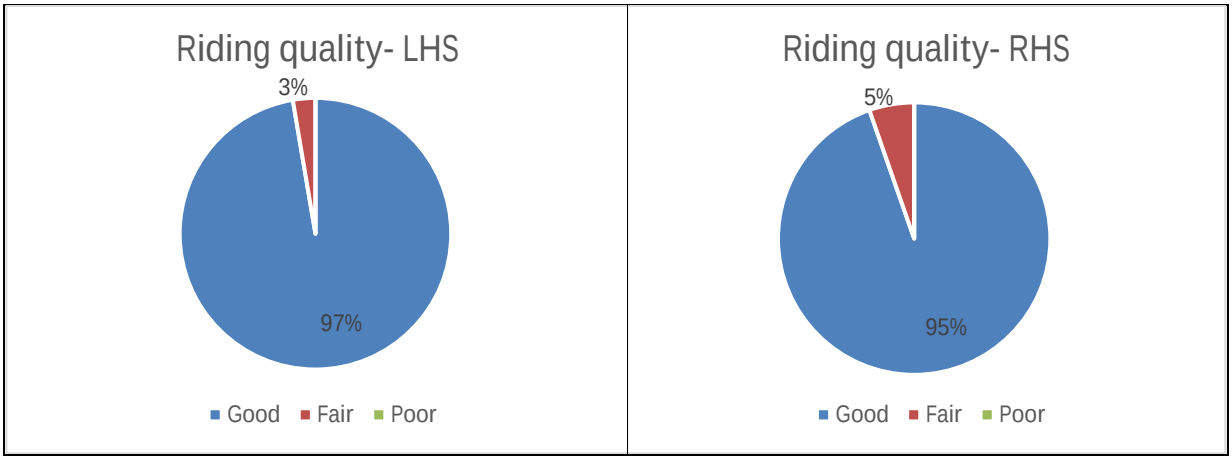
1) Roughness Survey:

Roughness Survey has been carried in the month of January 2022 using Laser Profilometer of NSV. Pavement classification has been done as per following criteria:

Good - less than 2000 mm / km
Fair -2001 to 3000 mm / km

Poor – above 3000 mm / km

Graphical presentation of roughness survey report is appended below:

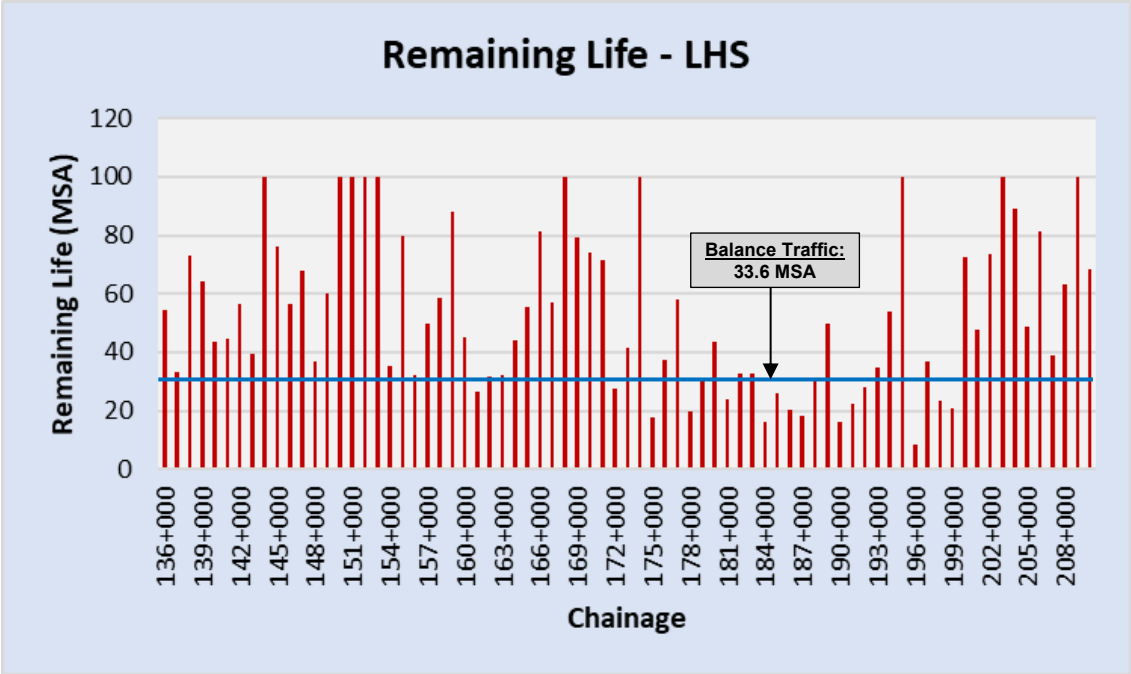


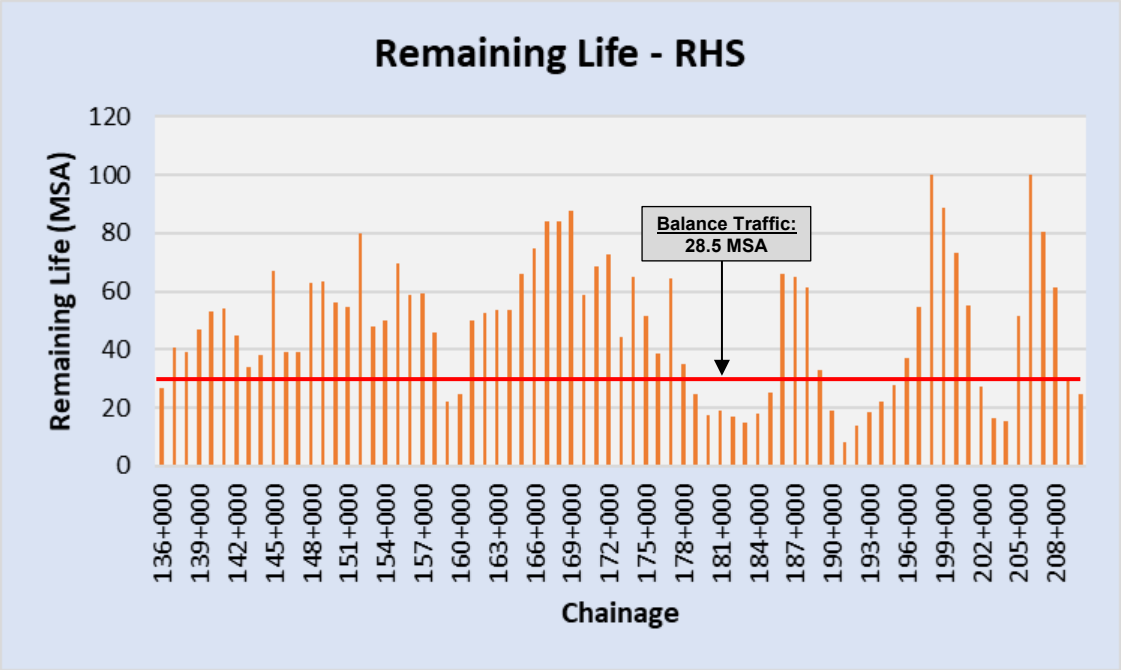
LHS – Kotakatta to Kurnool *RHS – Kurnool to Kotakatta*

Source: V R TECHNICHE Consultants Private Limited

2) Analysis of Existing Pavement – FWD Test

Concessionaire has conducted FWD survey in the month of April 2018 before carrying MMR. FWD survey report along with analysis has been provided in the data room. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented in figure below:





*Excessively high Remaining Life has been capped to 100 MSA for illustration in above figures

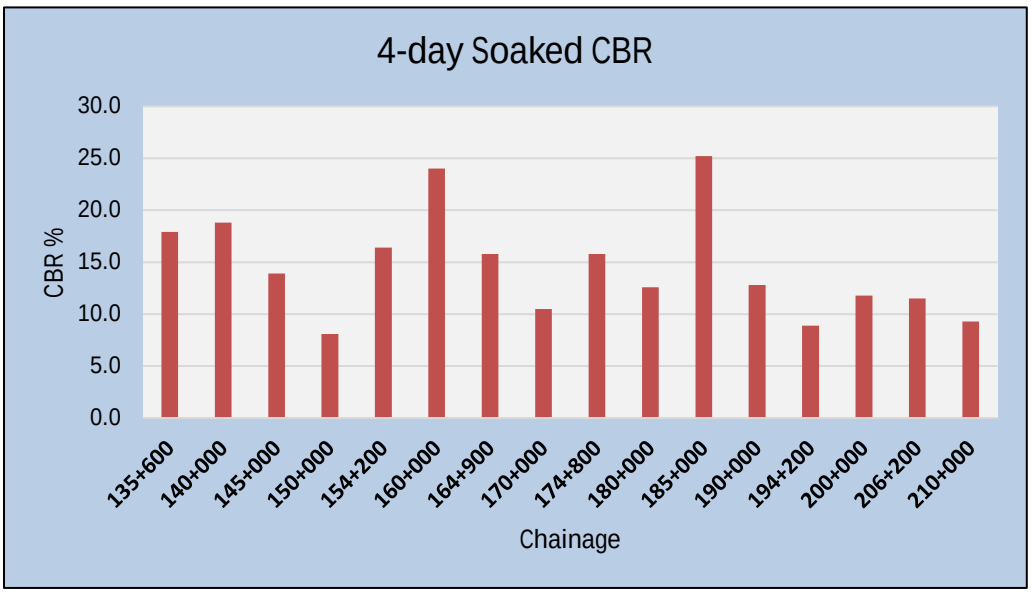
With ongoing Overlay of minimum 40mm BC, adding further life to the pavement which is already more than balance traffic in most of the section, AECOM understands that another 40mm BC will be sufficient to cater the traffic till end of Concession Period.

3) Test Pit

16 nos. of test pits were excavated in the project road and subgrade samples were collected and taken to laboratory for investigation.

4-days Soaked CBR of these subgrade samples varied from 8.1 to 25.2 %.

Variation of CBR along the project road as per Test Pit investigations is given below:



Similarly, Granular Material samples were collected from 8 test pits and test result for the same has been summarized in the table below:

Chainage	Side	Type of Material	Gradation Conforming to Specifications (as per MORTH 5th revision)	Atterberg Limits			Specific Gravity	Water Absorption (%)	Aggregate Impact Value (%)
				Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)			
140+000	RHS	GSB	Conforming to GSB Grade-I	19	NP	NP	2.73	0.35	13.1
150+000	RHS	WMM	Conforming to WMM gradation	18	NP	NP	2.65	0.41	11.4
160+000	RHS	WMM	Conforming to WMM gradation	20	NP	NP	2.73	0.55	13.5
170+000	RHS	WMM	Conforming to WMM gradation	19	NP	NP	2.68	0.44	11.9
180+000	RHS	GSB	Conforming to GSB Grade-III&IV	20	NP	NP	2.72	0.43	10.7
194+200	RHS	GSB	Conforming to GSB Grade-I	25	21	4	2.70	0.61	10.3
200+000	LHS	WMM	Conforming to WMM gradation	17	NP	NP	2.67	0.41	12.3
210+000	LHS	WMM	Conforming to WMM gradation	19	NP	NP	2.68	0.67	10.9

It is observed that both Subgrade soil and Granular Materials confirm to the general design requirements and MoRTH Specifications.

4) Core Test

For determining the thickness of Bituminous Layer provided along the project road, Core Cutting was carried out along the project road at 11 locations. Gradation and Bitumen extraction test were conducted on the samples Bituminous samples obtained from the core test.

Summary of Bituminous Layer thickness as per Core Cutting is presented below:

Sample No.	Chainage	Side	Lane Position	BT Thickness (mm)
1	138+300	LHS	Outer / Slow Moving Lane	210
2	148+600	RHS	Inner / Fast Moving Lane	190
3	160+000	RHS	Outer / Slow Moving Lane	175
4	167+000	LHS	Inner / Fast Moving Lane	155
5	176+800	RHS	Inner / Fast Moving Lane	220
6	182+000	LHS	Outer / Slow Moving Lane	140
7	188+900	RHS	Outer / Slow Moving Lane	220
8	197+800	RHS	Service Road	100
9	199+100	LHS	Inner / Fast Moving Lane	100
10	202+600	RHS	Inner / Fast Moving Lane	205
11	210+200	LHS	Outer / Slow Moving Lane	195

Thickness of Cores are generally satisfactory, except at chainage Km 199+100 which is found on lower side.

Similarly, the lab test result of the Bituminous core samples are presented below:

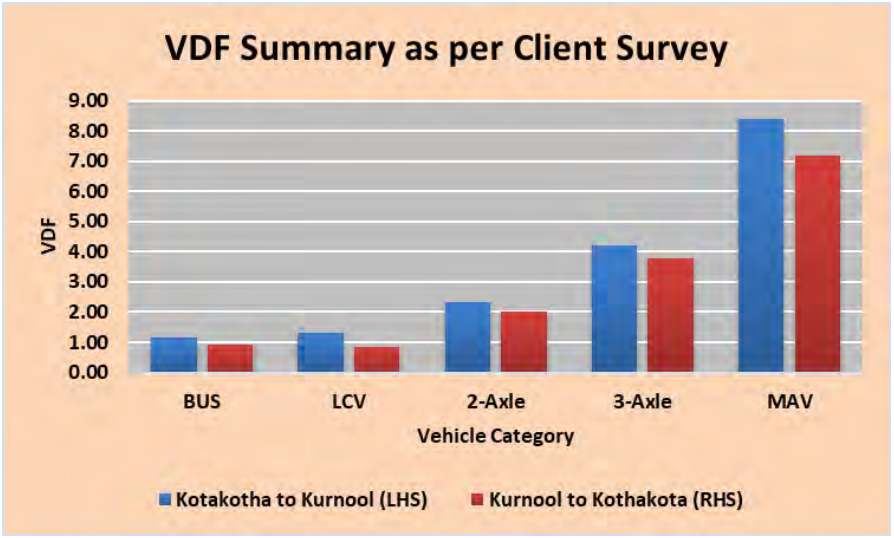
Sn	Chainage (Km.)	Side	Type of Material Tested	Source of Sample	Bitumen Content (%)	Gradation Confirming to MoRTH 5th Revision of Table 500-17
1	138+300	LHS	DBM	Core	4.8	Conforming to DBM-II
2	140+000	RHS	BC	Test pit	5.2	75µSieve material Slightly finer side in BC-1
3	160+000	RHS	DBM	Core	4.7	Conforming to DBM-II
4	167+000	LHS	BC	Core	5.3	Conforming to BC-I
5	176+800	RHS	BC	Core	4.7	Conforming to BC-I
6	182+000	LHS	DBM	Core	4.5	Conforming to DBM-II
7	188+900	RHS	BC	Core	5.1	Conforming to BC-II
8	197+800	RHS	DBM	Core	4.6	Conforming to DBM-II
9	200+000	LHS	BC	Test pit	5.2	Conforming to BC-I
10	202+600	RHS	BC	Core	5.1	Conforming to BC-II
11	210+200	LHS	DBM	Core	4.7	Conforming to DBM-II

As per above test results the Bitumen Content and Gradation of material used in Core Samples are found to confirming to design requirements except at one sample where slightly fine materials are found in the BC sample.

5) Axle Load Survey

As per the Pavement Design Report, Average VDF of 6.38 was adopted during the pavement design stage for computation of design traffic.

The VDF based on the Axle Load Survey conducted by client on April 2018 is presented in the figure below:

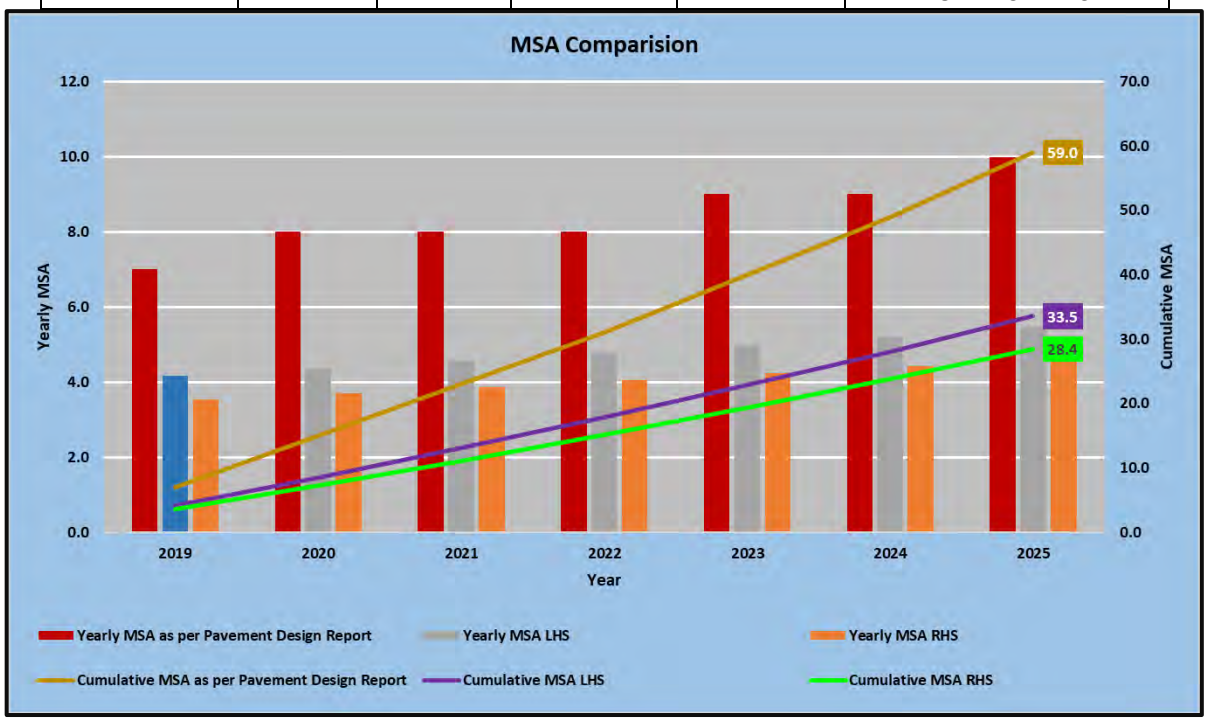


6) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from Year 2019 to End of Concession Period

Homogenous Section	Chainage		As per Pavement Design		Estimated Balance MSA as per Current Survey
	From	To	Design Traffic	Balance Traffic	
HS 1	136+077	210+699	86 MSA	59 MSA	33.5 MSA LHS 28.4 MSA RHS



AECOM is in the opinion that considering recently completed Major Maintenance, Remaining Life of Pavement as per FWD Test Results and estimated traffic, pavement shall hold good enough till end of Concession Period.

1.13 Major Maintenance

Major Maintenance is required to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Project road entered into the Commercial Operation on 30th Sep 2009. As per Clause 4.3.1 of Schedule L, a renewal coat of BC is to be laid every 5 years or where roughness value reaches 3000 mm/km. In line with this clause, Major Maintenance (Periodic Renewal Coat) was carried out on the project road between 07-03-2015 to 12-12-2015.

Similarly, Concessionaire has conducted detail pavement investigation in 2018 to carry out second cycle of Major Maintenance in the Year 2019.

Summary of Major Maintenance executed in FY19 is given in the table below:

Major Maintenance for FY 2019

Sn	Description	Proposal	Status
1.	Main Carriageway	Overlay with BC - 40 mm <u>Rehabilitation with 50mm BC:</u> LHS Inner Lane - 2.400 km LHS Outer Lane - 2.000 km RHS Inner Lane - 1.800 km RHS Outer Lane - 2.000 km	Completed

		Profile Corrective Course: LHS Inner Lane - 1.400 km LHS Outer Lane - 1.000 km RHS Inner Lane - 2.000 km RHS Outer Lane - 2.000 km	
2.	Service Road	Overlay with 30mm BC	

With Concession Period expiring on September 2026, analyzing the Remaining Life, Design Traffic and CA Provisions, third Major Maintenance Cycle has been proposed by Consultant for FY 2024 which is summarized in the table below:

Proposed Major Maintenance for FY 2024

Sn	Description	Proposal
1.	Main Carriageway	4.5.1 Overlay with BC - 40 mm
2.	Service Road	4.5.2 Overlay with BC - 30 mm
3.	Structure	4.5.3 Replacement of Wearing Coat with Milling 4.5.4 Replacement of Filler board expansion joint 4.5.5 LS provision of 20 lakh for rectification of other defects (drainage spout, crack sealing, repairing of railing etc.)

1.14 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period (7 years). O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. HTMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per AECOM calculation average yearly O & M Cost is Rs. 11.21 crore per year. Year wise cost summary is appended in below.

O and M Expense			
Project - APEL			
Sl.No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	1,778,318
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	-
3	Security Services	Includes manpower associated with security services.	14,636,726

O and M Expense			
Project - APEL			
SI.No.	Description	Remarks	Amount (in INR)
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc., Diesels expenses	19,946,873
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	5,884,120
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	-
7	HTMS related Expenses	AMCs for HTMS and replacement of equipment	1,546,370
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery, and other miscellaneous costs	2,854,091
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	1,844,182
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	11,543,644
11	Community Development	Includes CSR related expenses.	1,901,000
12	Communication Expenses	Includes phone charges.	164,659
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	14,050,909
15	IE Fees	Includes IE fees.	2,810,214
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	19,542,418
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc.	5,803,135
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	6,877,591
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	561,210
		O & M Cost (2021)	112,074,778
		O & M Cost (2021) in Crores	11.21

1.15 Major Maintenance Cost

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Major Maintenance cost for Year 2024 is summarized as below:

Sn	Year	Concessionaire Cost	AECOM Estimate*
1	2015	Not Available	-
2	2019	Not Available	-
3	2024	Not Available	97.07 Crore

** Cost as of Year Apr 2022*

1.16 List of Document Reviewed

Documents uploaded till 28 Nov 2019 has been reviewed during preparation of this DD report. The followings documents were reviewed during study:

Sn	List of Document	Status	Remarks
1	Concession Agreement – all Vols.	Available	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	Available	MOA and State support agreement available
3	Detail Highway Inventory and Condition Survey Report	Available	Condition Survey report not available
4	Detail Structure Inventory and Condition Survey Report	Available	Condition Survey report not available
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	Not Available	
6	Balance Work List with BOQ if any	Available	BOQ not available
7	Past Technical DD Report	Not Available	
8	Change of Scope Documents	Available	
9	Provisional COD Letter along with Punch List	Available	
10	Final COD Letter with Exclusion List if any	Not Available	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	Available	
12	NCR Status	Not Available	
13	Operation and Maintenance Manual, Yearly Maintenance Program	Available	
14	Current Operation and Maintenance Arrangement / Strategy	Available	
15	Detail of TMS and ATMS / HTMS installed at site	Available	TMS data not available
16	Pavement Design Report	Available	
17	Historical Major Maintenance and Strategy	Available	Periodic maintenance report

Sn	List of Document	Status	Remarks
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	Available	Axle Load, Core Cutting, Roughness, FWD, Pavement condition and investigation reports
19	As Built Drawing	Available	
20	MPR during Construction Stage (only last three months)	Not Available	
21	MPR of Independent Engineer during Maintenance stage	Available	
22	MPR Lender Report	Not Available	
23	Monthly Inspection Report during O and M	Available	
24	Historical O&M and MM Cot Cost	Available	O & M Contract with vendor available
25	Major Maintenance Forecast	Available	
26	Traffic Data (Actual till now and projection till end of Concession Period)	Available	AADT
27	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	Available	

2 Pavement Evaluation and Test

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

2.2 Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.3 Pavement Design

As per the Concession Agreement, minimum thickness of pavement layer for New Construction, Reconstruction and Overlay of MCW shall be as given in the table below:

Pavement Layer	Thickness in mm	
	New Construction / Reconstruction	Overlay over Existing Pavement
Bituminous Concrete (BC/AC)	50	50
Dense Bituminous Macadam (DBM)	135	115
Wet Mix Macadam (WMM)	250	-
Granular Sub-base (GSB)	230	-
Selected Subgrade (8% CBR)	500	-

Similarly, minimum thickness of pavement layer for Service/Slip Road shall be as given in the table below:

Pavement Layer	Thickness (mm)
Semi Dense Bituminous Concrete (SDBC)	25
Bituminous Macadam (BM)	75
Wet Mix Macadam (WMM)	250
Granular Sub-base (GSB)	150
Selected Subgrade (8% CBR)	500

2.4 Review of Pavement Design

Pavement for the project road has been proposed as per IRC: 37 - 2001. As per the Pavement Design Report received, following pavement has been adopted for MCW of project road:

Pavement Layer	Thickness (mm)	Design Life	MSA	Subgrade CBR %
Bituminous Concrete (BC/AC)	50	15 years (2008 - 2022)	86	8
Dense Bituminous Macadam (DBM)	135			
Wet Mix Macadam (WMM)	250			
Granular Sub-base (GSB)	230			
Selected Subgrade (8% CBR)	500			

Additionally, special provision has been proposed for the Black Cotton Soil or Clay Predominate in the natural ground from Km 178+000 to Km 204+000 according to Clause 305.3.4 of the MoRT&H Specifications for Road and Bridge Works, 2001 (Fourth Revision – reprinted in March 2003) published by Indian Roads Congress. According to this clause, on the ground where embankment is to be built has Clay having liquid limit exceeding 70 and plasticity index exceeding 45, at least 500 mm of such material must be removed and replaced by acceptable fill material (GSB material proposed for better strength and drainage) before embankment construction commences.

Similarly, following pavement has been adopted for Service/Slip Road along the project road:

Pavement Layer	Thickness (mm)
Semi Dense Bituminous Concrete (SDBC)	25
Bituminous Macadam (BM)	75
Wet Mix Macadam (WMM)	250
Granular Sub-base (GSB)	150

2.5 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement in the month of January 2022. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer.

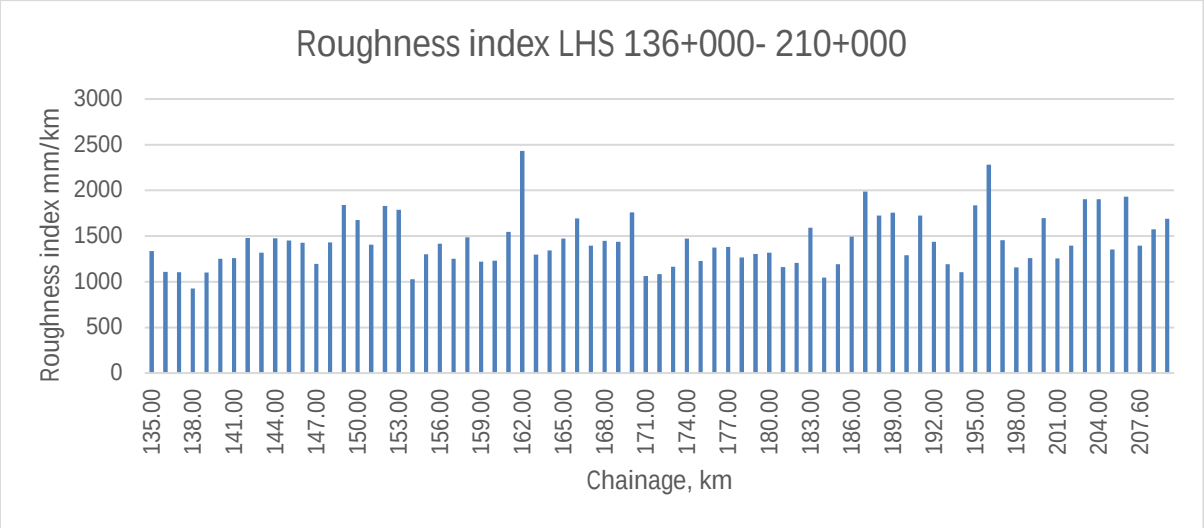
Based on the Roughness value, project road was classified into following three categories:

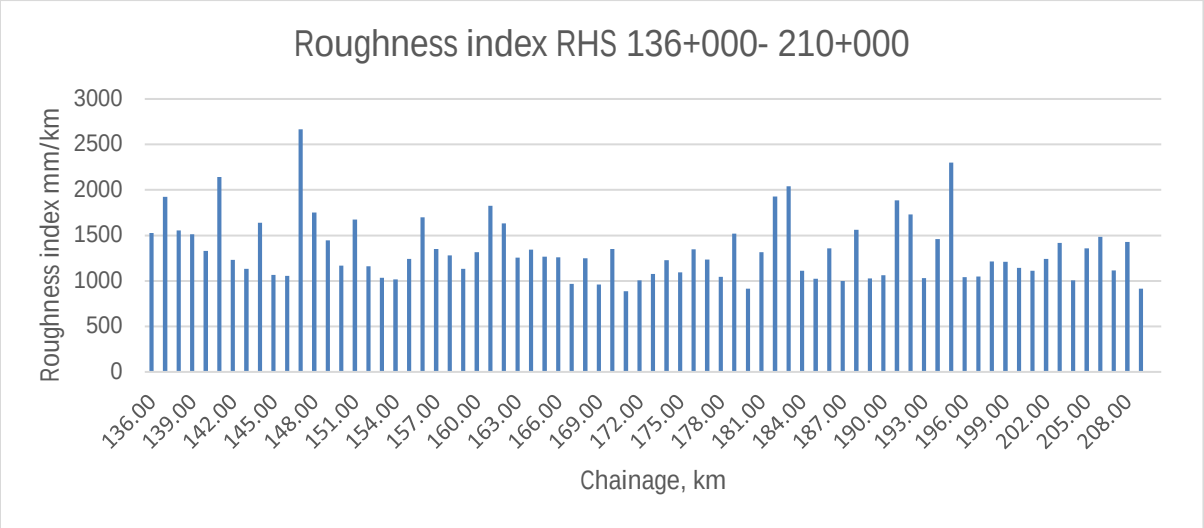
Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000 - 3000
Poor	>3000

The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:

Summary of Roughness Index

Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		Length - km	
		LHS	RHS
Good	< 2000	73	71
Fair	2000 - 3000	2	4
Poor	>3000	0	0





2.7 Test Pit

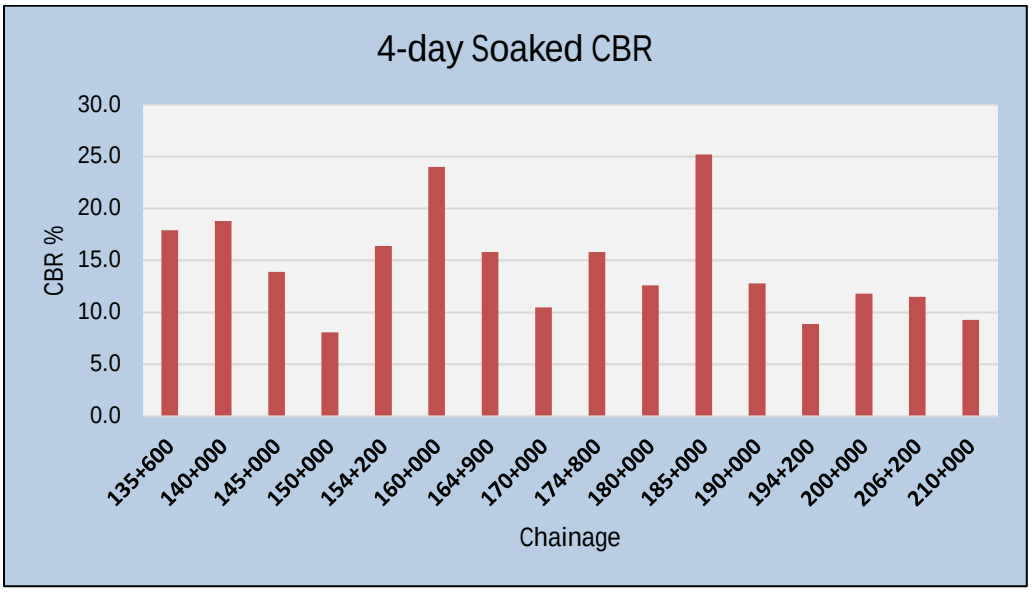
Detail Test Results from the Test Pit investigation carried out by the client has been shared through the data room.

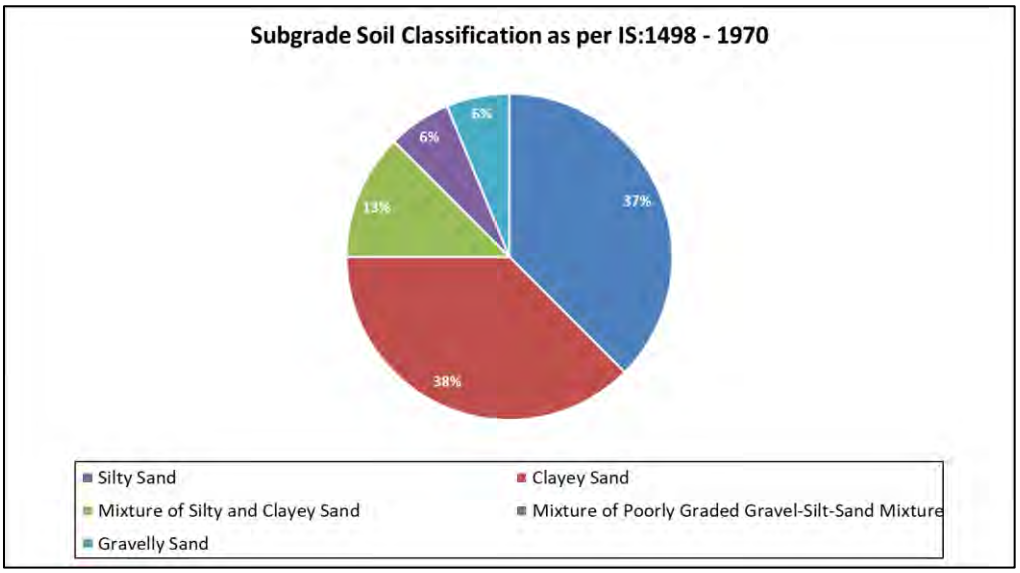
16 nos. of test pits (8 nos. on each side) investigations were carried out in the project road from which subgrade samples were collected and taken to laboratory for investigation.

4-days Soaked CBR of these subgrade samples varied from 8.1 to 25.2 %.

Similarly, Granular Layer samples were collected from 8 nos. of test pits and taken for lab examination.

Summary of Test Pit investigation results are illustrated below:





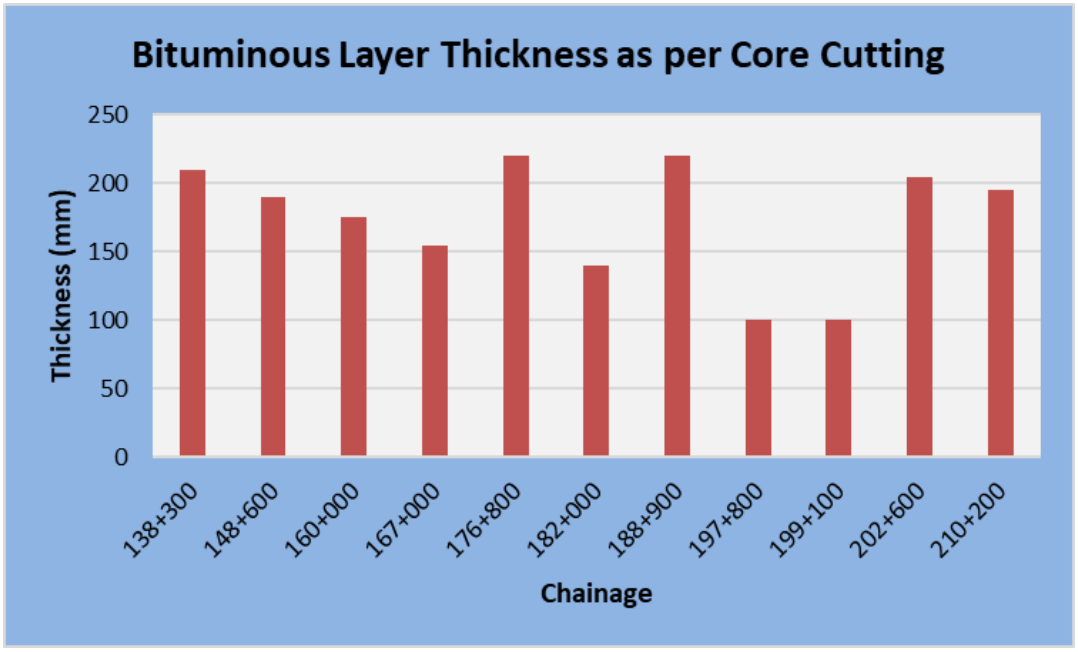
Similarly, Granular Material samples were collected from 8 test pits and test result for the same has been summarized in the table below:

Chainage	Side	Type of Material	Gradation Conforming to Specifications (as per MORTH 5th revision)	Atterberg Limits			Specific Gravity	Water Absorption (%)	Aggregate Impact Value (%)
				Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)			
140+000	RHS	GSB	Conforming to GSB Grade-I	19	NP	NP	2.73	0.35	13.1
150+000	RHS	WMM	Conforming to WMM gradation	18	NP	NP	2.65	0.41	11.4
160+000	RHS	WMM	Conforming to WMM gradation	20	NP	NP	2.73	0.55	13.5
170+000	RHS	WMM	Conforming to WMM gradation	19	NP	NP	2.68	0.44	11.9
180+000	RHS	GSB	Conforming to GSB Grade-III&IV	20	NP	NP	2.72	0.43	10.7
194+200	RHS	GSB	Conforming to GSB Grade-I	25	21	4	2.70	0.61	10.3
200+000	LHS	WMM	Conforming to WMM gradation	17	NP	NP	2.67	0.41	12.3
210+000	LHS	WMM	Conforming to WMM gradation	19	NP	NP	2.68	0.67	10.9

2.8 Core Test

For determining the thickness of Bituminous Layer provided along the project road, Core Cutting was carried out along the project road at 11 locations. Gradation and Bitumen extraction test were conducted on the samples Bituminous samples obtained from the core test.

Summary of Bituminous Layer thickness as per Core Cutting is illustrated in the figure below:



Similarly, the lab test result of the Bituminous core samples is presented below:

Sn	Chainage (Km.)	Side	Type of Material Tested	Source of Sample	Bitumen Content (%)	Gradation Confirming to MoRTH 5th Revision of Table 500-17
1	138+300	LHS	DBM	Core	4.8	Conforming to DBM-II
2	140+000	RHS	BC	Test pit	5.2	75µSieve material Slightly finer side in BC-1
3	160+000	RHS	DBM	Core	4.7	Conforming to DBM-II
4	167+000	LHS	BC	Core	5.3	Conforming to BC-I
5	176+800	RHS	BC	Core	4.7	Conforming to BC-I
6	182+000	LHS	DBM	Core	4.5	Conforming to DBM-II
7	188+900	RHS	BC	Core	5.1	Conforming to BC-II
8	197+800	RHS	DBM	Core	4.6	Conforming to DBM-II
9	200+000	LHS	BC	Test pit	5.2	Conforming to BC-I
10	202+600	RHS	BC	Core	5.1	Conforming to BC-II
11	210+200	LHS	DBM	Core	4.7	Conforming to DBM-II

As per above test results the Bitumen Content and Gradation of material used in Core Samples are found to confirming to design requirements except at one sample where slightly fine materials are found in the BC sample.

2.9 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD survey in the month of April 2019. FWD survey report along with analysis has been provided in the data room. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented below.

Chainage		15th Percentile Remaining Life		Chainage		15th Percentile Remaining Life	
From	To	LHS	RHS	From	To	LHS	RHS
136+077	137+000	54.3	26.8	174+000	175+000	120.4	65.0
137+000	138+000	33.0	40.5	175+000	176+000	17.7	51.4
138+000	139+000	73.0	39.4	176+000	177+000	37.5	38.8
139+000	140+000	64.4	46.9	177+000	178+000	58.1	64.6
140+000	141+000	43.5	52.9	178+000	179+000	19.6	35.2
141+000	142+000	44.8	54.2	179+000	180+000	30.8	24.5
142+000	143+000	56.7	44.7	180+000	181+000	43.6	17.5
143+000	144+000	39.5	34.1	181+000	182+000	23.7	19.2
144+000	145+000	103.0	38.0	182+000	183+000	32.7	17.0
145+000	146+000	76.1	66.8	183+000	184+000	33.0	15.0
146+000	147+000	56.7	39.1	184+000	185+000	15.9	17.9
147+000	148+000	68.1	39.0	185+000	186+000	26.1	25.0
148+000	149+000	36.7	63.0	186+000	187+000	20.3	66.1
149+000	150+000	60.1	63.5	187+000	188+000	18.5	64.8
150+000	151+000	180.5	55.9	188+000	189+000	30.5	61.3

Chainage		15th Percentile Remaining Life	
151+000	152+000	104.2	54.7
152+000	153+000	318.9	79.7
153+000	154+000	593.8	48.0
154+000	155+000	35.1	49.9
155+000	156+000	80.0	69.5
156+000	157+000	32.1	58.5
157+000	158+000	49.8	59.3
158+000	159+000	58.4	46.0
159+000	160+000	88.3	22.2
160+000	161+000	45.1	24.5
161+000	162+000	26.3	50.0
162+000	163+000	31.5	52.3
163+000	164+000	32.0	53.8
164+000	165+000	44.2	53.8
165+000	166+000	55.2	65.7
166+000	167+000	81.4	74.5
167+000	168+000	57.0	84.1
168+000	169+000	100.2	84.1
169+000	170+000	79.2	87.8
170+000	171+000	74.1	58.9
171+000	172+000	71.5	68.7
172+000	173+000	27.5	72.9
173+000	174+000	41.3	44.4

Chainage		15th Percentile Remaining Life	
189+000	190+000	49.5	33.2
190+000	191+000	16.3	18.9
191+000	192+000	22.5	8.0
192+000	193+000	28.0	13.9
193+000	194+000	34.9	18.2
194+000	195+000	54.1	22.2
195+000	196+000	187.9	27.8
196+000	197+000	8.5	37.0
197+000	198+000	36.6	54.4
198+000	199+000	23.6	101.4
199+000	200+000	20.7	88.8
200+000	201+000	72.3	73.3
201+000	202+000	47.4	55.0
202+000	203+000	73.4	27.3
203+000	204+000	246.0	16.3
204+000	205+000	89.3	15.5
205+000	206+000	48.7	51.4
206+000	207+000	81.3	141.6
207+000	208+000	39.1	80.4
208+000	209+000	63.3	61.3
209+000	210+000	390.3	29.7
210+000	210+699	68.1	24.5

2.10 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

As per the Pavement Design Report, average VDF of 6.38 was adopted during the pavement design stage for computation of design traffic. Similarly, the VDF based on the Axle Load Survey conducted by client on April 2018 is obtained through the data room and presented in the table below:

VDF Comparison

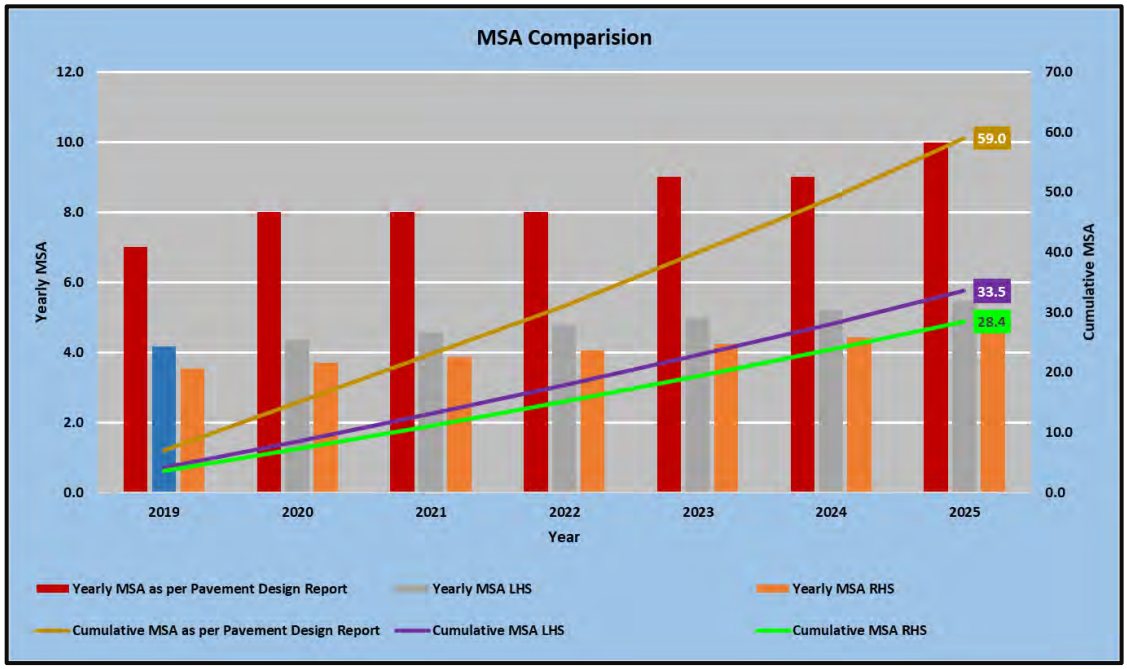
Sn	Vehicle Type	As per Pavement Design Report		Average VDF adopted as per Pavement Design Report
		Kotakatta -Kurnool (LHS)	Kurnool-Kottakota (RHS)	
1	LCV	1.30	0.86	6.38
2	BUS	1.14	0.92	
3	2-Axle	2.32	2.03	
4	3-Axle	4.21	3.79	
5	MAV	8.41	7.18	

2.11 Homogeneous Section and Design MSA

As per current traffic pattern, entire road has been considered as the single homogeneous section for calculation of Design MSA and same has been considered during calculation of Design Traffic during Pavement Design Stage.

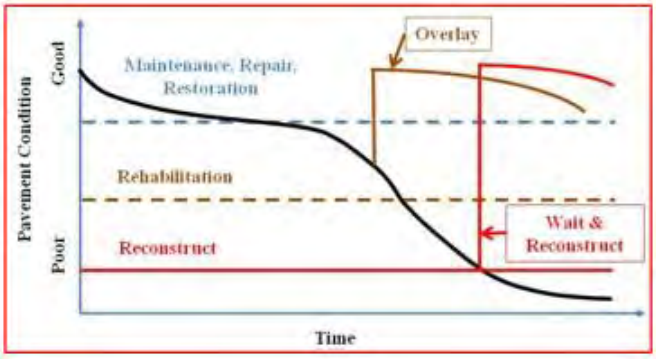
MSA for the balance Concession period is calculated based on the Traffic Data provided by client and VDF as discussed in the preceding section. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided by client is tabled below.

Homogenous Section	Chainage		As per Pavement Design		Estimated Balance MSA as per Current Survey
	From	To	Design Traffic	Balance Traffic	
HS 1	136+077	210+699	86 MSA	59 MSA	33.5 MSA LHS 28.4 MSA RHS



2.12 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Project road entered into the Commercial Operation on 30th Sep 2009. As per Clause 4.3.1 of Schedule L, a renewal coat of BC is to be laid every 5 years or where roughness value reaches 3000 mm/km. In line with this clause, Major Maintenance (Periodic Renewal Coat) was carried out on the project road between 07-03-2015 to 12-12-2015.

Similarly, Concessionaire has conducted detail pavement investigation in 2018 to carry out second cycle of Major Maintenance in the Year 2019.

Summary of Major Maintenance executed in FY19 is given in the table below:

Major Maintenance for FY 2019

Sn	Description	Proposal	Status
1.	Main Carriageway	Overlay with BC - 40 mm <u>Rehabilitation with 50mm BC:</u> LHS Inner Lane - 2.400 km LHS Outer Lane - 2.000 km RHS Inner Lane - 1.800 km RHS Outer Lane - 2.000 km <u>Profile Corrective Course:</u> LHS Inner Lane - 1.400 km LHS Outer Lane - 1.000 km RHS Inner Lane - 2.000 km RHS Outer Lane - 2.000 km	Completed
2.	Service Road	Overlay with 30mm BC	

With Concession Period expiring on September 2026, analyzing the Remaining Life, Design Traffic and CA Provisions, third Major Maintenance Cycle has been proposed by Consultant for FY 2024 which is summarized in the table below:

Proposed Major Maintenance for FY 2024

Sn	Description	Proposal
1.	Main Carriageway	4.5.6 Overlay with BC - 40 mm
2.	Service Road	4.5.7 Overlay with BC - 30 mm

3.	Structure	4.5.8 Replacement of Wearing Coat with Milling 4.5.9 Replacement of Filler board expansion joint 4.5.10 LS provision of 20 lakh for rectification of other defects (drainage spout, crack sealing, repairing of railing etc.)

2.13 TMS and HTMS

2.13.1 Toll Plaza and Associated Facilities

Concession Agreement Provision: As per Schedule-C: one Toll Plazas is proposed at suitable location between existing Km 200+700 to Km 201+250 just before the Tungabhadra Bridge with 6 lanes in each direction including a separate service lane for over-sized vehicles and/or toll free traffic.

Site Observations at Pullur Toll Plaza at Km 200+700:

1. Toll Plaza has provided at Km 200+700 with 6 lanes (including one extra wide lanes) in each direction of travel.
2. 4 nos. of High Mast Lights are provided at Toll Plaza which are functional.
3. Rigid Pavement (approx. 100m) is provided around the Toll Booth while flexible pavement is provided at tapering/approaches to toll booths.
4. Highway Nest (Mini) and Toilet Block Facilities (one on each side) are provided at Toll Plaza.

Since Project Road is being operated under the BOT (Annuity) Mode and Toll Collection is being done by Agency appointed by NHAI.

Snap of Pullur Toll Plaza

a. Highway Traffic Management System (HTMS)

Concession Agreement Provision: - As per Schedule-C; Project Highway shall be provided with HTMS to collect/disseminate information for traffic and incident management and for the Safety of Users.

HTMS shall comprise following sub-systems:

1) Emergency Communication System
2) Mobile Communication System
3) Variable Message Sign System
4) Meteorological Data System
5) Automatic Traffic Counter- cum- Classifier System
6) Power Supply System

i. Emergency Communication System:

Emergency Communication System shall have Emergency call Boxes (ECBs) installed throughout the stretch for the users in case of help required. They are directly connected to the Control Room for the fastest resolution of the issues (if any/emergency) raised by the users.

Highlights:

1. Main features of ECB
    a. Solar Panel with charging control circuit
    b. Battery
    c. Antenna
    d. Mike and speaker with amplifier
    e. Operating switch
2. Designed to support difficult conditions of acoustic and climatic conditions
3. Battery: Solar
4. Operation and Maintenance Team: IBI Consulting India Private Limited

Concession Agreement Provision: - As per Schedule-C; Emergency Communication System shall have Emergency Call Boxes (ECBs) installed at the spacing of 2 kms in a staggered manner on either side of the highway for both directions of and connected to the control center through the transmission of optical fiber cable and copper cables with suitable interfacing.

Status of ECBs:

1. 74 nos. of ECBs are found in the entire stretch.
2. ECBs are installed on both directions of the entire stretch.
3. Connectivity Mode: OFC of the ECBs are found to be in non-functional condition as per IE Inspection Report.

1. Locations of ECBs along the project road is given below:

Sn	Chainage
1	136+600
2	137+600
3	138+600
4	139+600
5	140+600
6	141+600
7	142+600
8	143+600
9	144+600
10	145+600
11	146+600

Sn	Chainage
12	147+600
13	148+600
14	149+600
15	150+600
16	151+600
17	152+600
18	153+600
19	154+600
20	155+600
21	156+600
22	157+600

Sn	Chainage
23	158+900
24	159+600
25	160+600
26	161+600
27	162+600
28	163+600
29	164+600
30	165+600
31	166+600
32	167+600
33	168+600

Sn	Chainage
34	169+600
35	170+600
36	171+600
37	172+600
38	173+600
39	174+600
40	175+600
41	176+600
42	177+600
43	178+600
44	179+600

Sn	Chainage
45	180+600
46	181+600
47	182+600
48	183+600
49	184+600
50	185+600
51	186+600
52	187+600

Sn	Chainage
53	188+600
54	189+600
55	190+600
56	191+600
57	192+600
58	193+600
59	194+600
60	195+600

Sn	Chainage
61	196+600
62	197+600
63	198+600
64	199+600
65	200+600
66	201+600
67	202+600
68	203+600

Sn	Chainage
69	204+600
70	205+600
71	206+600
72	207+600
73	208+600
74	209+600

Snaps of ECB along the Project Road

ii. Mobile Communication System:

Concession Agreement Provision: As per Schedule-C of CA, Mobile Communication System shall have mobile sets provided on ambulances, cranes and patrolling vehicles for facilitating speedy communication even when they are on the moves.

Status of Mobile Communication System:
As per IE Inspection Report, Mobile Communication System has not been provided.

iii. VMS (Variable Message Sign)
VMS system is a high bright LED's based display sign board located at important stretches to pass on the important information to commuters related to following parameters:

a. Temperature

b. Weather conditions such as heavy storm/rainfall etc.
c. Important information related to roads if any, such as diversion/work in progress etc.

Concession Agreement Provision: -As per Schedule-C; VMS shall be provided at an interval of 10 km in each direction of traffic to guide and for warn the users about the traffic and weather conditions on highways. The locations shall be decided for their maximum utility to the users.

Status of VMS:

a. 14 nos. of VMS (7 on each side) are present along the project road approximately at an interval of 10 km mounted on gantry.
b. Flashed messages are maintained manually (day/date/time wise).
c. Connectivity mode is OFC (optical fiber cable).
d. List of VMSs found along the project road along with their working status as per IE Inspection report is given below:

S.NO.	CHAINAGE (KM)	STATUS	
		LHS	RHS
1	146+800	Working	Working
2	156+500	Working	Working
3	166+600	Working	Working
4	176+400	Working	Non-functional
5	186+500	Working	Working
6	196+600	Working	Working
7	207+000	Working	Working

Snaps Variable message Sign (VMS) in the Project Road

i. CCTV (Closed Circuit Television)/Video Cameras:
CCTV surveillance shall comprise video camera having pan, tilt and zoom facility. It is mounted at a height to cover the target length of highway with an ability to withstand adverse weather conditions.

Concession Agreement Provision: As per Schedule-C; provision for installing of video cameras shall be made available at all major intersections and at least 4 video cameras shall be made available for use at any of the identified locations on need basis.

Status of CCTV:
Total number of 4 nos. CCTV has been provided at following locations:

a) Km 196

b) Km 202

c) Km 204

d) Km 208

As per IE Inspection Report, all the CCTV are functional.

ii. ATCC (Automatic Traffic Counters cum Classifier):

ATCC with an in-road loop detectors and treadles is used for audit purpose (as and when required) in case there is considerable difference in figures related to classification and counting of vehicles.

Concession Agreement Provision: As per Schedule-C; ATCC shall be installed at minimum two locations for traffic data collection and monitoring.

Status of ATCC:
2 nos. of ATCC are provided at Km 154 and Km 199.

As per IE Inspection Report, both ATCC are functional.

iii. MDS (Meteorological Data Station):
Following parameters can be known by use of MDS system

- Air Temperature
- Road Temperature
- Humidity
- Wind Speed
- Wind Direction

Concession Agreement Provision: - As per Schedule-C; MDS shall be installed at an interval of 25 km to provide weather information on temperature, wind speed, humidity and visibility. This information shall be available to users through VMS as per requirement.

Status of MDS:
3 nos. of MDS are provided along the project road. Locations of MDS along with their status as per IE Inspection Report is provided below:

Sn	Location	Status
1	Km 152	Functional
2	Km 178	Functional
3	Km 201	Functional

2.14 Road Safety Assessment

Safety Audit was conducted by M/s VR Techniche Consultants Pvt Ltd in the month of Jan 2019. Total number of accidents along the section of road and severity of accidents define the requirement of prioritization of a section for safety improvements. Severity Index for the Project Road and various sections along the Project Road has been estimated as number of persons killed per hundred accidents for the accident data obtained from Project Company for the period from October 2009 to 2018.

Following table presents the year wise Severity Index observed along the Project Road:

Sn	Month	Total Accident	No. of Fatalities	No. of Injured Person	Severity Index (Number of person killed per 100 Accident)	Number of person injured per 100 Accident	Remarks
1	2009	50	16	68	32.0	136.0	From October
2	2010	246	81	431	32.9	175.2	
3	2011	260	46	488	17.7	187.7	
4	2012	273	60	481	22.0	176.2	
5	2013	254	42	494	16.5	194.5	
6	2014	191	32	369	16.8	193.2	
7	2015	209	36	390	17.2	186.6	
8	2016	230	62	353	27.0	153.5	
9	2017	251	26	448	10.4	178.5	
10	2018	295	42	485	14.2	164.4	

As indicated in Safety Audit Report, Severity Index of project road is considerably lower than the Severity Index of Telangana, Andhra Pradesh as well as National Average.

Safety issue as identified in Safety Report and the corresponding AECOM observation are as follows:

Sn	Safety Concern	Probable Accident Type	Risk Category	AECOM Observation
1	Unauthorized Median Opening (UMO)	Right Angled Collison due to improper information to MCW traffic	High	Observed at few locations and few have been closed
2	Improper Connection of Minor Roads	Right Angled Collison due to improper information to MCW traffic	High to Moderate	Observed at site
3	Issues with Safety Barriers / Guard Rails / Guard Posts	Increased severity due to Hitting Fixed Object or Safety Barrier	High to Moderate	Observed at site
4	Visibility Issues along the Project Road Insufficient SSD Inadequate Night Visibility I. -Inadequate Lighting in Urban Sections	Rear End Collision / Involvement of Pedestrians or Slow-moving Vehicles	High to Moderate	Observed at site
5	Object Painting and Pavement Marking	Hitting Fixed Object, rear end, side swipe collisions due to unorganized/unregulated movement along the highways	High during Night and Moderate during day	Pavement Marking on progress after new Overlay.
6	Issues related to Sign Boards	Skidding, Rear end collision due to sudden breaking resulting from late information to users	High to Moderate	Observed at site
7	Insufficient/Unregulated Pedestrian Crossing facilities along the Project Road	Collision of fast-moving traffic with Pedestrians	Moderate to High depending on nearby development	Observed at site
8	Predominant Wrong side movement at few locations	Head on Collisions due to wrong side movement; rear end collisions due to sudden breaking by MCW traffic	High to Moderate depending on traffic intensity and visibility at the location	Observed at few locations

3. CAPEX REQUIREMENT

As per Article II of the Concession Agreement, construction of highway on the site set forth in Schedule A and as specified in Schedule B, together with provision of Project Facilities as specified in Schedule C, and in conformity with the Specifications and Standards set forth in Schedule-D. Project road has completed in compliance to Concession Agreement and there is no balance work to be considered in CAPEX. In general CAPEX is considered for following works:

1. Initial Repair and Rehabilitation Work
2. Balance Work as per Original Scope of Work
3. Penalty for Delay in Periodical Maintenance Work

The summary of all work and cost considered under Initial CAPEX is tabled as below:

Sn	Description of Work	Details	Amount (INR)
A.	Initial Repair and Rehabilitation Work	-	-
B.	Balance Work as per Original Scope of Work	- 170m of Service Road - Wayside Amentias	3.19 Cr
	TOTAL		3.19 Cr

3.2 Immediate Repair & Rehabilitation Work

Second Major Maintenance Cycle of the pavement is on progress and expected to be completed by the end of 2019. Hence, no Immediate Repair and Rehabilitation Work is required for pavement. Apart of these minor defects were observed in different components of the project road. However, the cost for these are expected to be covered under the O & M Estimate.

3.3 Balance Work as per Original Scope of Work

Two works are identified under the Balance Work and cost estimate for the same has been prepared by AECOM.

Summary of Balance Works along with their cost estimate is presented in the table below:

Sn	Description of Work	Location	Status	Estimated Cost of Balance Work, INR (in Crores)	Remarks
1	Construction of Service Road at Kurnool Stretch	Km. 209+080 to Km. 209+190 LHS Km. 209+340 to Km. 209+400 LHS	Pending due to land not handed over by NHAI	0.63	
2	Wayside Amenities (Rest Area)	Km 154+050 RHS on Pebbair Bypass	Pending due to land not handed over by NHAI	2.21	Other Rest Area at Km 200+100 is near Completion
		Total (1 & 2)		2.85	
		GST 12%		0.34	
		Grand Total (Rs.)		3.19	

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

Sn	Year		Treatment Proposed	
			LHS	RHS
1	2023 / 24 (MS)	MCW	40mm BC Overlay	40mm BC Overlay
		Service road	30mm BC Overlay	30mm BC Overlay

Structure Major Maintenance

a) Replacement of Wearing Coat every fifth year

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates as of Mar 2022 is as follows:

Bitumen Price @ 1st March 2022	CPCL Chennai		
Bitumen	Base Price	Discount	Ex MI price
VG30	46,652		46,652
VG40	51,432		51,432

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

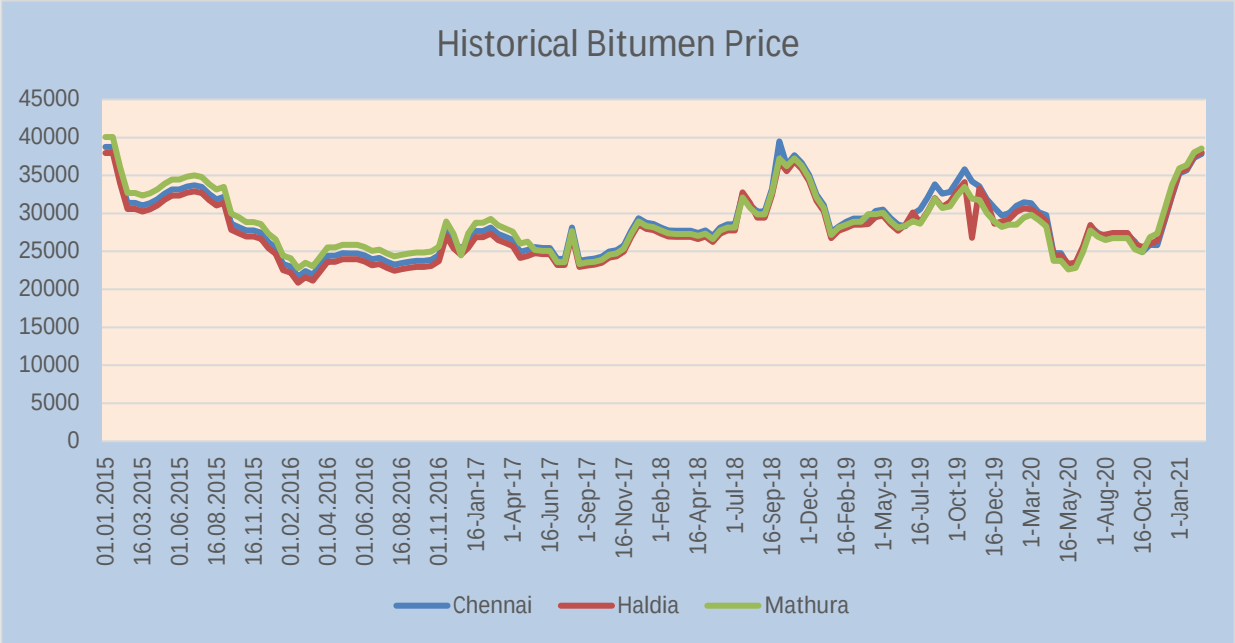
ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

xii) The historical bitumen price from year 2015 to till date is present in below graph.

xiii) Cube Highway forecast Bitumen for upcoming year as follows:



FY 2024 onwards till end of Concession Period, Bitumen Price is considered as per following assumption:

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY 22	2.83%	1.000
FY 23	4.66%	1.047
FY 24	5.65%	1.106
FY 25	5.37%	1.165
FY 26	5.52%	1.229
FY 27	5.25%	1.294
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948
FY 38	3.98%	2.026
FY 39	4.00%	2.107
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	9733
2	Bituminous Concrete	Cum	12,224
3	Micro surfacing	Sqm	176
4	Road Marking	sqm	439
5	Road Studs - Normal	nos	220
6	Road Studs - Solar	nos	1592

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cycle wise cost estimate is presented on the next page. Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)					
Sl. No.	Activity	Unit	Unit Rate 2022	Treatment Cycle Qty	Treatment Cycle Amount
				FY 2024	FY 2024
A	**Main Carriageway - Flexible Pavement**				
1	Tack Coat	Sqm	12	1,392,259	17,041,253
2	Bituminous Concrete with VG 40	Cum	12,224	55,690	680,743,487
3	Painting of Road Kerb	sqm	121	3,249	393,103
					-
B	**Structure(Including FO,ROB,VUP,PUP,CUP and Bridges)**				-
1	Tack Coat	Sqm	12	57,240	700,621
2	Bituminous Concrete with VG 40	Cum	12,224	1,717	20,990,671
3	Milling of existing 30mm BC	Sqm	66	57,240	3,777,858
4	Painting of Crash Barrier	sqm	121	21,574	2,610,457
5	Drainage spout, crack sealing, repairing of railing etc	LS	2,195,455	1	2,195,455
					-
C	**Toll Plaza and Truck Laybye - Rigid**				-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	132		-
2	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum	7,135		-
					-
D	**Service Road**				-
1	Tack Coat	Sqm	12	125,655	1,538,020
2	Functional Overlay using VG-30	Cum	11,473	3,770	43,250,144
					-
E	**Other Works**				-
1	Replacement of Road Studs				-
	Road Studs	Nos	220	19,000	4,180,000
2	Road Marking	Sqm	439	61,415	26,961,066
3	Maintenance of Earthen Shoulder	cum	307	4,138	1,270,286
F	**Contingency - 2 % above amount**				16,113,048
A	**Major Maintenance Cost excl. GST (INR)**				821,765,469
B	**GST (12% of A)**				98,611,856
	Major Maintenance Cost incl. GST (INR)				920,377,326
	Escalation Factor				1.106
	Esclated Amount keping Bitumen Component w/o Escalation				970,675,266

5. OPERATION AND MAINTENANCE COST

5.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article XVIII - Operation &Maintenance & Schedule - L Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article XVIII is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article XVIII.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. HTMS
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)
6. Major Maintenance (Functional Overlay and Strengthening Layer)

5.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2022, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	Not Applicable due to recent Major Maintenance
3	Roughness Value (IRI), Rutting	NSV Survey (Laser Profilometer)
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection

Sn	Description of Data	Methodology adopted
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	HTMS	As per manufacturer's / supplier's recommendation
10	TMS	Not applicable due to project being operated under BOT (Annuity) Model

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each item.

5.3 Requirement of CA (Schedule L and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-L (the "Maintenance Requirements").

5.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine and preventive maintenance covers maintenance of following assets:

- Main Carriageway – Left and Right Carriageway, Rigid and Flexible pavement
- Service Roads – Left and Right direction
- Median
- Kerbs
- Plantation and Landscaping
- Shoulder
- Road side and median safety barrier
- W Beam Crash Barrier
- Concrete Barrier
- Pedestrian guard rail
- Signs and markings
- Lighting
- Studs and other safety devises
- Traffic signs and LED blinker
- Boundary stones/KM stones/HM Stones
- Bus Bays
- Truck Lay byes
- Structures
- Drains and Protection works
- Retaining Walls
- Crossroads
- Junctions

Routine maintenance quantity has been derived with respect to total quantity of work multiplying factor decided by expert in relevant field.

The Average Cost towards Routine maintenance is Rs. 19,486/KM/Month excluding GST. And preventive maintenance considered is Rs.12,597 / Km / Month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light will be operated for 10 hours a day round the year

b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 11 Rs / Kwh.
The calculated electricity cost for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount (INR)
1	Spare Parts for Highway Lighting (AMC)	Km	20.00	137,216	2,744,318
2	Highway Lighting Electricity Charge	Kwh	544,960	12.08	6,580,387
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos	56	3,293	184,418
	Total				5,884,120

5.6 HTMS
Following consideration has made during calculation of O & M cost for HTMS Equipment:

a) 5% of Total Cost of HTMS Equipment is considered for AMC cost towards TMS is considered 0.15 Crore per year
b) With only 6 years of Concession Period remaining, replacement of HTMS Equipment is not deemed required.

5.7 Corridor Management
O & M cost for Highway Patrol, Ambulance, Cranes shall be outsourced. The Corridor management works out to be 1.99 Crore per Year as per AECOM Estimate.

5.8 Manpower Cost
The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

i. Management, Administration / HR and Supervision Staff: in-house manpower
ii. Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as Rs. 1.46 core per year.

5.9 Office Expenses
Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 3.37 crore per year. Year wise O & M Cost (OPEX) is presented in next page.

The Year wise Operation and maintenance cost are presented Next Page.

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost - Andhra Pradesh Expressway Limited											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	13,241,935	19,542,418	5,884,120	1,546,370	19,946,873	1,778,318	14,636,726	1,844,182	33,653,835	112,074,778
3	2023-24	14,970,764	19,542,418	5,884,120	1,546,370	19,946,873	1,778,318	14,636,726	1,844,182	33,653,835	113,803,606
4	2024-25	7,808,286	19,542,418	5,884,120	1,546,370	19,946,873	1,778,318	14,636,726	1,844,182	33,653,835	106,641,128
5	2025-26	10,229,321	19,542,418	5,884,120	1,546,370	19,946,873	1,778,318	14,636,726	1,844,182	33,653,835	109,062,163
	Total	46,250,306	78,169,673	23,536,479	6,185,478	79,787,493	7,113,272	58,546,905	7,376,727	134,615,342	441,581,675
	Total Cost in Crore	4.63	7.82	2.35	0.62	7.98	0.71	5.86	0.74	13.46	44.16

6. PROJECT ROAD ANALYSIS

6.1 Reconnaissance Survey

This project road is a Kotakatta - Kurnool section of NH 7 (New NH 44) in the state of Telangana and Andhra Pradesh. Project road starts from Km 136+077 at the end of Kotakatta Bypass in the state of Telangana to Km 210+699 at Kurnool in the state of Andhra Pradesh. The total length of the project road is 74.622 km and located in the Plain terrain. The project road has been visited by Consultant's team of Engineers in the month of November 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretch and length is given as below:

Detail of Project Stretch

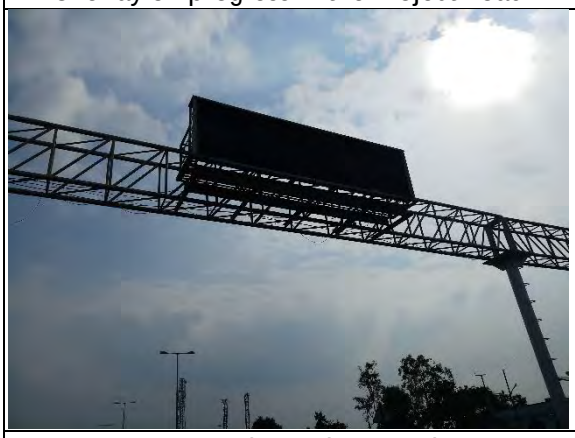
Project Name as per CA	Start Chainage	End Chainage	Length (km)	Remarks
Design, Construction, Development, Finance, Operation and Maintenance of Km 135.469 (End of proposed Kotakatta Bypass) to Km 211 (Kurnool) on NH-7 in the State of Andra Pradesh under the North-South Corridor (NHDP Phase II) on BOT (Annuity) Basis	136+077	210+699	74.622	4- Lane Divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

a) Cross sectional elements
b) Embankment Height
c) Terrain and Land use pattern along the project corridor
d) Toe Wall, Retaining Wall, RE Wall and other retaining structures
e) Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
f) Toll Plaza and associated facilities
g) Safety barriers and Guard Rails
h) Junctions and cross road details
i) Drainage details
j) Sign Board, Traffic Safety Devices and other Roadside Furniture items
k) Landscaping and Plantation details along the project corridor
l) Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

Start Point of Project Road at Km 136+077	Toll Plaza at Km 200+800
Overlay on progress in the Project Road	Wayside Amenities (Rest Area) at Km 200+300
	
VMS on the Project Road	End Point of Project Road at Km 210+699

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 135+469 (End of proposed Kotakatta Bypass) of Kotakatta - Kurnool Section of NH-7 (New NH 44)	Km 136+077 (End of proposed Kotakatta Bypass) of Kotakatta - Kurnool Section of NH-7 (New NH 44)	
2	Project Road End	Km 211+000 (Kurnool) of Kotakatta - Kurnool Section of NH-7 (New NH 44)	Km 210+699 (Kurnool) of Kotakatta - Kurnool Section of NH-7 (New NH 44)	
3	Project Length	74.720	74.622	
6	Carriageway	4-lane highway with divided carriageway paved width 8.75 m on either side and Service/Slip Road on selected stretches.	4-lane highway with divided carriageway paved width 8.75 m on either side and Service/Slip Road on selected stretches.	
7	Shoulders	1.0 m Earthen shoulder for Main Carriageway.	1.0 m Earthen shoulder for Main Carriageway.	
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	
9	Service Roads	5.5 m Width LHS - 2.550 km RHS - 1.950 km 7.0 m Width LHS - 5.756 km RHS - 5.756 km	5.5 m Width LHS - 2.550 km RHS - 1.950 km 7.0 m Width LHS - 5.756 km RHS - 5.756 km 13.5 m Width LHS - 0.970 km RHS - 0.970 km Balance Length: 0.150 km (7.0m wide/LHS)	
10	Major Bridge	3	3	

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
11	Minor Bridge	40	37	
12	Pipe, Box & Slab Culverts	157	149	
13	Major/Minor Junctions	Major: 7 Minor: 62	Major: 8 Minor: 48	
14	Underpasses	3	PUP - 3 CUP - 1 VUP - 2 (* 1 Under-Construction)	
15	Grade Separator	3	2	
15	ROB/RUB	1	1	
16	Toll Plazas	1	1	
17	Truck Lay-byes/Truck Parking	4	4	
18	Bus Bays/Bus Stops	42	49	
19	Wayside Amenities	LHS - Km 199+500 RHS - Km 154+000	LHS - Km 200+300 (Under Construction)	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

Typical Cross Section without Service Road	Typical Section GS Approach
Section with 5.5m wide Service Road and Drain	Toll Plaza

Eight type of TCS has been proposed in Schedule-B of CA and same has adhered along with some modifications as per site condition along project road.

6.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at Toll Plazas where Rigid Pavement has been provided at approximately 100m length. Pavement condition is generally Good throughout the project corridor as recent.

6.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

Comparison of Service Road Location between Schedule B and as per Site

Sn	As per Schedule B					As Per Site				
	Location		Side	Length (m)	Width (m)	Location		Side	Length (m)	Width (m)
	From	To				From	To			
1	139+650	140+250	RHS	600	5.50	140+230	140+800	RHS	570	5.5
2	146+000	146+650	LHS	650	5.50	146+700	147+400	LHS	700	5.5
3	146+000	146+650	RHS	650	5.50	146+700	147+400	RHS	700	5.5
4	166+725	166+725	LHS	400	5.50	165+800	166+500	LHS	700	5.5
5	166+725	166+725	RHS	400	5.50	165+800	166+500	RHS	700	5.5
6	197+150	198+250	LHS	1100	7.00	196+780	198+000	LHS	1220	7
7	197+150	198+250	RHS	1100	7.00	196+780	198+000	RHS	1220	7
8	202+175	202+725	LHS	550	5.50	202+000	202+800	LHS	800	5.5
9	202+175	202+725	RHS	550	5.50	202+000	202+800	RHS	800	5.5
10	204+500	204+850	LHS	350	5.50	205+800	208+100	LHS	2300	7
11	204+500	204+850	RHS	350	5.50	205+800	208+100	RHS	2300	7
12	206+100	210+350	LHS	4200	7.00	208+100	209+070	LHS	970	13.5
13	206+100	210+350	RHS	4200	7.00	208+100	209+070	RHS	970	13.5
14	210+600	211+100	LHS	456	7.00	209+070	209+950	RHS	880	7
15	210+600	211+100	RHS	456	7.00	209+220	209+950	LHS	730	7
16						210+300	210+699	LHS	399	7
17						210+300	210+699	RHS	399	7
TOTAL				16012					16358	

Additionally, 150m of Service Road remains to be constructed on LHS between Km 209+070 to Km 209+220.

Snaps of Service/Slip Roads along various sections of the Project Road

6.2.4 Median

Generally, of 4.5 m is observed in the project road in rural stretches while 2 m wide Median was observed in the built-up stretches respectively. Plantation provided along entire median is in in good condition. Wider median is observed in the Major Bridge approaches.

Typical 4.5 m wide median with Antiglare

Typical Median Opening along the Project Road

58 nos. of Median Openings were identified along project road. Solar Blinkers and Metal Beam Crash were found in the Median Openings:

Sn	Chainage	Length of Opening (m)	Type	Reserve Lane	Remarks
1	136+040	10	Authorized		
2	136+300	10	Authorized		
3	137+800	10	Authorized	Yes	
4	139+200	20	Authorized	Yes	
5	139+850	10	Authorized		
6	140+160	20	Authorized	Yes	
7	141+800	20	Authorized	Yes	
8	143+200	20	Authorized	Yes	
9	144+250	5	Authorized	Yes	Closed
10	145+300	20	Authorized	Yes	
11	146+720	20	Authorized	Yes	
12	149+670	20	Authorized	Yes	
13	152+400	20	Authorized	Yes	
14	153+040	30	Authorized	Yes	
15	153+700	20	Authorized	Yes	
16	155+500	20	Authorized	Yes	
17	156+020	10	Authorized	Yes	
18	157+750	20	Authorized	Yes	
19	158+750	30	Authorized	Yes	
20	159+100	20	Authorized	Yes	
21	159+500	20	Authorized	Yes	
22	160+700	20	Authorized	Yes	Closed
23	162+100	20	Authorized	Yes	

Sn	Chainage	Length of Opening (m)	Type	Reserve Lane	Remarks
24	163+600	20	Authorized	Yes	
25	165+750	30	Authorized	Yes	
26	167+530	20	Authorized	Yes	
27	168+300	20	Authorized	Yes	
28	169+670	5	Authorized	Yes	
29	170+200	20	Authorized	Yes	Storage Lane
30	172+900	10	Authorized	Yes	
31	174+300	20	Authorized	Yes	Storage Lane
32	175+280	20	Authorized	Yes	
33	176+800	20	Authorized	Yes	
34	177+100	20	Authorized	Yes	
35	178+600	20	Authorized	Yes	
36	180+050	30	Authorized	Yes	Storage Lane
37	181+100	30	Authorized	Yes	Storage Lane
38	181+600	20	Authorized	Yes	
39	183+450	20	Authorized	Yes	
40	186+000	20	Authorized	Yes	
41	187+300	20	Authorized	Yes	
42	189+460	30	Authorized	Yes	
43	192+100	20	Authorized	Yes	
44	193+200		Authorized		
45	193+800	20	Authorized	Yes	
46	195+100	20	Authorized	Yes	
47	199+230	10	Authorized	Yes	
48	200+200	10	Authorized	Yes	
49	201+000	20	Authorized		
50	202+830	20	Authorized	Yes	
51	203+200	20	Authorized		On Truck Lay Bye
52	203+500	20	Authorized		
53	204+200	30	Authorized	Yes	
54	204+500	20	Authorized		
55	206+400	20	Authorized		
56	207+100	20	Authorized		
57	207+600	30	Authorized		
58	208+100	20	Authorized		

6.2.5 Solar Blinkers

Solar Blinkers were observed in the Median Opening locations and at some cross roads of At-Grade Intersection. 48 single headed and 38 double headed blinkers were recorded in the project road. Details of Solar Blinkers present along the project road has been presented in the table below:

Sn	Chainage	Solar Blinkers		
		Single Head at Median	Double Head at Median	Single Head on Cross Road
1	136+040		1	

Sn	Chainage	Solar Blinkers		
		Single Head at Median	Double Head at Median	Single Head on Cross Road
2	137+800		1	
3	139+200		1	1
4	140+160		1	
5	141+800		1	1
6	143+200		1	1
7	144+250		2	1
8	145+300		1	
9	146+720		1	
10	149+670		1	
11	152+400		1	
12	153+040	2		
13	153+700		1	
14	155+500		1	
15	156+020	2		
16	157+750		1	1
17	158+750		1	1
18	159+500		1	
19	162+100	2		
20	163+600		1	1
21	165+750		1	2
22	167+530	2		
23	168+300		1	
24	170+200	2		1
25	172+900		1	
26	174+300		1	
27	175+280		1	
28	177+100	2		
29	178+600		1	
30	180+050		1	1
31	181+600		2	1
32	183+450		1	1
33	186+000		2	1
34	187+300	2		
35	189+460		2	1
36	192+100		1	
37	193+200			1
38	193+800		1	
39	195+100	2		
40	199+230			1
41	200+200	2		
42	202+830		2	1
43	203+200	1		
44	203+500	3		
45	204+200		2	1
46	204+500	2		
47	206+400	1		
48	207+100	1		

Sn	Chainage	Solar Blinkers		
		Single Head at Median	Double Head at Median	Single Head on Cross Road
49	207+600	2		
50	208+100	1		

Solar Blinkers present in the Project Road

6.2.6 Roadside Drain

16.718 km of RCC Drain is present in the project road. These drains are provided in edge of Service/Slip roads as well as on the edge of Truck Lay bye. Location and type of drain as provided is presented below:

Location of RCC Drain

Sn	Chainage		Length (m)	Side	Remarks
	From	To			
1	140+230	140+800	570	RHS	
2	146+700	147+400	700	LHS	
3	146+700	147+400	700	RHS	
4	150+100	150+300	200	LHS	On Truck Lay Bye
5	151+650	151+850	200	RHS	On Truck Lay Bye
6	165+800	166+500	700	LHS	
7	165+800	166+500	700	RHS	
8	196+780	198+000	1220	LHS	
9	196+780	198+000	1220	RHS	
10	201+500	201+700	200	LHS	On Truck Lay Bye
11	202+000	202+800	800	LHS	
12	202+000	202+800	800	RHS	
13	203+000	203+200	200	RHS	On Truck Lay Bye
14	205+800	208+100	2300	LHS	
15	205+800	208+100	2300	RHS	
16	208+100	209+000	900	LHS	
17	208+100	209+200	1100	RHS	
18	209+400	209+450	50	RHS	Inner Side of Slip Road
19	209+470	210+000	530	LHS	

Sn	Chainage		Length (m)	Side	Remarks
	From	To			
20	209+470	210+000	530	RHS	
21	210+300	210+699	399	LHS	
22	210+300	210+699	399	RHS	

RCC Drain at Edge of Service Road

RCC Drain at Edge of Truck Laybye

6.2.7 Median Drain

Longitudinal Median Drain and Median Cut Drain are present in the project road at Superelevated sections on the project corridor. Locations of Median Cut Drain and Longitudinal Drain are provided in the table below:

Location of Median Drain

Median Cut Drain

Sn	Chainage		Length (m)
	From	To	
1	146+600	146+800	200
2	151+100	151+400	300
3	151+130	151+300	170
4	153+200	153+350	150
5	155+600	155+950	350
6	156+050	156+225	175
7	161+400	161+800	400
8	182+400	182+600	200
9	194+300	194+600	300
10	205+000	205+650	650
11	206+700	206+820	120

Longitudinal Median Drain

Sn	Chainage		Length (m)
	From	To	
1	152+950	153+000	50
2	187+200	187+400	200
3	194+200	194+500	300
4	194+550	194+600	50

Median Longitudinal Drain on the project road

6.2.8 Major and Minor Junctions

As per the site inventory, 8 major and 48 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Snaps of Major Junction (LHS) and Minor Junction (RHS) along the project road

Details of Major Junctions

Sn	Chainage	Type of Junction	LHS		RHS		Remarks
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
1	153+050	Y	7.0	BT			Pebbair Town Entry
2	156+000	Y	7.0	BT			Pebbair Town Exit
3	165+800	X	7.0	BT	7.0	BT	
4	197+450	X	7.0	BT	7.0	BT	
5	202+800	T	7.0	BT	7.0	BT	
6	204+200	T	7.0	BT	7.0		To Kurnool City
7	206+400	T	7.0	BT			
8	208+450	X	7.0	BT	7.0	BT	To Kurnool City

6.2.9 Guard Stones

Guard Stones are presented in the project road at High Embankment and Curve locations for the safety of road users. Around 1500 guard stones are present in the project road.

Snaps showing Guard Stones present in the project road

6.2.10 Safety Barriers

46.240 km of Metal Beam Crash barriers was present at carriageway edges at high embankment locations, narrow medians, ECB locations, structure approaches and at cross roads at some junctions. Similarly, 7.818 km of Pedestrian Guard Rails are at the carriageway edges on separators between the Service Road and Main Carriageway.

Detail of crash barriers present in the project road is given below:

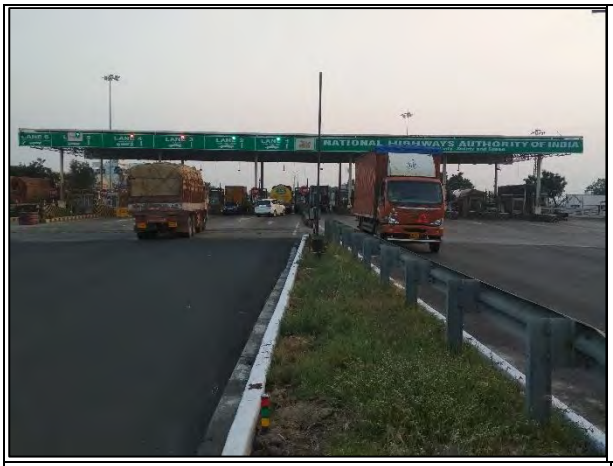
Type of Crash Barrier	Side	Length (km)
Metal Beam	Cross Road at Junctions	0.970
	Median	11.880
	Carriageway Edges	23.535
	ECB Locations	1.020
	Minor Bridge and Culvert Locations	3.360
	Median Openings	5.475
Pedestrian Guard Rail	Separators between MCW and Service Road	5.923
	Bus Bay	1.895

PGR and W-Beam present on the project road

6.2.11 Toll Plaza and Other Facilities

As per Schedule-C, one toll plaza with 6 lanes in each direction has been proposed between Km 200+700 to Km 201+250 at suitable location and same has been provided at Km 200+800 in Pullur.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

<table>
<tr><td>  </td><td> </td></tr>
<tr><td>Pullur Toll Plaza (Km 200+800)</td><td>O&M Camp Office of AEPL</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Toilet Block provided near Toll Plaza</td><td>Highway Nest (Mini) near Toll Plaza</td></tr>
</table>

It is noted full fledge Administrative Office, Operation and Maintenance Base camp of the Concessionaire, Toilet Block and Highway Mini Nest has been constructed at Pullur Toll Plaza. Rigid Pavement is provided for approximately 100m around the toll booths in the toll plaza.

6.2.12 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza, built-up areas, GS structres approaches and truck lay byes as per Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

Sn	Chainage		Single Arm		Double arm		Remarks
	From	To	LED	Sodium Vapour	LED	Sodium Vapour	
1	146+000	147+000	44		15		
2	147+000	148+000	20				
3	140+000	140+500			15		
4	146+700	147+300			15		
5	150+000	150+200	6				Truck lay bye
6	151+400	151+600	6				Truck lay bye
7	158+600	159+000			10		
8	159+000	160+000			14	2	
9	165+000	166+000	6		8	6	
10	166+000	167+000	20	24			
11	174+300	174+500			5		
12	196+700	198+000	36		28		
13	196+000	197+000	6				
14	197+000	198+000	30				
15	200+000	201+000			30		
16	201+500	201+700	6				Truck lay bye
17	201+000	202+000	29		36		
18	202+000	203+000	22				
19	202+800	203+000	6				Truck lay bye
20	205+000	206+000	10		2		
21	206+000	207+000	60		23		
22	207+000	208+000	54		8		
23	208+000	209+000	85		28		
24	209+000	210+000	29	15	24		
25	210+000	211+000	27		10		

High Mast Lighting has been provided at the Junctions and Toll Plaza locations along the project road. There are 15 no. of High Mast Lights along the project road. Detail location of High Mast Lights has been provided in the table below:

High Mast Location

Chainage	Location	Type of Light	No. of High Mast Lights	No. of Fixtures
153+100	Pebbair Bypass Start	Sodium Vapour	1	8 Normal + 2 Additional
156+000	Pebbair Bypass End	Sodium Vapour	1	7 Normal + 3 Additional
165+800	Erravalli Junction	Sodium Vapour	2	5 Normal + 2 Additional on each
197+400	Alampur Junction	Sodium Vapour	2	6 Fixtures on each
200+650	Toll Plaza	Sodium Vapour	4	8 Fixutres on each
202+800	Panchalingala Junction	Sodium Vapour	1	6 Fixtures on each
204+100	VUP Junction	Sodium Vapour	1	6 Fixtures on each
208+400	Bellary Junction	Sodium Vapour	1	6 Fixtures on each
209+650	Kallur Junction	Sodium Vapour	2	8 Fixtures on each

Lighting at Truck Lay-bye

High Mast Light at Major Junction at Km 153+100 (Start of Pebbair Bypass)

6.2.13 Bus Bays and Bus Shelter

49 Bus bays with shelter are present along the project road. All the bus shelters are made of concrete and most of these are provided with drinking water facility.

Bus Shelter at Km 151+700 (LHS)

Bus Shelter at Km 176+750 (RHS)

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with Shelter

Sn	Chainage	Side	Surface	Condition	Construction Type	Drinking Water Facility	Remarks
1	143+400	RHS	BT	Good	Concrete	Provided	Kondathanda
2	151+750	LHS	Paver Blocks	Good	Concrete	Not Provided	For School
3	166+000	RHS	BT	Good	Concrete	Provided	Eravali
4	179+980	LHS	BT	Good	Concrete	Provided	Dharmavera
5	189+700	RHS	BT	Good	Concrete	Provided	Itikyala Peda
6	136+250	LHS	BT	Good	Concrete	Provided	Amadabakula
7	136+600	RHS	BT	Good	Concrete	Provided	Amadabakula
8	137+700	LHS	BT	Good	Concrete	Provided	Sanka Reddy Palle
9	137+900	RHS	BT	Good	Concrete	Provided	Sanka Reddy Palle
10	139+200	LHS	BT	Good	Concrete	Provided	Rayani Peta
11	139+400	RHS	BT	Good	Concrete	Provided	Rayani Peta

Sn	Chainage	Side	Surface	Condition	Construction Type	Drinking Water Facility	Remarks
12	140+000	LHS	BT	Good	Concrete	Provided	Mumala Palle
13	141+700	LHS	BT	Good	Concrete	Provided	Kodukantla
14	141+900	RHS	BT	Good	Concrete	Provided	Kodukantla
15	142+800	LHS	BT	Good	Concrete	Provided	Kondathanda
16	144+100	LHS	BT	Good	Concrete	Provided	Villiankonda
17	145+100	LHS	BT	Good	Concrete	Provided	Mirasapalle
18	145+400	RHS	BT	Good	Concrete	Provided	Mirasapalle
19	149+600	LHS	BT	Good	Concrete	Provided	Thomla Palle
20	149+850	RHS	BT	Good	Concrete	Provided	Thomla Palle
21	155+600	LHS	BT	Good	Concrete	Provided	Pebbair
22	155+600	RHS	BT	Good	Concrete	Provided	Pebbair
23	159+100	LHS	BT	Good	Concrete	Provided	Rangapuram
24	163+200	LHS	BT	Good	Concrete	Provided	
25	163+200	RHS	BT	Good	Concrete	Provided	
26	165+800	LHS	BT	Good	Concrete	Provided	Eravali
27	167+550	LHS	BT	Good	Concrete	Provided	Kondair
28	167+700	RHS	BT	Good	Concrete	Provided	Kondair
29	168+200	LHS	BT	Good	Concrete	Provided	Kottan College
30	168+800	RHS	BT	Good	Concrete	Provided	Kottan College
31	169+700	RHS	BT	Good	Concrete	Provided	Jhinkhapalle
32	170+000	LHS	BT	Good	Concrete	Provided	Itikyala
33	170+200	RHS	BT	Good	Concrete	Provided	Jhinkhapalle
34	174+200	LHS	BT	Good	Concrete	Provided	Kodandapuram
35	174+350	RHS	BT	Good	Concrete	Provided	Kodandapuram
36	176+750	LHS	BT	Good	Concrete	Provided	Vemula
37	176+900	RHS	BT	Good	Concrete	Provided	Vemula
38	179+980	LHS	BT	Good	Concrete	Provided	Dharmavaram
39	179+980	RHS	BT	Good	Concrete	Provided	Dharmavaram
40	181+600	LHS	BT	Good	Concrete	Provided	Narayanpuram
41	181+700	RHS	BT	Good	Concrete	Provided	Narayanpuram
42	183+400	LHS	BT	Good	Concrete	Provided	Boravelli
43	183+650	RHS	BT	Good	Concrete	Provided	Boravelli
44	186+100	RHS	BT	Good	Concrete	Provided	Manopody
45	186+100	LHS	BT	Good	Concrete	Provided	Manopody
46	187+100	LHS	BT	Good	Concrete	Provided	Jallapuram
47	189+300	LHS	BT	Good	Concrete	Provided	Itikyala Peda
48	202+700	LHS	BT	Good	Concrete	Provided	Panchaligala
49	202+800	RHS	BT	Good	Concrete	Provided	Panchaligala

6.2.14 Truck Lay Byes

Four Truck Lay-byes are present in the project road. Details of Truck-lay byes present in the project road is given in the table below:

Details of Truck Lay-bye

Sn	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	150+200	LHS	NA	Available	Available
2	151+750	RHS	NA	Available	Available
3	201+600	LHS	NA	Available	Available
4	203+100	RHS	NA	Available	Available

Truck Laybye and Toilet Block at Km 203+100 RHS

6.2.15 Slope Protection Measures

About 14 km of Stone Pitching and Chutes are provided in the high embankment locations for protection of embankment from erosion. These are mostly provided in Approaches to Major Bridge and other structure locations.

Stone Pitching provided at Tungabhadra Bridge Approach (Km 203+000 RHS)

6.2.16 Wayside Amenities/Rest Areas

Two Wayside Amenities Complex (Rest Areas) are to be provided in the project road as per Concession Agreement. At present one Wayside Amenities Complex is under construction in the project road at Km 200+100. One more Wayside Amenities Complex to be provided at Km 154+000 in Pebbair Bypass is pending due to land issue. Details of Wayside Amenities present in the project road is given in the table below:

Details of Wayside Amenities/Rest Area

SN	Chainage	Side	Type	Remarks
1	200+100	LHS	Wayside Amenities / Rest Area	Under Construction
2	154+000	RHS	Wayside Amenities / Rest Area	Pending due to Land Issue

Wayside Amenites Complex under-construction at Km 200+100 LHS

6.2.17 Signage and Marking

Road Signs

1609 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Overhead Gantry at the Start of Project Road

Place Identification Board on the Project Road

Summary of different sign board found along the project road is presented below:

Type of Sign Board	No. of Sign Boards	
	LHS	RHS
Accident Prone Area	7	2
Advance Direction	3	10
Bus Stop	22	19
Cantilever Gantry	8	0
Chevron	87	68
Clearance	0	0
Curve Ahead	42	39
Delineators	13	0
Direction	39	3
ECB	34	25
Emergency Contacts	7	1
Give Way	23	4
Go Slow	2	3
Hazard Marker	175	119
Hump Ahead	5	7
Junction (X, +)	24	17
Junction (T, Y)	56	44
Keep Left	44	41

Type of Sign Board	No. of Sign Boards	
	LHS	RHS
Median Opening	76	59
Merging Traffic	0	0
Narrow Road Ahead	3	5
No Entry	1	0
No Overtaking	6	4
No Parking	17	23
Overhead Gantry	7	1
Other Information Board	6	2
Pedestrian Crossing	77	74
Petrol Pump	0	1
Place Identification	14	21
Reassurance Sign	9	11
Route Marker	39	36
School Zone	11	4
Speed Limit	27	11
Stop	22	0
Toll Plaza Sign Board	10	12
Warning Sign	9	18

Road Marking

Major Maintenance is under progress in the project road hence road marking is missing in majority of section. While in other stretches, marking is under progress.

Snaps showing condition of Road Marking in Main Carriageway

6.2.18 Landscaping and Tree Plantation

Median plantation has been provided at 4.5 m median along the project road. Condition of median plantation is found to be good. Avenue plantation has been provided wherever available.

Snaps showing Median and Avenue Plantation along the Project Road

6.3 Structure Inventory and Condition Survey

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

2 Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
3 Existing width of roadway and total width.
4 Type and condition of protection work, if any, and information regarding scour and erosion.
5 Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
6 Type of foundation
7 Type and size of culverts.
8 Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 3 no of Major Bridge having total length varies from 175 m to 941 m are generally found in good condition.
- 37 nos. of Minor bridges having total length varies from 6.8 m to 59 m are generally found in good condition.
- 1 no of Vehicular Underpass having span arrangement of 1 x 22.8 m is found in good condition and 1 no of VUP is under construction.
- 3 nos. of Pedestrian Underpass having span arrangement of 1 x 5.5 m and 1 x 12 m and 1 no of Cattle Underpass having span arrangement of 1 x 4.5 m are found in good condition.
- 1 no of Railway over Bridge of total length of 31 m having span arrangement 1 x 31 m is in good condition
- 2 nos. of Flyover having span arrangement of 1 x 29.12 m and 1 x 20 + 1 x 40 + 1 x 20 m are found in good condition

149 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

6.3.2.1 Major Bridges

Salient features of the 3 Major bridges are discussed here

Major bridge – CH. 161+650

It consists of Major Bridge on both the carriageways. It has span arrangement of 1x22.25m +1x33.825m+24x34.75m+1x28.65m+1x22.25m on LHS & 56x16m on RHS. The super structure comprises of PSC & RCC Girder on LHS and Grid Slab on RHS. Foundation is not visible, Elastomeric bearings are adopted on LHS for resting of superstructure on RCC wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of RHS

View of LHS

Major Bridge at Ch. 161+650

Major bridge – CH. 203+080

It consists of Major Bridge on both the carriageways. It has span arrangement of 2x40m+14x38.8m on LHS & 32x19.40m on RHS. The super structure comprises of PSC Girder on LHS and RCC Girder on RHS. Foundation is well foundation; Elastomeric bearings are adopted on LHS & RHS for resting of superstructure on RCC wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS View of RHS

Major Bridge at Ch. 203+080

Major bridge – CH. 209+550

It consists of Major Bridge on both the carriageways. It has span arrangement of 2x19.55+7x19.4m on LHS & 9x19.4m on RHS. The super structure comprises of RCC Girder on LHS & RHS. Foundation is not visible, Elastomeric bearings are adopted on LHS & RHS for resting of superstructure on RCC wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS View of Median

Major Bridge at Ch. 209+550

6.3.2.2 Minor Bridge

Salient features of the 37 Minor bridges are discussed here.

Minor Bridge – CH.135+576

It consists of new bridge on LHS and old bridge on RHS. LHS new bridge and on RHS Old Bridge with T-Beam was widened with Slab. The Bridge on LHS has a span arrangement of 1x8.6m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x8.6m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on SM & RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

RHS T-Girder & Slab

Minor Bridge at Ch. 135+576

Minor Bridge – CH.138+250

It consists of old bridge on LHS and new bridge on RHS. Old Bridge with T-Beam was widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 5x10m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on SM & RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x10.2+2x20.4m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction.

A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 138+250

Minor Bridge – CH.139+216

It consists of old bridge on LHS and new bridge on RHS. Old Bridge with T-Beam was widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 6x7m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on SM & RCC Wall type abutment. The Bridge on RHS has a span arrangement of 2x21m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

View of Median

Minor Bridge at Ch. 139+216

Minor Bridge – CH.143+488

It consists of old bridge on LHS and new bridge on RHS. Old Bridge with T-Beam was widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 2x8.65m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on SM & RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x17.3m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS T-Girder & Slab

View of Median

Minor Bridge at Ch. 143+488

Minor Bridge – CH.144+235

It consists of old bridge on LHS and new bridge on RHS. Old Bridge with T-Beam was widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 2x8.7m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of

1x17.4m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 144+235

Minor Bridge – CH.145+314

It consists of new bridge on LHS and old bridge on RHS. LHS new bridge and on RHS Old Bridge with T-Beam was widened with Slab. The Bridge on LHS has a span arrangement of 2x17.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 3x9.6m. The super structure comprises of RCC solid slab. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on SM & RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 145+314

Minor Bridge – CH.147+090

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x9.4m. The super structure comprises of RCC Slab. Tarpaper bearing is adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 3x3.2m. The super structure comprises of RCC solid slab. Tarpaper bearing is adopted for resting of superstructure on SM & RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 147+090

Minor Bridge – CH.148+143

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x9.5m. The super structure comprises of RCC Slab. Tarpaper bearing is adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 3x3.2m. The super structure comprises of RCC solid slab. Tarpaper bearing is adopted for resting of superstructure on SM & RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 148+143

Minor Bridge – CH.149+852

It consists of Old Bridge widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 3x7m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on SM & RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 1x20.9m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS T-Girder & Slab

View of RHS

Minor Bridge at Ch. 149+852

Minor Bridge – CH.150+150

It consists of old Bridge widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 2x8.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 1x16.8m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 150+150

Minor Bridge – CH.151+460

It consists of Slab Bridge on Both Carriage Ways. The Bridge on LHS has a span arrangement of 1x7.8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x7.8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 151+460

Minor Bridge – CH.152+211

It consists of old bridge on LHS and new bridge on RHS. Old Bridge with T-Beam was widened with Slab on LHS and on RHS New Bridge. The Bridge on LHS has a span arrangement of 5x10.2m. The super structure comprises of RCC solid slab & T-Beam. Tarpaper & Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 1x10.3+2x20.6m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 152+211

Minor Bridge – CH.152+720

It consists of I Girder on Both Carriage Ways. The Bridge on LHS has a span arrangement of 2x14m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 2x14m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 152+720

Minor Bridge – CH.153+870

It consists of Slab Bridge on Both Carriage Ways. The Bridge on LHS has a span arrangement of 1x7.5m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of

superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x7.5m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. The existing bridge is using as underpass. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 153+870

Minor Bridge – CH.156+416

It consists of Slab Bridge on Both Carriage Ways. The Bridge on LHS has a span arrangement of 1x8.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x8.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 156+416

Minor Bridge – CH.166+087

It consists of New Bridge on LHS and RHS. The Bridge on LHS has a span arrangement of 2x16m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 4x8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 166+087

Minor Bridge – CH.167+760

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x14.4m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 2x3.93+2x3.63m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 167+760

Minor Bridge – CH.169+246

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x11.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 3x3.7m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 169+246

Minor Bridge – CH.169+998

It consists of Slab Bridge on Both Carriage Ways. The Bridge on LHS has a span arrangement of 1x7.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x7.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 169+998

Minor Bridge – CH.170+395

It consists of New Bridge on LHS and RHS. The Bridge on LHS has a span arrangement of 1x16.4m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x16.4m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 170+395

Minor Bridge – CH.172+085

It consists of New Bridge on LHS and RHS. The Bridge on LHS has a span arrangement of 3x9.35m. The super structure comprises of RCC Box type. The Bridge on RHS has a span arrangement of 3x9.35m. The super structure comprises of RCC Box type.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 172+085

Minor Bridge – CH.173+968

It consists of old bridge on LHS & New bridge on RHS. The Bridge on LHS has a span arrangement of 2x3.4m. The super structure comprises of RCC solid slab and stone wall type abutment & pier as sub structure. The Bridge on RHS has a span arrangement of 1x6.8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 173+968

Minor Bridge – CH.174+310

It consists of Old Bridge widened with Slab on LHS and New Bridge on RHS. The Bridge on LHS has a span arrangement of 3x4.2m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & Pier. The Bridge on LHS has a span arrangement of 1x12.6m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 174+310

Minor Bridge – CH.177+108

It consists of New Bridge on LHS and RHS. The Bridge on LHS has a span arrangement of 1x15.2m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 2x7.6m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 177+108

Minor Bridge – CH.177+823

It consists of Slab Bridge on Both Carriage Ways. The Bridge on LHS has a span arrangement of 1x8.5m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 1x8.5m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 177+823

Minor Bridge – CH.179+176

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x10.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 2x3.54+1x3.74m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 179+176

Minor Bridge – CH.180+825

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x9.3m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 3x3.1m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 180+825

Minor Bridge – CH.184+590

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 4x5.25m. The super structure comprises of RCC Box. The Bridge on RHS has a span arrangement of 4x5.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of Median

Minor Bridge at Ch. 184+590

Minor Bridge – CH.185+887

It consists of Old Bridge widened with Slab on LHS and New Bridge on RHS. The Bridge on LHS has a span arrangement of 2x3.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier. The Bridge on RHS has a span arrangement of 1x6.8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 185+887

Minor Bridge – CH.186+628

It consists of Old Bridge widened with Slab on LHS and New Bridge on RHS. The Bridge on LHS has a span arrangement of 2x5.2m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier. The Bridge on RHS has a span arrangement of 1x10.4m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 186+628

Minor Bridge – CH.191+950

It consists of Old Bridge widened with Slab on LHS and New Bridge on RHS. The Bridge on LHS has a span arrangement of 2x4.2m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier. The Bridge on RHS has a span arrangement of 1x8.2m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 191+950

Minor Bridge – CH.194+012

It consists of Old Bridge widened with Slab on LHS and New Bridge on RHS. The structure on LHS has a span arrangement of 1x5.6m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC & SM Wall type abutment & pier. The Bridge on RHS has a span arrangement of 1x8m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 194+012

Minor Bridge – CH.197+929

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 1x16.8m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 4x4.2m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 197+929

Minor Bridge – CH.199+305

It consists of New Bridge on LHS and on RHS Old Bridge widened with Slab. The Bridge on LHS has a span arrangement of 2x15.6m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The Bridge on RHS has a span arrangement of 4x7.9m. The super structure comprises of RCC solid slab. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of Median

Minor Bridge at Ch. 199+305

Minor Bridge – CH.204+042

It consists of New Bridge on LHS and Old Bridge on RHS. The Bridge on LHS has a span arrangement of 2x7.5+1x44m. The super structure comprises of PSC Girder & RCC Slab. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS has a span arrangement of 1x28.2m. The super structure comprises of RCC Integral slab and RCC Wall type abutment substructure.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 204+042

Minor Bridge – CH.205+167

It consists of New Bridge on LHS and RHS. The Bridge on LHS has a span arrangement of 3x8.5m. The super structure comprises of RCC Box type. The Bridge on RHS has a span arrangement of 3x8.5m. The super structure comprises of RCC Box type.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 205+167

Minor Bridge – CH.208+830

It consists of New Bridge on main carriageway of LHS, RHS & LHS service road and old bridge on RHS service road. The Bridge on main carriageway of LHS, RHS & LHS service road has a span arrangement of 2x14.2+1x21.3m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The Bridge on RHS service road has a span arrangement of 7x7.1m. The super structure comprises of RCC Solid slab. Tarpaper bearings are adopted for resting of superstructure on Stone Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS SR

Minor Bridge at Ch. 208+830

6.3.2.3 Vehicular Under-Passes (VUPs)

There are total of 02 VUPs in the entire project road. VUPs are with vertical clearance of minimum 5.5m. The clear Span arrangement for VUPs at Ch. 203+808 is 1x22.8m on LHS & 1x22+2x5 on RHS and VUP at Ch.206+570 (COS) is under construction.

VUPs are generally in good condition with some minor damages.

View of LHS

View of RHS

VUP at Ch. 203+808

View of Carriageway

Span Arrangement

VUP under construction at Ch. 206+570

6.3.2.4 Pedestrian & Cattle Under-Passes (PUPs & CUPs)

There is a total of 03 PUPs & 01 CUPs has been provided. PUPs at Ch.139+969, 146+400 having span of 1x5.5m and PUP at Ch.209+020 having span 1x12m. CUP at Ch.154+500 is having a span 1x4.5m.

PUPs are generally in good condition with some minor damages. Few pictures to ascertain the conditions of PUPs are presented as follows:

View of LHS

View of RHS

VUP at Ch. 139+969

View of LHS

View of RHS

PUP at Ch. 146+400

View of LHS

View of RHS

CUP at Ch. 154+500

View of LHS

View of RHS

PUP at Ch. 209+020

6.3.2.5 Railway over Bridge (ROBs)

a) ROB at Ch. 195+443

It consists of old bridge on LHS and new bridge on RHS on over railway tracks. The old bridge has a span arrangement of 1x10.35m. The super structure comprises of RCC Steel Girder. The Foundation is not visible. The new bridge has a span arrangement of 1x31m. The super structure comprises of RCC I-Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC portal type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of LHS side

View of RHS Side

Elastomeric bearing

RHS Carriage Way and Expansion Joints Buried

ROB at Ch. 195+443

6.3.2.6 Grade Separators (Flyover)

There are 02 nos. of grade separators in the entire project road. Salient features of the grade separators are discussed here.

Grade Separator at Ch. 196+846

It consists of new flyover on both carriageways. It has a span arrangement of 1x29.12m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction.

A few pictures to ascertain the conditions of Grade Separator are presented as follows: -

Median View

Span Arrangement

Girder View

Spalling and Exposed Reinforcement

Flyover at Ch. 196+846

Grade Separator at Ch. 207+850

It consists of flyover on both carriageways. It has a span arrangement of 2x20+1x40m. The super structure comprises of RCC BOX Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction.

A few pictures to ascertain the conditions of Grade Separator are presented as follows: -

Span Arrangement

View of Median

Carriageway

Expansion joint damage

Flyover at Ch. 207+850

6.3.2.7 Culverts

There are 149 numbers of culverts in entire project corridor.
The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

Box Culvert at Ch. 136+263

Box Culvert at Ch. 136+420

Slab Culvert at Ch. 164+944

Slab Culvert at Ch. 171+413

Box Culvert at Ch. 184+864

Box Culvert at Ch. 205+873

Slab /Box Culverts

A Few pictures to ascertain the conditions of Pipe culverts are presented as follows:

Pipe Culvert at Ch. 139+024

Pipe Culvert at Ch.141+756

Pipe Culvert at Ch. 146+690

Pipe Culvert at Ch.114+530

Pipe Culvert at Ch. 166+280

Pipe Culvert at Ch. 185+341

Pipe Culvert

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
Major Bridge	1	**161+650**	**MJB**	**LHS**	1x22.25+1x33.825+ 24x34.751x28.65+ 1x22.25	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	56x16	8.4		●	●	●	-	●	●	●	●	●	●	Stable	
	2	**203+080**	**MJB**	**LHS**	2x40+14x38.8	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	32x19.40	8.4		●	●	●	●	●	●	●	●	●	●	Stable	
	3	**209+550**	**MJB**	**LHS**	2x19.55+7x19.4	8.4	Y	●	●	●	●	-	●	●	●	●	●	Stable	
				RHS	9x19.4	12		●	●	●	●	●	●	●	●	●	●	Stable	
Minor Bridge	4	**135+576**	**MNB**	**LHS**	1x8.6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x8.6	12		●	●	●	●	●	●	●	●	●	●	Stable	
	5	**138+250**	**MNB**	**LHS**	5x10	12	Y	●	●	●	●	-	-	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
				RHS	1x10.2+2x20.4	12		●	●	●	●	●	●	●	●	●	●	Stable	
	6	**139+216**	**MNB**	**LHS**	6x7	12	Y	●	●	●	●	-	-	●	●	●	●	Stable	
				RHS	2x21	12		●	●	●	●	●	-	●	●	●	●	Stable	
	7	**143+488**	**MNB**	**LHS**	2x8.65	12	Y	●	●	●	●	-	●	●	●	●	●	Stable	
				RHS	1x17.3	12		●	●	●	●	●	●	●	●	●	●	Stable	
	8	**144+235**	**MNB**	**LHS**	2x8.7	12	Y	●	●	●	●	-	●	●	●	●	●	Stable	
				RHS	1x17.4	12		●	●	●	●	●	●	●	●	●	●	Stable	
	9	**145+314**	**MNB**	**LHS**	2x17.5	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	3x9.6	12		●	●	●	●	-	●	●	●	●	●	Stable	
	10	**147+090**	**MNB**	**LHS**	1x9.4	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x3.2	12		●	●	●	-	-	●	●	●	●	●	Stable	
	11	**148+143**	**MNB**	**LHS**	1x9.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x3.2	12		●	●	●	-	-	●	●	●	●	●	Stable	
	12	**149+852**	**MNB**	**LHS**	3x7	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x20.9	12		●	●	●	●	●	●	●	●	●	●	Stable	
	13	**150+150**	**MNB**	**LHS**	2x8.4	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x16.8	12		●	●	●	●	●	●	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
	14	**151+460**	**MNB**	**LHS**	1x7.8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x7.8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	15	**152+211**	**MNB**	**LHS**	5x10.2	12	Y	●	●	●	●	-	●	●	●	●	●	Stable	
				RHS	2x20.6+1x10.3	12		●	●	●	●	●	●	●	●	●	●	Stable	
	16	**152+720**	**MNB**	**LHS**	2x14	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x14	12		●	●	●	●	●	●	●	●	●	●	Stable	
	17	**153+870**	**MNB**	**LHS**	1x7.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x7.5	12		●	●	●	-	-	●	●	●	●	●	Stable	
	18	**156+416**	**MNB**	**LHS**	1x8.4	-	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x8.4	-		●	●	●	-	-	●	●	●	●	●	Stable	
	19	**166+087**	**MNB**	**LHS**	2x16	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	4x8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	20	**167+760**	**MNB**	**LHS**	1x14.4	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x3.93+2x3.63	12		●	●	●	-	-	●	●	●	●	●	Stable	
	21	**169+246**	**MNB**	**LHS**	1x11.5	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
			-	**RHS**	3x3.7	12		●	●	●	-	-	●	●	●	●	●	Stable	
	22	**169+998**	**MNB**	**LHS**	1x7.4	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
				RHS	1x7.4	11		●	●	●	-	-	●	●	●	●	●	Stable	
	23	**170+395**	**MNB**	**LHS**	1x16.4	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x16.4	12		●	●	●	●	●	●	●	●	●	●	Stable	
	24	**172+085**	**MNB**	**LHS**	3x9.35	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x9.35	12		●	●	●	-	-	●	●	●	●	●	Stable	
	25	**173+968**	**MNB**	**LHS**	2x3.4	11.4	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1x6.8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	26	**174+310**	**MNB**	**LHS**	3x4.2	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1x12.6	12		●	●	●	●	●	●	●	●	●	●	Stable	
	27	**177+108**	**MNB**	**LHS**	1x15.2	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x7.6	12		●	●	●	-	-	●	●	●	●	●	Stable	
	28	**177+823**	**MNB**	**LHS**	1x8.5	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1x8.5	12		●	●	●	-	-	●	●	●	●	-	Stable	
	29	**179+176**	**MNB**	**LHS**	1x10.4	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2x3.54+1x3.74	12		●	●	●	-	-	●	●	●	●	-	Stable	
	30	**180+825**	**MNB**	**LHS**	1x9.3	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x3.1	12		●	●	●	-	-	●	●	●	●	-	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
	31	**184+590**	**MNB**	**LHS**	4x5.25	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	4x5.4	12		●	●	●	-	-	●	●	●	●	-	Stable	
	32	**185+887**	**MNB**	**LHS**	2x3.4	13	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x6.8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	33	**186+628**	**MNB**	**LHS**	2x5.2	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x10.4	12		●	●	●	-	-	●	●	●	●	●	Stable	
	34	**191+950**	**MNB**	**LHS**	1x8.2	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	2x4.2	12		●	●	●	-	-	●	●	●	●	-	Stable	
	35	**194+012**	**MNB**	**LHS**	1x5.6	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1x8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	36	**197+929**	**MNB**	**LHS**	1x16.8	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	4x4.2	12		●	●	●	-	-	●	●	●	●	●	Stable	
	37	**199+305**	**MNB**	**LHS**	2x15.6	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	4x7.9	12		●	●	●	-	-	●	●	●	●	●	Stable	
	38	**204+042**	**MNB**	**LHS**	2x7.5+1x44	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x28.2	8.4		●	●	●	-	-	●	●	●	●	●	Stable	
	39	**205+167**	**MNB**	**LHS**	3x8.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
				RHS	3x8.5	12		●	●	●	-	-	●	●	●	●	●	Stable	
	40	**208+830**	**MNB**	**LHS**	2x14.2+1x21.3	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x14.2+1x21.3	12		●	●	●	●	●	●	●	●	●	●	Stable	
				LHS-SR	2x14.2+1x21.3	8.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS-SR	7x7.1	8.1		●	●	●	-	-	●	●	●	●	●	Stable	
Fly Over	41	**196+846**	**FO**	**LHS**	1x29.12	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x29.12	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
	42	**207+850**	**FO**	**LHS**	2x20+1x40	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x20+1x40	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
Vehicular Underpass	43	**203+808**	**VUP**	**LHS**	1x22.8	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x22+2x5	8.3	-	●	●	●	●	●	●	●	●	●	-	Stable	
	44	**209+020**	**VUP**	**LHS**	1x12	12	-	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	1x12	12	-	●	●	●	●	●	●	●	●	●	-	Stable	
Pedestrian Underpass	45	**139+969**	**PUP**	**LHS**	1x5.5	12	-	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	1x5.5	12		●	●	●	●	●	●	●	●	●	-	Stable	
	46	**146+400**	**PUP**	**LHS**	1x5.5	12	-	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	1x5.5	12		●	●	●	●	●	●	●	●	●	-	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way	Existing Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
	47	**154+500**	**CUP**	**LHS**	1x4.5	12	-	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	1x4.5	12		●	●	●	●	●	●	●	●	●	-	Stable	
Railway Over Bridge	48	**195+443**	**ROB**	**LHS**	1x10.35	8.4	-	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	1x31	12		●	●	●	●	●	●	●	●	●	-	Stable	

Condition Summary of Culverts based on Visual Observation is presented below:

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
1	136+110	HPC			●	●					Yes	Yes	√	√		Buried
2	136+263	Box	2x3.0	●	●		●			●	No	No	√			
3	136+420	Box	2x3.0	●	●			●			No	No	√			
4	136+947	Box	1x2.5	●	●		●			●	No	No	√			
5	137+606	Box	1x1.5	●	●		●			●	No	No	√			
6	137+858	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
7	137+966	Box	1x1.5	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
8	138+486	Box	1x1.5	●	●		●			●	No	No	√			
9	138+553	HPC	1x1.0 Ø		●	●					No	No	√			
10	138+746	Box	1x1.5	●	●		●			●	No	No	√			
11	139+024	HPC	1x1.0 Ø		●	●					No	No	√			
12	139+273	Box	1x2.0	●	●		●			●	No	No	√			
13	139+458	Box	1x2.5	●	●		●			●	No	No	√			
14	139+558	HPC	1x1.0 Ø		●	●					No	No	√			
15	139+688	Box	1x2.5	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
16	139+930	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
17	140+040	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
18	140+280	Box	2x3.0	●	●			●		●	No	No	√			
19	140+402	HPC	1x1.0 Ø		●	●					No	No	√			
20	141+436	HPC	1x1.2 Ø		●	●					Yes	No	√	√	4 Nos	
21	141+756	HPC	3x1.2 Ø		●	●					No	No	√		4 Nos	
22	142+055	Box	2x3.0	●	●		●			●	No	No	√		4 Nos	
23	142+675	HPC	2x1.2 Ø		●	●					No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
24	143+110	Box	2x3.0	●	●			●		●	No	No	√		4 Nos	
25	143+539	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
26	144+062	HPC	1x1.0 Ø		●	●					No	No	√			
27	144+098	HPC	1x1.0 Ø		●	●					No	No	√			
28	144+154	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
29	144+638	HPC	2x1.0 Ø		●	●					Yes	No	√	√		
30	144+994	HPC	1x1.0 Ø		●	●					No	No	√			
31	145+006	HPC	2x1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
32	145+099	HPC	1x1.0 Ø		●	●					No	No	√			
33	145+507	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
34	145+539	HPC	1x1.0 Ø		●	●					No	No	√			
35	145+803	HPC	1x1.0 Ø		●	●					No	No	√			
36	146+002	HPC	2x1.0 Ø		●	●					Yes	No	√	√		
37	146+690	HPC	2x1.2 Ø		●	●					Yes	No	√	√		
38	146+978	HPC	2x1.2 Ø		●	●					No	No	√			
39	148+278	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
40	148+892	HPC	2x1.0 Ø		●	●					No	No	√		4 Nos	
41	149+382	HPC	1x1.0 Ø		●	●					No	No	√			
42	149+664	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
43	151+791	HPC	1x1.2 Ø		●	●					No	No	√			
44	152+008	HPC	1x1.2 Ø		●	●					Yes	No	√	√		
45	152+255	HPC	1x1.0 Ø		●	●					No	No	√			
46	152+409	HPC	1x1.0 Ø		●	●					No	No	√			
47	152+650	HPC	1x1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
48	152+800	HPC	2x1.0 Ø		●	●					No	No	√			
49	153+060	Box	1x1.5	●	●		●			●	No	No	√			
50	153+225	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
51	153+525	HPC	2x1.0 Ø		●	●					No	No	√		4 Nos	
52	153+700	HPC	2x1.0 Ø		●	●					No	No	√			
53	154+075	HPC	2x1.0 Ø		●	●					No	No	√			
54	154+200	HPC	2x1.0 Ø		●	●					No	No	√			
55	154+375	HPC	2x1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
56	154+454	HPC	2x1.0 Ø		●	●					No	No	√		4 Nos	
57	155+125	HPC	2x1.0 Ø		●	●					No	No	√		4 Nos	
58	155+450	HPC	2x1.0 Ø		●	●					No	No	√		4 Nos	
59	156+582	Box	1x2.0	●	●		●			●	No	No	√		4 Nos	
60	158+302	HPC	1x1.0 Ø		●	●					No	No	√			
61	158+746	Box	1x2.0	●	●		●			●	Yes	No	√	√	4 Nos	
62	159+359	HPC	1x1.0 Ø		●	●					No	No	√			
63	159+413	HPC	2x1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
64	160+425	HPC	2x1.0 Ø		●	●					No	No	√			
65	163+030	Box	1x2.0	●	●		●			●	No	No	√			
66	163+570	HPC	1x1.0 Ø		●	●					No	No	√			
67	163+897	Box	1x3.0	●	●		●			●	No	No	√			
68	164+098	Box	1x2.0	●	●		●			●	No	No	√			
69	164+498	Box	1x2.0	●	●		●			●	Yes	No	√	√		
70	164+647	Box	1x2.0	●	●		●			●	No	No	√			
71	164+944	Box / Slab	2x2.0 / 1x4.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
72	165+526	Box	1x1.5	●	●		●			●	No	No	√			
73	166+022	HPC	1x1.0 Ø		●	●					No	No	√			
74	166+051	HPC	1x1.0 Ø		●	●					No	No	√			
75	166+280	HPC	1x1.0 Ø		●	●					No	No	√			
76	166+372	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
77	166+467	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
78	167+075	Box	2x2.0	●	●		●			●	No	No	√			
79	167+926	HPC	1x1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
80	168+290	HPC	1x1.0 Ø		●	●					Yes	No	√	√		
81	168+708	Box	2x2.0 / 1x4.0	●	●		●			●	No	No	√			
82	169+331	HPC	1x1.0 Ø		●	●					No	No	√			
83	169+371	HPC	1x1.0 Ø		●	●					No	No	√			
84	170+134	HPC	2x1.0 Ø		●	●					No	No	√			
85	170+755	HPC	1x1.0 Ø		●	●					No	No	√			
86	170+972	Box	1x2.0	●	●		●			●	No	No	√			
87	171+280	Box	1x2.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
88	171+413	Box / Slab	1x3.0	●	●		●			●	No	No	√			
89	171+486	Box	1x1.5	●	●		●			●	No	No	√			
90	173+139	Box / Slab	2x2.5 / 1x5.0	●	●		●			●	No	No	√			
91	174+825	HPC	2x1.0 Ø		●	●					No	No	√			
92	175+132	Box	2x2.0	●	●		●			●	No	No	√			
93	175+312	Box	2x2.0	●	●		●			●	No	No	√			
94	175+573	Box	1x1.5	●	●		●			●	No	No	√			
95	175+699	Box / Slab	2x2.0 / 1x4.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
96	176+134	Box	1x2.5	●	●		●			●	No	No	√			
97	177+744	Box	2x2.5	●	●		●			●	No	No	√			
98	178+906	Box	1x1.5	●	●		●			●	No	No	√			
99	179+969	Box	2x3.0	●	●		●			●	No	No	√			
100	181+333	HPC	2x1.0 Ø		●	●					No	No	√			
101	181+513	Box	1x3.0	●	●		●			●	No	No	√			
102	181+830	Box	1x2	●	●		●			●	No	No	√			
103	182+173	Box	1x1.5	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
104	182+380	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
105	182+938	HPC	1x1.0 Ø		●	●					No	No	√			
106	183+482	HPC	1x1.0 Ø		●	●					No	No	√			
107	184+864	Box	2x3.0	●	●		●			●	No	No	√			
108	185+163	Box	1x2.0	●	●		●			●	No	No	√			
109	185+341	HPC	1x1.0 Ø		●	●					No	No	√			
110	185+430	Box	1x3.0	●	●		●			●	No	No	√			
111	185+739	Box	1x3.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
112	187+012	Box	1x2.0	●	●		●			●	No	No	√		4 Nos	
113	187+285	HPC	1x1.0 Ø		●	●					No	No	√			
114	187+594	HPC	1x1.0 Ø		●	●					No	No	√			
115	187+904	Box	3x1.5	●	●		●			●	No	No	√			
116	188+095	Box	1x1.5	●	●		●			●	No	No	√			
117	188+358	Box	2x3.0	●	●		●			●	No	No	√			
118	188+956	Box	1x2.0	●	●		●			●	No	No	√			
119	189+522	Box	2x3.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
120	190+135	Box	1x2.0	●	●		●			●	No	No	√			
121	190+715	Box	2x3.0	●	●		●			●	No	No	√			
122	191+311	Box	2x3.0	●	●		●			●	No	No	√			
123	192+155	Box	1x1.5	●	●		●			●	No	No	√			
124	192+322	Box	2x3.0	●	●		●			●	No	No	√			
125	192+573	HPC	1x1.0 Ø		●	●					No	No	√			
126	193+316	Box	2x3.0	●	●		●			●	No	No	√			
127	194+181	Box	1x2.0	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
128	194+856	Box	2x3.0	●	●		●			●	No	No	√			
129	196+465	Box	1x3.0	●	●		●			●	No	No	√			
130	196+919	HPC	1x1.0 Ø		●	●					No	No	√			
131	197+087	Box	2x1.5	●	●		●			●	No	No	√			
132	197+244	Box	1x2.0	●	●		●			●	No	No	√			
133	197+544	HPC	1x1.0 Ø		●	●					No	No	√			
134	198+265	Box	2x1.5	●	●		●			●	No	No	√			
135	198+597	Box	1x1.5	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
136	198+845	Box	1x2.5	●	●		●			●	No	No	√			
137	199+010	Box	1x2.0	●	●		●			●	No	No	√			
138	199+813	Box	1x1.5	●	●		●			●	No	No	√			
139	200+359	HPC	1x1.0 Ø		●	●					No	No	√			
140	200+416	HPC	1x1.0 Ø		●	●					No	No	√		4 Nos	
141	204+563	Box	1x3.0	●	●		●			●	No	No	√			
142	205+325	Box	1x1.5	●	●		●			●	No	No	√			
143	205+873	Box	1x1.5	●	●		●			●	No	No	√			

Sn	Chainage	Type of Culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/ Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible [illegible])	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
144	206+590	Box	1x2.5	●	●		●			●	Yes	No	√	√		
145	207+080	Box	1x2.0	●	●		●			●	Yes	No	√	√		
146	207+780	Box	1x3.0	●	●		●			●	No	No	√			
147	208+453	HPC	1x1.2 Ø		●	●					No	No	√			
148	209+065	Box	1x3.0	●	●		●			●	No	No	√			
149	209+862									●	Yes	No	√	√		Buried

AECOM Imagine it. Delivered.

P

TECHNICAL DUE DILIGENCE REPORT

DA Toll Road Private Limited

Report Number:

ACM-60657056-TDD-DATRL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **DA Toll Road Private Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **DA Toll Road Private Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber
City, DLF Phase
2Gurgaon
122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
RP	PS	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

DA Toll Road Private Limited

6, Floor-2nd, Plot No. 134,
Birla Mansion, Nagindas Master Lane,
Kala Ghoda, Fort,
Mumbai-400001

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**

Project Background 3
Project Salient Features 3
Project Principle Participants 4
Project Operation and Maintenance Cost 4
Limitation of Scope 7

1. INTRODUCTION **8**

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 11

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Pavement Design 14
2.3 Estimation of Design Traffic 15
2.4 Test Pit 17
2.5 Core Test 18
2.6 Evaluation by Falling Weight Deflectometer (FWD) Technique 19
2.7 Pavement Condition Survey using Network Survey Vehicle (NSV) 24
2.8 Roughness Survey using Network Survey Vehicle (NSV) 25
2.9 Base Year Pavement Rehabilitation Requirement 26
2.10 Future Maintenance Requirements 26

3 CAPEX REQUIREMENT **28**

3.1 CAPEX needs 28
3.2 Construction Quantities and Cost 30

4 MAJOR MAINTENANCE COST **32**

4.1 `Major Maintenance Cycle 32
4.2 Major Maintenance Quantity 32
4.3 Unit Rate Analysis 33
4.4 Cost Estimate 35

5 OPERATION AND MAINTANANCE COST - OPEX **37**

5.1 O & M Requirement as per CA 37
5.2 O & M Strategy 37
5.3 Routine and Preventive Maintenance 38
5.4 Highway Lighting 39
5.5 TMS Cost 39
5.6 Incident Management 39
5.7 Manpower Cost 40
5.8 Office Expenses 40

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **42**

6.1 Reconnaissance Survey 42
6.2 Road Inventory and Condition Survey 42
6.3 Inventory and Condition Survey of Structures 53

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DATL	Delhi Agra Tollway Private Limited
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge

MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Delhi Agra Tollway Private Limited ("DATL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and DATL (hereinafter the "Client"), have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Delhi – Agra Section from Km 20+500 to Km 200+000 Section of NH 19 (old NH 2) in the State of Haryana / Uttar Pradesh. The project road is constructed under NHDP Phase V as BOT (on DBFO Pattern) mode for a Concession Period of 26 years including Construction period of 912 days (hereinafter referred to as the Project). The Concession agreement for the project road was signed on 16th July 2010 and Appointed date 16 Oct 2012. As per Concession Agreement concession period ends on 15 Oct 2038 and extended concession period ends on 31 Mar 2044.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Six Laning of Delhi - Agra Section of NH-2 from Km 20.500 to Km 200.000 (Length - Km 179.500) in the State of Haryana and Uttar Pradesh under NHDP Phase V as BOT (Toll) on DBFO Pattern
Project Length	Km 179.500
Execution Type	DBFOT Model
Name of SPV	DA Toll Road Private Limited
Signing of Agreement	16 July 2010
Appointed Date	16 Oct 2012
Schedule Completion Date	15th May 2016
PCOD	Status Not Available
COD	Status Not Available
Concession Period	26 years
End of Concession Period	19 Oct 2020
Likely End of Concession Period	31-Mar-2044
EPC Contractor for Six laning	M/s Reliance Utility Engineers Pvt Ltd (EPC Contractor)

	M/s. L&T Limited (Sub-Contractor)
Number of Toll Plaza	3 nos, plaza having 12 lanes including extra width

* - as per information provided by the Company

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	DA Toll Road Private Limited
3	Annuity Concessionaire	NA
4	Independent Engineer	URS SCOTT WILSON INDIA PVT. LTD & RODIC CONSULTANTS (JV)
5	Maintenance Contractor	AR Tollways Private limited South Asian Tollways Private Limited, G4S India for Security
6	EPC Contractor for Schedule B Work	M/s Reliance Utility Engineers (EPC Contractor) M/s L&T (EPC Sub Contractor)

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Balance Works and Change of Scope Items.

Provisional Completion Certificate (PCC) is issued on 20th May 2022 with balance work (Punchlist A work to be completed within 3 months i.e., by 19 Aug 2022 and Punchlist B work to be completed within 90 days from date of encumbrance free land to be made available). The cost towards Punch List A and B is as below:

A. Balance Work as per Punch List A: 31.99 crore

B. Balance Work as per Punch List B: 6.12 crore

Total Balance Work: 38.11 crore including GST as on FY 22.

b) Major Maintenance (MM) Cost

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K.

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. MM Cycles for balance concession period is to be planned as follows: The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2021/22 to 2022/23	Micro surfacing in 33% of length + 30mm BC in 57% of length +35mm to 50mm BC in 10% of length + 50 to 145 mm DBM in 30 % of length 30 mm BC in 20% of Length and Micro surfacing in 30% of length in Service Road	300.10
2.	2029/30	30 mm BC in 100% length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	283.16
3.	2036/37	30 mm BC in 100% length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	354.33
4.	2043/44	30 mm BC in 100% length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	532.75

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

c) Operation and Maintenance (OpEX)

As Per Schedule K, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway till the end of Concession Period i.e., Oct 2038. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule K elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2021/21 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	23,816,302
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	68,338,781
3	Security Services	Includes manpower associated with security services.	37,131,737
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	41,377,825
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	16,958,000
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	22,129,580
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	62,698,244
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	6,761,053
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	6,454,636
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	10,700,057
11	Community Development	Includes CSR related expenses.	5,412,318
12	Communication Expenses	Includes phone charges.	907,500
13	Conveyance Expenses	Includes boarding & lodging expense.	330,000
14	Project Insurance Expenses	Includes project insurance expenses.	74,470,000
15	IE Fees	Includes IE fees.	6,600,000
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	62,039,791
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	18,121,862

Sl. No.	Description	Remarks	Amount (in INR)
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	6,319,962
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	710,773
		O & M Cost for Year 2020-21	471,278,422

A total of Rs. 47.27 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

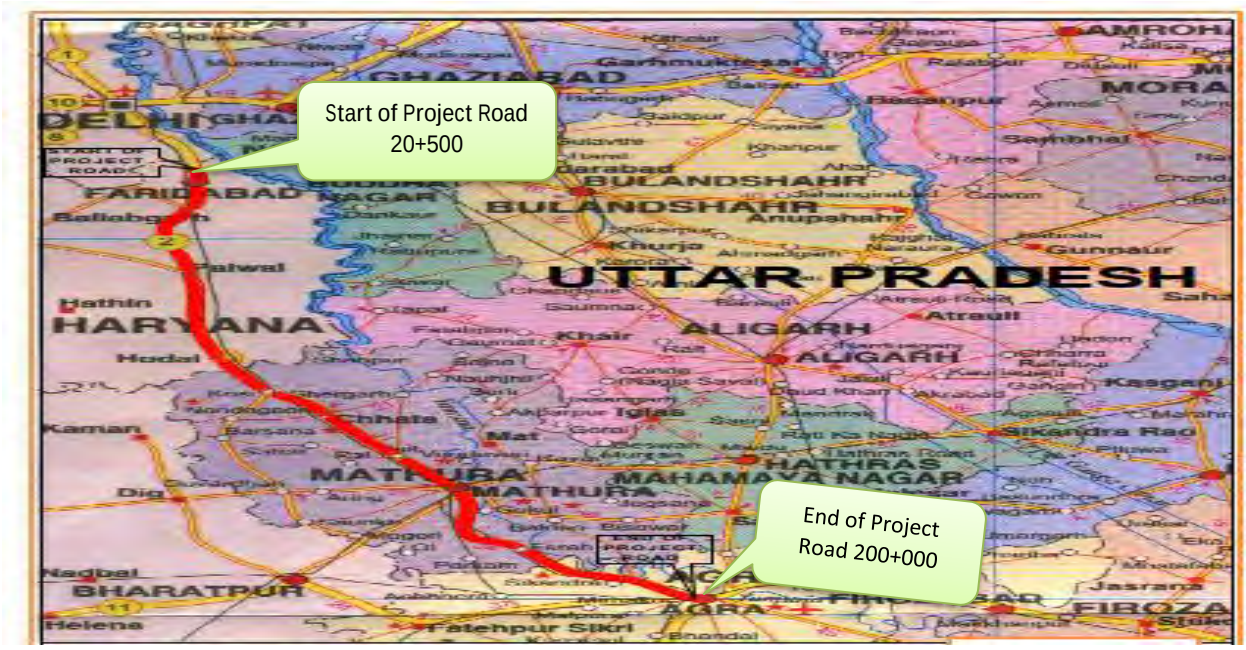
1.1 Project Background

DA Toll Road Private Limited (hereinafter referred to as DATRL or the Concessionaire), Six Lanning of Delhi – Agra Section of NH-2 from KM 20.500 to KM 200.00 (DBFOT Model) in the State of Haryana / Uttar Pradesh. M/s Cube Highways and Infrastructure Pte. Ltd. (herein after referring as Cube Highways or the Company) intend to acquire this operational asset and shall undertake Tolling, Operation, Maintenance & Transfer (DBFOT Model) for balance Concession Period.

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. As per CA concession period ends on 15 Oct 2038 and extended up to 31 Mar 2044.
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.
This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

Delhi-Agra section of National Highway no. 2 is a part of Golden Quadrilateral connecting cities of Delhi and Kolkata. This stretch from Delhi to Agra of NH-2. The project road starts from Km 20+500 of NH-2 and ends at Km 200+000 of NH-2, thus making a total length of 179.5 km. The project road lies in State of Haryana and Uttar Pradesh, starts from Badarpur Delhi Border (Km 20.500) and passes through Faridabad industrial area, Ballabgarh, Palwal, Hodal, Kosi, Mathura and ends at Agra (Km.200.00). The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	179.50 km
Carriageway	Six Lane (2 x 12.5m Paved Width)
Type of Pavement	Flexible Pavement - MCW & Service Road Rigid Pavement -Toll Plaza
Shoulder	2 m earthen for MCW at Rural Area
Service Road / Slip Road	204.164 km total length having width of 5.5 to 7.0 m
Major / Minor Junction	36 Major & 242 Minor
RCC Drain	Median Drain of length of 15.760 Km
Median Opening	41 Nos
Toll Plaza	3 Nos –12 lanes (6 + 6 lanes on each side)
Truck Lay-bys	4 Nos
Bus Bays with shelter	23 Bus Shelter
Highway Lighting	1539 Nos. Double Arm and 1488 nos Single arm
High Mast	10 nos
Highway Patrol	4 nos (To be deployed after O&M handover)
Ambulance	3 nos (To be deployed after O&M handover)
Crane	3 nos (To be deployed after O&M handover)

b) Structure

Description	Project Features
Major Bridge	1 Nos
Minor Bridge	14 Nos
Viaduct	1 Nos
Flyovers	14 Nos
ROB and RUB	9 No
Overpass	2 Nos
VUP	23 VUPS and 9 PUPS
Culverts	203 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.
b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work

- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 2-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Pavement Design

Design parameter and thickness of pavement is summarized as follows:

a. Design Life and Design Traffic

- Total Design Traffic as per Design MSA provided by the Cube Highways, cumulative MSA till 2045, for LHS is 80 MSA to 90 MSA and for RHS is 85 MSA to 97 MSA.
- Highway Project is divided into 3 Homogeneous Sections

Sn	HS	CHAINAGE		LENGTH (km)	TOLL PLAZA LOATION	REMARKS
		FROM	TO			
1	HS 1	20+500	60+000	39.500	KM 46	Start of Project to Palwal
2	HS 2	60+000	152+000	92.000	KM 94	Palwal to Mathura
3	HS 3	152+000	200+000	48.000	KM 164	Mathura to End of Project Road

- VDF adopted for calculation of design traffic by concessionaire is given below:

NH-2_Axle Load_45+000: VDF Summary				
S. No	Vehicle Type	Direction		Adopted Value
		From Delhi-Agra	From Agra-Delhi	
		LHS	RHS	
1	BUS	0.9	1.0	1.0
2	LCV	0.9	0.9	0.9
3	2-Axle	4.6	2.4	4.6
4	3-Axle	5.5	5.0	5.5
5	MAV	6.5	8.5	8.5

NH-2_Axle Load_75+000: VDF Summary				
S. No	Vehicle Type	Direction		Adopted Value
		From Delhi-Agra	From Agra-Delhi	
		LHS	RHS	
1	BUS	1.0	0.9	1.0
2	LCV	1.3	1.0	1.3
3	2-Axle	4.0	2.4	4.0

4	3-Axle	5.1	6.3	6.3
5	MAV	6.0	7.4	7.4

NH-2_Axle Load_164+000: VDF Summary				
S. No	Vehicle Type	Direction		Adopted Value
		From Delhi-Agra	From Agra-Delhi	
		LHS	RHS	
1	BUS	1.0	0.9	1.0
2	LCV	1.2	1.1	1.2
3	2-Axle	4.0	4.3	4.3
4	3-Axle	5.5	6.3	6.3
5	MAV	6.1	7.1	7.1

b. Subgrade

As per the Pavement Design Note provided to the consultant, it is mentioned that the Subgrade CBR for all the subgrade samples along the project road was found to be more than 10%. Hence the CBR of 10% has been adopted for the design of pavement.

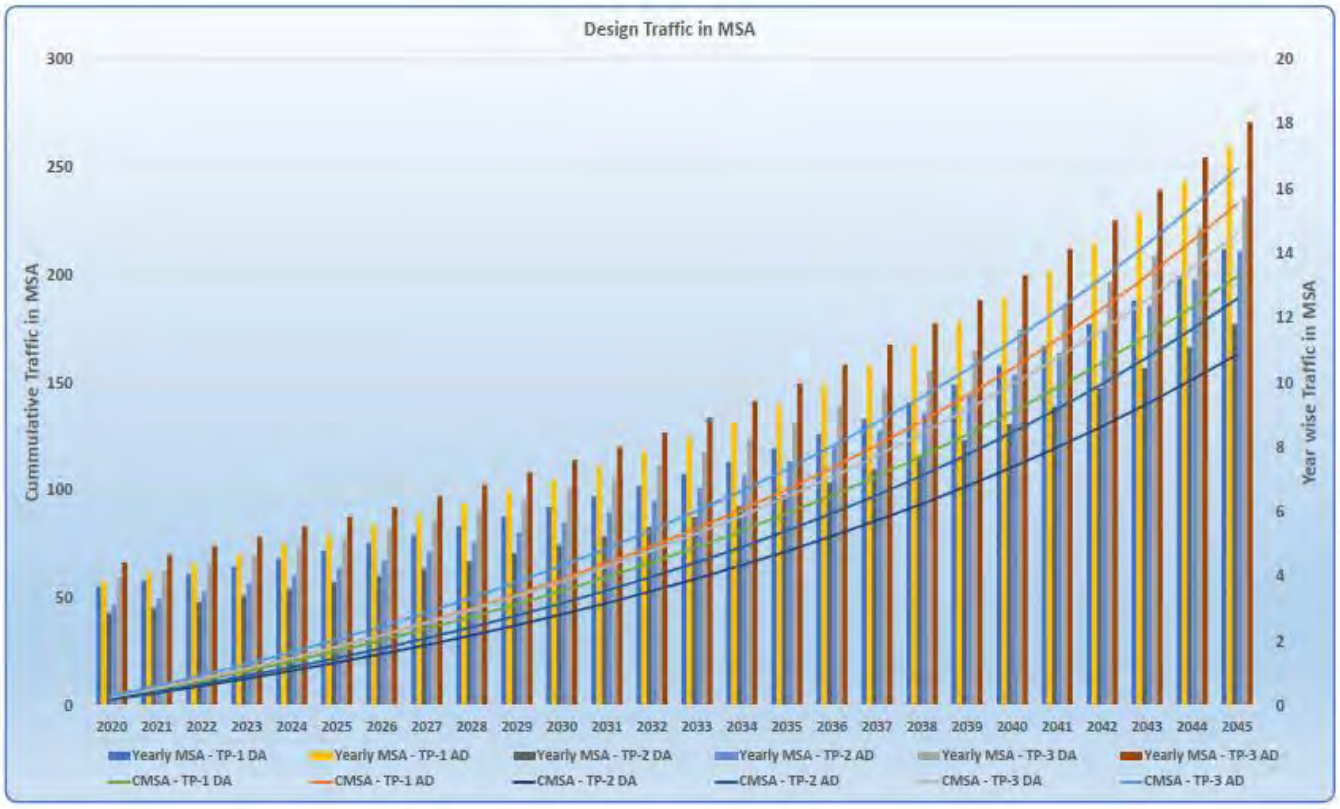
c. Design Thickness

Thickness of pavement as per IRC: 37 – 2001

Homogenous Section	Direction	CBR (%)	Design MSA	Crust Composition (mm)				
				BC	DBM	WMM	GSB	Total Thickness
HS-1(Haryana)	D-A	10	55	40	115	250	200	605
	A-D	10	60	40	115	250	200	605
HS-2 (Haryana)	D-A	10	52	40	115	250	200	605
	A-D	10	60	40	115	250	200	605
HS-2(U.P)	D-A	10	53	40	115	250	200	605
	A-D	10	67	40	120	250	200	610
HS-3 (U.P)	D-A	10	44	40	105	250	200	595
	A-D	10	52	40	115	250	200	605

2.3 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till 2045, for 1st Cycle of MM design period for LHS from 80 MSA to 90 MSA and for RHS 85 MSA to 97 MSA whereas cumulative MSA up to 2038 is ranging from 94 MSA to 126 MSA for LHS and 107 MSA to 143 MSA for RHS and up to the end of extended concession period i.e. 2045 is ranging from 163 MSA to 220 MSA for LHS and 189 MSA to 249 MSA for RHS. Year wise and cumulative MSA is presented in graph below:



DA – Delhi to Agra direction

AD – Agra to Delhi direction

2.4 Test Pit

S:No	Existing Chainage (Km.)	Side (LHS/RHS)	4-Days Soaked CBR (%)
1	28+300(SR)	LHS	11.6
2	31+000(SR)	LHS	10.9
3	34+000	RHS	14.7
4	39+400	RHS	12.5
5	43+000	RHS	13.0
6	48+500	LHS	14.1
7	54+000	RHS	13.8
8	64+000	RHS	17.5
9	73+000	LHS	8.1
10	77+600	RHS	11.4
11	82+100	LHS	12.4
12	85+000	RHS	16.4
13	91+000	LHS	11.2
14	95+000	RHS	22.3
15	100+000	RHS	13.9
16	106+000	RHS	10.1
17	110+000	LHS	12.7
18	115+000	RHS	14.4
19	120+000	RHS	12.9
20	125+000	RHS	10.0
21	130+000	LHS	9.4
22	135+000	RHS	12.9
23	140+000	LHS	13.8
24	146+000	RHS	16.4
25	151+200	LHS	10.3
26	155+000	RHS	13.7
27	161+000	LHS	13.4
28	164+400	RHS	11.9
29	169+800	LHS	15.7
30	175+000	RHS	9.0
31	179+200	LHS	12.9
32	185+000	RHS	9.6
33	186+800	LHS	12.8
34	186+600(SR)	RHS	10.3
35	190+000	RHS	20.5

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from 70 mm to 270 mm and granular layer thickness varies from 480 mm to 680 mm.

2.5 Core Test

Core test was conducted at 15 locations on the existing pavement to measure the actual thickness of existing bituminous layer. Furthermore, the core samples were also taken for laboratory test in order to determine various material properties such as bitumen content, aggregate properties of bituminous layers etc. Thickness of bituminous cores obtained from the core cutting is summarized as below:

Chainage (Km)	Side (LHS/RHS)	Height of the Core (mm)	Remarks
31+630	LHS	280	De-bonding of Layer
37+500	RHS	75	
43+600	RHS	130	Segregation/Pulverization
44+770	LHS	190	Top down cracking
47+120	RHS	110	
48+000	LHS	210	
56+270	RHS	110	Full depth crack
69+100	LHS	170	Full depth crack, De-bonding of Layer
78+000	LHS	175	
81+250	RHS	165	
82+300	RHS	240	De-bonding of Layer
95+750	LHS	180	De-bonding of Layer, Segregation
100+000	RHS	160	
105+500	RHS	90	
106+600	LHS	185	De-bonding of Layer
110+450	LHS	160	De-bonding of Layer
118+100	RHS	240	
125+000	LHS	170	De-bonding of Layer
133+400	RHS	190	
148+600	RHS	190	De-bonding of Layer

Chainage (Km)	Side (LHS/RHS)	Height of the Core (mm)	Remarks
149+090	LHS	250	De-bonding of Layer
155+000	LHS	180	
155+350	RHS	160	
160+350	RHS	230	
161+000	LHS	280	De-bonding of Layer
163+800	RHS	90	
165+850	LHS	280	De-bonding of Layer
175+340	LHS	140	De-bonding of Layer
181+350	LHS	130	De-bonding of Layer/Top down cracking
182+350	RHS	200	De-bonding of Layer
189+000	LHS	210	De-bonding of Layer
192+275	RHS	170	

2.6 Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS
1	20+500	21+000	251
2	21+000	22+000	698
3	22+000	23+000	80
4	23+000	24+000	169
5	24+000	25+000	55
6	25+000	26+000	335

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
1	20+500	21+000	20
2	21+000	22+000	119
3	22+000	23+000	35
4	23+000	24+000	33
5	24+000	25+000	12
6	25+000	26+000	90

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS
7	26+000	27+000	240
8	27+000	28+000	61
9	28+000	29+000	75
10	29+000	30+000	91
11	30+000	31+000	45
12	31+000	32+000	74
13	32+000	33+000	43
14	33+000	34+000	30
15	34+000	35+000	24
16	35+000	36+000	26
17	36+000	37+000	555
18	37+000	38+000	31
19	38+000	39+000	27
20	39+000	40+000	411
21	40+000	41+000	26
22	41+000	42+000	26
23	42+000	47+000	83
24	47+000	48+000	702
25	48+000	49+000	17
26	49+000	56+000	22
27	56+000	57+000	34
28	57+000	58+000	16
29	58+000	59+000	100
30	59+000	60+000	82
31	60+000	61+000	14
32	61+000	67+000	42
33	67+000	68+000	246
34	68+000	69+000	31
35	69+000	74+000	302
36	74+000	75+000	24
37	75+000	76+000	3
38	76+000	77+000	29
39	77+000	81+000	14
40	81+000	82+000	19
41	82+000	83+000	25
42	83+000	84+000	8
43	84+000	85+000	17
44	85+000	86+000	52

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
7	26+000	27+000	61
8	27+000	28+000	36
9	28+000	29+000	4
10	29+000	30+000	114
11	30+000	31+000	9
12	31+000	32+000	13
13	32+000	33+000	8
14	33+000	34+000	13
15	34+000	35+000	4
16	35+000	36+000	37
17	36+000	37+000	152
18	37+000	38+000	2
19	38+000	39+000	12
20	39+000	40+000	10
21	40+000	41+000	9
22	41+000	42+000	5
23	42+000	43+000	12
24	43+000	44+000	11
25	44+000	45+000	25
26	45+000	46+000	24
27	46+000	47+000	18
28	47+000	48+000	15
29	48+000	49+000	14
30	49+000	50+000	14
31	50+000	51+000	9
32	51+000	52+000	6
33	52+000	53+000	8
34	53+000	54+000	12
35	54+000	55+000	37
36	55+000	56+000	23
37	56+000	57+000	20
38	57+000	58+000	20
39	58+000	59+000	13
40	59+000	60+000	5
41	60+000	61+000	17
42	61+000	62+000	15
43	62+000	63+000	18
44	63+000	64+000	45

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS
45	86+000	87+000	30
46	87+000	88+000	12
47	88+000	89+000	72
48	89+000	90+000	2
49	90+000	91+000	2
50	91+000	94+000	16
51	94+000	95+000	4
52	95+000	96+000	14
53	96+000	97+000	17
54	97+000	98+000	45
55	98+000	99+000	11
56	99+000	100+000	12
57	100+000	101+000	14
58	101+000	102+000	9
59	102+000	103+000	13
60	103+000	104+000	49
61	104+000	105+000	4
62	105+000	106+000	6
63	106+000	107+000	9
64	107+000	108+000	13
65	108+000	109+000	7
66	109+000	110+000	8
67	110+000	111+000	14
68	111+000	112+000	6
69	112+000	113+000	2
70	113+000	114+000	4
71	114+000	115+000	13
72	115+000	116+000	9
73	116+000	117+000	1
74	117+000	118+000	23
75	118+000	119+000	11
76	119+000	122+000	5
77	122+000	123+000	7
78	123+000	124+000	9
79	124+000	125+000	36
80	125+000	126+000	8
81	126+000	127+000	7
82	127+000	128+000	6

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
45	64+000	65+000	15
46	65+000	66+000	7
47	66+000	67+000	50
48	67+000	68+000	78
49	68+000	69+000	117
50	69+000	70+000	30
51	70+000	71+000	18
52	71+000	72+000	36
53	72+000	73+000	32
54	73+000	74+000	32
55	74+000	75+000	83
56	75+000	76+000	72
57	76+000	77+000	34
58	77+000	78+000	44
59	78+000	79+000	18
60	79+000	80+000	32
61	80+000	81+000	48
62	81+000	82+000	20
63	82+000	83+000	21
64	83+000	84+000	16
65	84+000	85+000	42
66	85+000	87+000	75
67	87+000	88+000	23
68	88+000	90+000	12
69	90+000	91+000	
70	91+000	92+000	98
71	92+000	93+000	31
72	93+000	94+000	44
73	94+000	95+000	48
74	95+000	96+000	28
75	96+000	97+000	42
76	97+000	98+000	28
77	98+000	99+000	11
78	99+000	100+000	21
79	100+000	101+000	46
80	101+000	102+000	2
81	102+000	103+000	6
82	103+000	104+000	63

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS
83	128+000	129+000	29
84	129+000	130+000	39
85	130+000	131+000	40
86	131+000	132+000	47
87	132+000	133+000	33
88	133+000	134+000	23
89	134+000	135+000	9
90	135+000	137+000	3
91	137+000	138+000	27
92	138+000	139+000	30
93	139+000	140+000	30
94	140+000	141+000	27
95	141+000	142+000	48
96	142+000	143+000	28
97	143+000	144+000	36
98	144+000	145+000	17
99	145+000	146+000	37
100	146+000	147+000	35
101	147+000	148+000	42
102	148+000	149+000	10
103	149+000	150+000	40
104	150+000	151+000	12
105	151+000	152+000	22
106	152+000	153+000	17
107	153+000	154+000	6
108	154+000	155+000	8
109	155+000	156+000	33
110	156+000	157+000	42
111	157+000	158+000	10
112	158+000	159+000	11
113	159+000	160+000	16
114	160+000	161+000	13
115	161+000	162+000	15
116	162+000	163+000	23
117	163+000	164+000	20
118	164+000	165+000	12
119	165+000	166+000	14
120	166+000	167+000	87

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
83	104+000	105+000	6
84	105+000	106+000	3
85	106+000	107+000	21
86	107+000	108+000	10
87	108+000	109+000	10
88	109+000	110+000	8
89	110+000	111+000	11
90	111+000	112+000	10
91	112+000	113+000	26
92	113+000	114+000	10
93	114+000	115+000	10
94	115+000	116+000	16
95	116+000	118+000	
96	118+000	119+000	5
97	119+000	120+000	8
98	120+000	121+000	12
99	121+000	122+000	24
100	122+000	123+000	11
101	123+000	124+000	19
102	124+000	125+000	36
103	125+000	126+000	33
104	126+000	127+000	40
105	127+000	128+000	4
106	128+000	129+000	3
107	129+000	130+000	24
108	130+000	131+000	41
109	131+000	132+000	31
110	132+000	134+000	26
111	134+000	135+000	15
112	135+000	136+000	9
113	136+000	137+000	14
114	137+000	138+000	12
115	138+000	139+000	8
116	139+000	140+000	5
117	140+000	141+000	6
118	141+000	142+000	4
119	142+000	143+000	6
120	143+000	144+000	5

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS
121	167+000	168+000	2
122	168+000	169+000	76
123	169+000	170+000	18
124	170+000	171+000	19
125	171+000	172+000	23
126	172+000	173+000	21
127	173+000	174+000	8
128	174+000	175+000	10
129	175+000	176+000	23
130	176+000	177+000	6
131	177+000	178+000	28
132	178+000	179+000	16
133	179+000	180+000	16
134	180+000	181+000	18
135	181+000	182+000	9
136	182+000	184+000	13
137	184+000	185+000	2
138	185+000	186+000	2
139	186+000	187+000	6
140	187+000	188+000	3
141	188+000	189+000	5
142	189+000	190+000	4
143	190+000	191+000	7
144	191+000	192+000	5
145	192+000	193+000	2
146	193+000	194+000	6
147	194+000	195+000	4
148	195+000	196+000	4
149	196+000	197+000	4
150	197+000	198+000	3
151	198+000	199+000	6
152	199+000	200+000	4

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
121	144+000	145+000	5
122	145+000	146+000	4
123	146+000	147+000	7
124	147+000	148+000	12
125	148+000	149+000	11
126	149+000	150+000	15
127	150+000	151+000	26
128	151+000	152+000	13
129	152+000	153+000	19
130	153+000	154+000	3
131	154+000	155+000	10
132	155+000	156+000	40
133	156+000	157+000	35
134	157+000	158+000	28
135	158+000	159+000	20
136	159+000	160+000	8
137	160+000	161+000	9
138	161+000	162+000	16
139	162+000	163+000	45
140	163+000	164+000	20
141	164+000	165+000	3
142	165+000	166+000	4
143	166+000	167+000	4
144	167+000	168+000	16
145	168+000	169+000	5
146	169+000	170+000	6
147	170+000	171+000	7
148	171+000	172+000	5
149	172+000	173+000	27
150	173+000	174+000	7
151	174+000	175+000	27
152	175+000	176+000	10
153	176+000	177+000	16
154	177+000	178+000	39
155	178+000	179+000	25
156	179+000	180+000	4
157	180+000	181+000	13
158	181+000	182+000	24

S. No	Chainage (KM)		Remaining Life (MSA)
	From	To	LHS

S. No From	Chainage (KM)		Remaining Life (MSA)
	From	To	RHS
159	182+000	184+000	6
160	184+000	185+000	4
161	185+000	186+000	3
162	186+000	187+000	6
163	187+000	188+000	3
164	188+000	189+000	3
165	189+000	190+000	12
166	190+000	191+000	6
167	191+000	192+000	4
168	192+000	193+000	6
169	193+000	194+000	5
170	194+000	195+000	11
171	195+000	196+000	5
172	196+000	197+000	8
173	197+000	198+000	5
174	198+000	199+000	13
175	199+000	201+000	17

Based on remaining life of pavement, structural overlay is not required till end of concession period.

2.7 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	Cracks	- Type: Longitudinal, Transverse, Block, Alligator - Extent: % of Pavement Area Influenced by distress - Severity: High (> 3mm wide), Low (<3mm wide)
2	Pothole	- Extent: % of Pavement Area Influenced by distress - No. of Potholes - Depth Severity: Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	Raveling	- Extent: % of Pavement Area Influenced by distress

Sn	Distress	Details Captured and Yard Stick adopted for Classification
		- Severity: Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	Patching	- Extent: % of Pavement Area Influence by distress - Severity: Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	Shoving	- Extent: % of Pavement Area Influence by distress - Severity: Low (<15mm), High (>15mm)
6	Flushing/Bleeding	- Extent: % of Pavement Area Influence by distress - Severity: Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	Depression	- Extent: % of Pavement Area Influence by distress - Severity
8	Delamination	- Extent: % of Pavement Area Influence by distress - Severity: Low (<1 sq.m area), High (>1 sq.m area)
9	Edge Break	- Extent: % of Pavement Area Influence by distress - Severity: Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	Pavement Missing	- Extent: % of Pavement Area Missing
11	Rutting	- Rut Depth

2.8 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$3.\quad BI = 630\,(IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

IRI = International Roughness Index

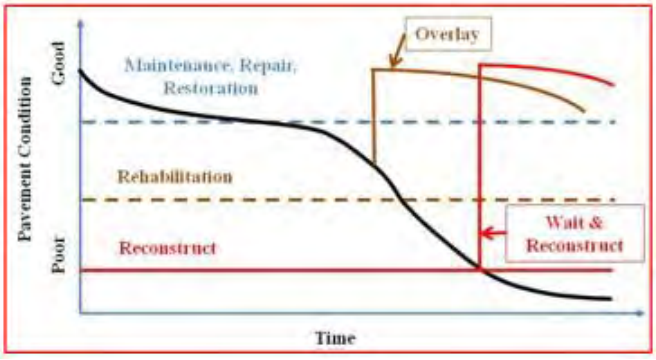
Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000 - 3000
Poor	>3000

Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.

2.8 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.9 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, immediate structural overlay is required. The requirement of overlay is calculated for design MSA till end of Concession Period with 116 MSA , 94 MSA and 126 MSA for HS 1, HS 2 & HS 3 respectively for LHS of MCW and with 132 MSA , 107 MSA and 143 MSA for HS 1, HS 2 & HS 3 respectively for RHS of MCW. In addition of overlay requirement as per FWD Test, it is recommended to carryout CIPR of 110 mm thickness at along distress pavement locations. The Km wise proposed rehabilitation proposal is tabled below:

2.10 Future Maintenance Requirements

The Concessionaire shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Concessionaire. The Company shall be responsible for Operation and maintenance with the provisions of CA as per Schedule K. AECOM consider Structural Overlay required in 2021/22 & 2022/23 and functional Overlay is required at every 7 year

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 & 2022/23 is calculated using IIT Paved and it is found that Structural Overlay is

considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is always required to satisfy Schedule K requirement.

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule K till end of concession period and at the time of divestment as per Article 38 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1.	2021/22 to 2022/23	Structural Overlay	Micro surfacing in 33% + 30mm BC in 57% +35mm to 50mm BC in 10% + 50 to 145 mm DBM in 30 %	30 mm BC in 20% and Micro surfacing in 30%
2.	2029/30	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %
3.	2036/37	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %
4.	2043/44	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

The Concessionaire has achieved Provisional Completion and PCC issued on issued on 20th May 2022 with balance work (Punchlist A work to be completed within 3 months i.e., by 19 Aug 2022 and Punchlist B work to be completed within 90 days from date of encumbrance free land to be made available).

Scope of Work

In general CAPEX is considered for following works:

1. Balance work – Punch List A and Punch List B
2. Immediate rehabilitation of existing pavement – MMR Planned in Year 2022/23
3. Replacement of defective Equipment at Toll Plaza, software and ECB – Not Applicable
4. Penalty for due to Failure of rectification of defects and deficiency during O & M Period - Not Applicable

The balance work along with status of Punchlist A and B work is tabled as below:

a) Punchlist A

S. No	Description	Unit	Qty as per Punch List A	Executed Quantity	Balance Quantity
1	Main Carriageway	m	45	Work in progress	Cost considered in MM of FY 23
2	Service Road	m	1260		880
3	Separator	m	3430		3430
4	PGR	m	3835		3835
5	Drain	m	8178		8178
6	Footpath	m	17400		17400

S. No	Description	Unit	Qty as per Punch List A	Executed Quantity	Balance Quantity
7	Damaged Service Road	km	7.182	Work in progress	Cost considered in MM of FY 23
8	Grating for Drain Chamber	km	52.110		52.100
9	Drain Cover	Locations	54		54
10	Street Lighting	Stretch	As per List	Work in progress	252 nos 9 m pole and 101 nos below structures
11	Damaged Sign board/ Gantry	Nos	19	Work in progress	Cost considered in OPEX
12	Pavement jerks	Locations	44	Work in progress	Cost considered in MM of FY 23
13	Drainage Issue (Cleaning)	Locations	22		30 km
	Drainage Issue (RWH Cross Wave)				25 nos
	Drainage Issue (RWH Conventional)				13 nos
	Drainage Issue (RWH Recharge)				21 nos
14	Structure Down take pipe	Structures	39		39
15	Structure repair	Structures	2		2
16	Damaged parapet wall	Stretch (m)	280		Cost considered in OPEX
17	Balance expansion joint	Number	6		6
18	Earthen shoulder	Km	20.52		20.52
19	Median & Avenue Plantation				
	Median	Nos	2000		2000
	Avenue	Nos	24000		24000
20	Overlay on Main Carriageway (Km) - FP	Flexible	105 km	Work in progress	Cost considered in MM of FY 23
	Overlay on Main Carriageway (Km) - RP	Rigid	42 km	Work in progress	Cost considered in MM of FY 23
21	RE Wall Wooden pegs	Structures	30		Cost considered in OPEX
22	Palwal Elevated Highway balance works	Observations	6		Balance Footpath 1480 m

S. No	Description	Unit	Qty as per Punch List A	Executed Quantity	Balance Quantity
23	Ambulance & Crane	As per CA	To be provided as per CA		Cost considered in OPEX
24	Median cuts	Number	37		Cost considered in OPEX
25	Major junction	Number	1		Completed
26	Safety Audit Report	As per Safety Audit	As per Safety Consultant Report		3250 nos of MBCB

b) Punchlist B

S. No	Description	Unit	Qty as per Punch List B	Executed Quantity	Balance Quantity
1	Main Carriageway	m	592 (4 to 5 m width)		
2	Service Road	m	1062		
3	Drain	m	995		
4	Footpath	m	4480		

3.2 Construction Quantities and Cost

Quantity for balance work calculated based on schedule B and C in accordance with Schedule D. The detail quantities of work are provided in soft copy along with this report. Balance work summary for Punchlist A and B is as follows:

Cost as of 2022/23

a) Balance Work Cost for Punch List A Work

S No.	Item Description	Balance Amount	Remarks
1	Main Carriageway		Considered in MM Cost FY 22/23
2	Service Road	8,715,332	380 m completed out of Total 1260 m. Cost considered for 880 m
3	Separator	6,530,720	
4	PGR	10,308,480	
5	Drain	96,706,435	
6	Footpath	37,027,200	

S No.	Item Description	Balance Amount	Remarks
7	Damaged Service Road		Considered in MM Cost FY 22/23
8	Grating for Drain Chamber	881,354	
9	Drain Cover	864,808	
10	Street Lighting	20,839,626	
11	Damaged Sign board/ Gantry		Considered in OPEX
12	Pavement jerks		Considered in MM Cost FY 22/23
13	Drainage Issue (Cleaning)	8,850,000	
	Drainage Issue (RWH Cross Wave)	28,380,106	
	Drainage Issue (RWH Conventional)	6,407,856	
	Drainage Issue (RWH Recharge)	1,881,600	
14	Structure Down take pipe	7,910,336	
15	Structure repair	5,179,923	
16	Damaged parapet wall		Considered in OPEX
17	Balance expansion joint	2,383,600	
18	Earthen shoulder	8,503,488	
19	Median & Avenue Plantation		
	Median	200,000	
	Avenue	24,000,000	
20	Overlay on Main Carriageway (Km) - FP		Considered in MM Cost FY 22/23
	Overlay on Main Carriageway (Km) - RP		Considered in MM Cost FY 22/23
21	RE Wall Wooden pegs		Considered in OPEX
22	Palwal Elevated Highway balance works	3,149,440	
23	Ambulance & Crane		Considered in OPEX
24	Median cuts		Considered in OPEX
25	Major junction		Work completed
26	Safety Audit Report	41,155,450	
	Total	319,875,754	

b) Cost of Punch List B Work

S No.	Item Description	Amount	Remarks
1	Main Carriageway	13,298,333	Encumbrance free land is not made available therefore all work balance.
2	Service Road	27,322,527	
3	Drain	11,033,000	
4	Footpath	9,533,440	
	Total Amount of Punch List B	61,187,300	

Total CAPEX – Rs. 38.11 Crore

4 MAJOR MAINTENANCE COST

4.1 `Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 2.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1.	2021/22 to 2022/23	Structural Overlay	Micro surfacing in 33% + 30mm BC in 57% +35mm to 50mm BC in 10% + 50 to 145 mm DBM in 30 %	30 mm BC in 20% and Micro surfacing in 30%
2.	2029/30	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %
3.	2036/37	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %
4.	2043/44	Functional Overlay	30 mm BC in 100% length	30 mm BC in 50 % and Micro surfacing in 50 %

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

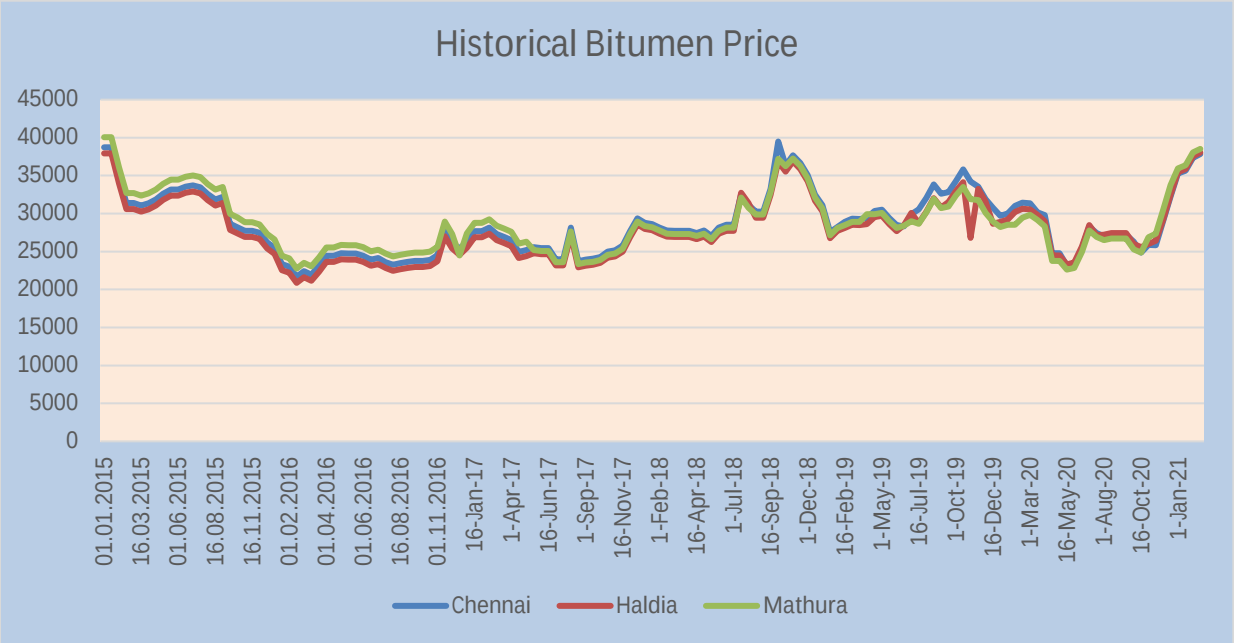
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 2024 onwards	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	31,573	2650	28,923
VG40	35,053	2650	32,403

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY - 22	2.83%	1.000
FY - 23	4.66%	1.047
FY - 24	5.65%	1.106
FY - 25	5.37%	1.165
FY - 26	5.52%	1.229
FY - 27	5.25%	1.294
FY - 28	4.86%	1.357
FY - 29	4.44%	1.417
FY - 30	4.24%	1.477
FY - 31	4.13%	1.538
FY - 32	4.08%	1.601
FY - 33	4.01%	1.665
FY - 34	4.00%	1.732
FY - 35	4.03%	1.801
FY - 36	4.01%	1.874

Year	Growth Rate	Escalation Factor
FY - 37	3.98%	1.948
FY - 38	3.98%	2.026
FY - 39	4.00%	2.107
FY - 40	3.99%	2.191
FY - 41	3.99%	2.278
FY - 42	3.99%	2.369
FY - 43	3.99%	2.464
FY - 44	3.99%	2.562
FY - 45	3.99%	2.664
FY - 46	3.99%	2.771
FY - 47	3.99%	2.881
FY - 48	3.99%	2.996
FY - 49	3.99%	3.116
FY - 50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – VG 40	Cum	10,875
2	Bituminous Concrete – VG 40	Cum	12,677
3	Micro surfacing	Sqm	178
4	Replacement of Joint Sealant in PQC	m	132
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

Unit Rate as of 2024 Onwards

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – VG 40	Cum	8,201
2	Bituminous Concrete – VG 40	Cum	9,399
3	Micro surfacing	Sqm	178
4	Replacement of Joint Sealant in PQC	m	132
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

4.4 Cost Estimate

Cost estimates each cycle wise is presented in next page.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)

Sl. No.	Activity	Unit	Unit Rate 2022	Unit Rate 2024 onwards	Treatment Cycle 1 Qty	Treatment Cycle 2 Qty	Treatment Cycle 3 Qty	Treatment Cycle 4 Qty	Treatment Cycle 1 Amount	Treatment Cycle 2 Amount	Treatment Cycle 3 Amount	Treatment Cycle 4 Qty
					2022/23 to 2023/24	2029/30	2036/37	2043/44	2022/23 & 2023/24	2029/30	2036/37	2043/44
A	**Main Carriageway - Flexible Pavement**											
1	Tack Coat	Sqm	13	13	3,155,275	3,907,799	3,907,799	3,907,799	39,819,571	49,316,420	49,316,420	49,316,420
2	Bituminous Concrete with VG-40 Bitumen	Cum	12,677	9,399	99,275	111,160	110,395	110,395	1,258,513,146	1,044,785,746	1,037,601,525	1,037,601,525
3	Dense Bituminous Macadam (VG-40)	Cum	10,875	8,201	39,939	-	-	-	434,318,008	-	-	-
4	Milling of existing BC	Sqm	77	77	673,400	195,390	195,390	195,390	51,851,800	15,045,025	15,045,025	15,045,025
5	Raising of Road Kerb	m	439	439	351,869		351,869		154,470,535	-	154,470,535	-
6	Painting of Road Kerb	sqm	121	121	83,862	83,862	83,862	83,862	10,147,318	10,147,318	10,147,318	10,147,318
7	Miscrosurafacing	sqm	176	176	1,342,500				236,280,000	-	-	-
										-	-	-
B	**Structure(Including FO,ROB,VUP,PUP,CUP and Bridges)**									-	-	-
1	Tack Coat	Sqm	13	13		112,451	112,451	112,451	-	1,419,135	1,419,135	1,419,135
2	Bituminous Concrete with VG-40 Bitumen (30 mm)	Cum	12,677	9,399		3,374	3,374	3,374	-	31,707,778	31,707,778	31,707,778
3	Milling of existing 30mm BC	Sqm	77	77		112,451	112,451	112,451	-	8,658,746	8,658,746	8,658,746
4	Painting of Crash Barrier	sqm	121	121		80,042	80,042	80,042	-	9,685,069	9,685,069	9,685,069
										-	-	-
C	**Toll Plaza and Truck Laybye - Rigid**									-	-	-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	132	132	-	1,203,328	-	1,203,328	-	158,839,283	-	158,839,283
2	Replacement of PQC Slab consider in OPEX	Cum	8,135	8,135						-	-	-
3	Joint Sealant Replacement Every 7th Year (5 %)	m	220	220	332,505	332,505	332,505	332,505	73,151,151	73,151,151	73,151,151	73,151,151
4	Pot Hole Filling (0.5 %)	Sqm	549	549	-	-	-	-	-	-	-	-
5	Cross stitching of PQC slab (0.5 %)	Rm	549	549	-	-	-	-	-	-	-	-
										-	-	-
D	**Service Road**								-	-	-	-
1	Tack Coat	Sqm	13	13	281,132	702,829	702,829	702,829	3,547,881	8,869,702	8,869,702	8,869,702
2	Functional Overlay using VG-30	Cum	12,131	8,853	8,434	21,085	21,085	21,085	102,309,356	186,655,709	186,655,709	186,655,709
3	Miscrosurfacing	sqm	176	176	421,697	702,829	702,829	702,829	74,218,742	123,697,904	123,697,904	123,697,904
										-	-	-
E	**Other Works**								-	-	-	-
1	Replacement of Road Studs								-	-	-	-
	Road Studs	Nos	220	220	10,000	10,000	10,000	10,000	2,200,000	2,200,000	2,200,000	2,200,000
	Solar Studs	Nos	1,647	1,647					-	-	-	-
										-	-	-
2	Road Marking	Sqm	439	439	202,312	202,312	202,312	202,312	88,814,977	88,814,977	88,814,977	88,814,977
3	Maintenance of Earthen Shoulder	Sqm	22	22	695,208	695,208	695,208	695,208	15,294,572	15,294,572	15,294,572	15,294,572
F	**Contingency - 2 % above amount**								50,102,350	35,579,442	35,348,383	35,435,758
												-
A	**Major Maintenance Cost excl. GST (INR)**								2,595,039,406	1,863,867,977	1,852,083,950	1,856,540,073
B	**GST (12% of A)**								311,404,729	223,664,157	222,250,074	222,784,809
	Major Maintenance Cost incl. GST (INR)								2,906,444,135	2,087,532,135	2,074,334,024	2,079,324,882
	Escalation Factor								1.047	1.477	1.948	2.562
	Esclated Amount keping Bitumen Component w/o Escalation								3,009,547,435	2,831,585,559	3,543,320,101	5,327,451,031

5 OPERATION AND MAINTANANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 17 – Operation &Maintenance & Schedule –K Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 17 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 25,716 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs.18,650 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 10.18 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	55	137,216	7,546,875
2	Highway Lighting Electricity Charge	Kwh	3,952,862	11.17	44,159,257
3	Operation and Maintenance of DG Set	Nos	6	140,235	841,408
4	Solar Blinker	Nos	6	3,293	19,759
5	Lighting at Toll Plaza	Kwh		54,886	1,975,909
6	Office Building Electricity Charge	LS	36	137,216	7,546,875
	Total				54,543,209

5.5 TMS Cost

O and M cost for TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is Rs. 2.21 crore per year and additional cost of Rs. 6.26 crore for replacement of equipment at every 7 (seven) years.

5.6 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 3 nos of Crane of 30 MT as per Sub-clause 17.5 of CA
b) Traffic Aid Post with 4 nos of route patrol vehicle as per Article 20
c) 3 nos of Ambulance as per Sub-clause 21.3 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 4.13 crore per year including GST.

5.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of tolls. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.
   As per Company, overloading shall not be collected from this asset therefore only four Toll Collector is considered for 10 lane plaza from FY 2023 onwards. at this stage.

The cost of manpower is estimated as Rs. 12.92 crore per year from FY 2022/23 onwards.

5.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses based on data provided by the Company. The cost estimated is Rs. 10.34 crore per year.

Year wise O & M Cost (OPEX) is presented in next page.

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost - OPAL											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	25,152,597	62,039,791	16,958,000	84,827,825	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	471,278,422
3	2023-24	39,953,050	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	423,380,630
4	2024-25	46,464,880	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	429,892,460
5	2025-26	53,071,214	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	436,498,794
6	2026-27	57,477,424	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	440,905,004
7	2027-28	61,796,201	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	445,223,781
8	2028-29	61,796,201	62,039,791	16,958,000	84,827,825	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	507,922,026
9	2029-30	25,152,597	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	408,580,177
10	2030-31	25,152,597	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	408,580,177
11	2031-32	39,953,050	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	423,380,630
12	2032-32	46,464,880	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	429,892,460
13	2033-34	53,071,214	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	436,498,794
14	2034-35	57,477,424	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	440,905,004
15	2035-36	61,796,201	62,039,791	16,958,000	84,827,825	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	507,922,026
16	2036-37	25,152,597	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	408,580,177
17	2037-38	25,152,597	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	408,580,177
18	2038-39	39,953,050	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	423,380,630
19	2039-2040	46,464,880	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	429,892,460
20	2040-2041	53,071,214	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	436,498,794
21	2041-2042	57,477,424	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	440,905,004
22	2042-2043	61,796,201	62,039,791	16,958,000	84,827,825	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	507,922,026
23	2043-2044	25,152,597	62,039,791	16,958,000	22,129,580	41,377,825	1,778,318	129,286,820	6,454,636	103,402,610	408,580,177
	Total	989,000,085	1,364,875,396	373,076,000	737,643,749	910,312,140	39,123,000	2,844,310,036	142,002,000	2,274,857,428	9,675,199,833
	Total Cost in Crore	98.90	136.49	37.31	73.76	91.03	3.91	284.43	14.20	227.49	967.52

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

Delhi-Agra section of National Highway no. 2 is a part of Golden Quadrilateral connecting cities of Delhi and Kolkata. This stretch from Delhi to Agra of NH-2. The project road starts from Km 20+500 of NH-2 and ends at Km 200+000 of NH-2, thus making a total length of 179.5 km in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Six Lanning of Delhi – Agra Section of NH-2 from KM 20.500 to KM 200.00 (DBFOT Model) in the State of Haryana / Uttar Pradesh	20+500	200+000	179.500	Six lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor

Various key features along the project road such as slope protections, median openings,

Start Point of Project Road at Km 20+500

End Point of Project Road at Km 200+000

- Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 20+500 at Badarpur Border of NH-2	Km 20+500 at Badarpur Border of NH-2
2	Project Road End	Km 200+000 at Agra of NH 2	Km 200+000 at Agra of NH 2
3	Project Length	179.50 Km	179.50 Km
6	Carriageway	6 lane highway with paved width 12.5 m on either side	6 lane highway with paved width 12.5m on either side
7	Shoulders	2 m earthen for MCW	2 m earthen for MCW
8	Median	4.5 m wide in rural areas and 2 m in Urban Stretches.	4.5 m wide in rural areas and 2 m in Urban Stretches.
9	Service Roads	Total Length is 204 .160 KM	Total Length is 204 .160 KM
10	Major Bridge/ Viaduct	1 Nos/ 1Nos	1 Nos/1 Nos
11	Minor Bridge	9 Nos.	14 Nos.
12	Pipe, Box & Slab Culverts	203 Nos.	203 Nos.
13	Major/Minor Junctions	36 Major & 242 Minor	36 Major & 242 Minor
14	Underpass/Overpass	19 Nos VUP, 10 Nos PUP & 5 Nos Overpass	23 VUPS and 9 PUPS & 2 Nos Over Pass
15	Grade Separator	18 Nos	14 Nos
15	ROB/RUB	8 Nos	9 Nos
16	Toll Plazas	3 Nos	3 Nos
17	Truck Lay-byes/Truck Parking	4 Nos.	4 Nos.
18	Bus Shelter	23 Nos.	23 Nos.

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

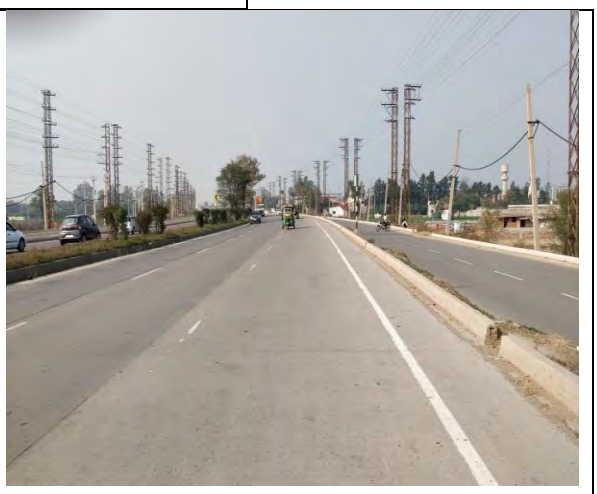
Typical Cross Section	Typical Section of Approach
Typical Rural Section	Toll Plaza

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Length		Pavement Type	
	LHS	RHS	LHS	RHS
1	40.560	15.350	CC	CC
2	138.940	164.150	BT	BT
	179.500	179.500	Total Length	

Flexible Pavement



Rigid Pavement

6.2.3 Service Roads

As per Schedule B of CA 204.16 km service of width 5.5m to 7m wide to be constructed.

6.2.4 Median

Median width of 4.5 m was observed in the Rural and 2 m in approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in Fair condition.

Narrow median without MBCB

4 m wide Median with Shrubs

41 nos. of authorized and 13 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening without Solar Blinker

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. As per Schedule B lined drains are to be provided at the sides of the Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total 59.750 Km of covered line side drain is to be provided. Drain found in good condition.

Road Side Drain at Project Road

6.2.6 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	42.28
	Median	40.74
Pedestrian Guard Rail	Carriageway Edge	49.08
PGR	Median	4.5
Concrete Barrier	Carriageway Edge & Median	38.02
RCC Railing	Carriageway Edge & Median	1.17
Barbed wire fence	Carriageway Edge	1.8

PGR on Median and MBCB present on the project road

6.2.7 Toll Plaza and Other Facilities

There are 3 nos. of toll plaza in present project road at following locations.

1) Km 46+000 with (5+1) lanes in each direction
2) Km 94+000 with (5+1) lanes in each direction
3) KM 164+000 with (5+1) lanes in each direction

Toll Plaza

6.2.8 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at built-up area, approach of grade separated structures. All lights were provided with LED bulbs for better quality and low operation cost.

High Mast and Highway Light along project Highway

6.2.9 Bus Bays and Bus Shelter

There are 23 Bus bays along the project road. All bus shelters present in the project road are in good condition.

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	20+550	LHS	Bus Bay with Shelter	BT
2	21+200	RHS	Bus Bay with Shelter	BT
3	24+500	LHS	Bus Bay with Shelter	BT
4	24+500	RHS	Bus Bay with Shelter	BT
5	25+500	RHS	Bus Bay with Shelter	BT
6	25+900	LHS	Bus Bay with Shelter	BT
7	27+200	LHS	Bus Bay with Shelter	BT
8	27+200	RHS	Bus Bay with Shelter	BT
9	28+700	LHS	Bus Bay with Shelter	BT
10	29+200	RHS	Bus Bay with Shelter	BT
11	31+000	RHS	Bus Bay with Shelter	BT
12	31+600	LHS	Bus Bay with Shelter	BT
13	32+450	LHS	Bus Bay with Shelter	BT
14	35+400	LHS	Bus Bay with Shelter	BT
15	77+350	LHS	Bus Bay with Shelter	BT
16	142+450	LHS	Bus Bay with Shelter	BT
17	142+750	RHS	Bus Bay with Shelter	BT
18	145+100	LHS	Bus Bay with Shelter	BT
19	145+550	RHS	Bus Bay with Shelter	BT
20	151+850	RHS	Bus Bay with Shelter	BT
21	152+300	LHS	Bus Bay with Shelter	BT
22	158+000	RHS	Bus Bay with Shelter	BT
23	167+500	RHS	Bus Bay with Shelter	BT

6.2.10 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	42+600	RHS	NA	NA	Yes

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
2	94+775	BHS	NA	NA	Yes
3	123+525	LHS	NA	NA	Yes
4	161+600	RHS	NA	NA	Yes

Truck Lay Bye

6.2.11 Major and Minor Junctions

As per the site inventory, 37 major and 242 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas

Major Junction at KM 199+800	Major Junction at KM 152+000

6.2.12.1 Signage and Marking

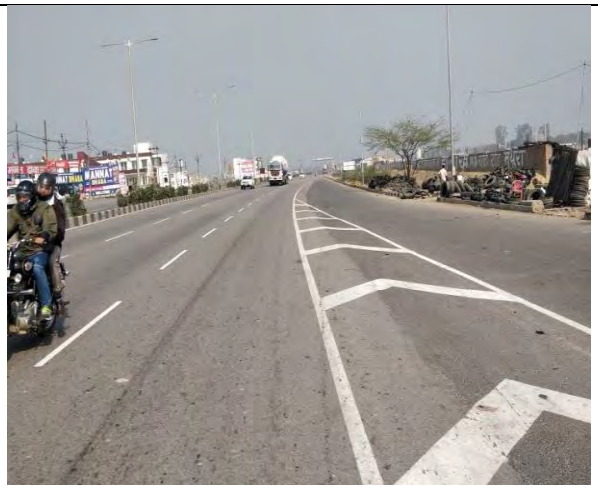
Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.



Road marking along the carriageway

6.2.12.2 Landscaping and Tree Plantation

Median plantation has provided at 4m median and narrow median. Condition of median plantation is good. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road	Plantation at Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they need maintenance to extend their design life.

As per site inspection it has been observed that

- There is 1 Nos Major Bridge with length of 66m is found in good Condition.
- 1 Nos of Viaduct with length of 2148m is found in good Condition.
- 14 nos. of Minor bridges having total length varies from 7 m to 48.50 m are generally found in good condition.
- 23 nos. of Vehicular Underpass having span arrangement of 1 x 20 are found in good condition.
- 9 nos. of Vehicular Underpass having span arrangement of 1 x 4 are found in good condition.
- There are 8 nos. of ROB and 1 Nos RUB which are generally in good condition.
- 2 nos. of Overpass having span arrangement of 1 x 4 are found in good condition
- There is 14nos of Flyovers are in good condition.
- 203 (pipe/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

Major Bridge and Viaduct

Salient features along with condition of 1 Nos Major bridge and 1 Nos of Viaduct are discussed here.

a) Major Bridge – CH.91+900

It consists bridge in both carriageways. Both the bridge has Span arrangement of 1x34 + 1x32. Wearing coat and other general condition of the bridge is in good condition. Periodic maintenance of the bridge is to be done within definite time frame.

A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Major Bridge at Ch. 91+900

b) Via Duct – 58+070 to 60+194

It consists Viaduct in both carriageways. Both the bridge has Span arrangement of 1 x 26.78 + 1 x 46.00 + 77 x 26.78 + 1 x 46.00 + 1 x 26.78, total length of 2148m. Wearing coat and other general condition of the bridge is in good condition. Periodic maintenance of the bridge is to be done within definite time frame.

Minor Bridges

Salient features along with condition of 14 Minor bridges are discussed here.

c) Minor Bridge – CH.21+860

It consists bridge in both carriageways. Both the bridge have Span arrangement of 1x20.3m. Wearing coat and other general condition of the bridge is in good condition. Periodic maintenance of the bridge is to be done within definite time frame.

d) Minor Bridge – CH.26+065

It consists bridge in both carriageways. Both the bridge have Span arrangement of 4x2.1m, Super structure comprises of RCC Box. Wearing coat and other general condition of the bridge is in good condition. Periodic maintenance of the bridge is to be done within definite time frame.

e)Minor Bridge – CH.34+530

It consists of two bridge structures in each carriageway. Both the bridges Span arrangement of 1x4.6m+3x5m+1x4m+1x6m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

f) Minor Bridge – CH. 54+100

It consists of two bridges on each carriageway. The Bridges has Span arrangement of 1x7.0m. Wearing coat and other conditions of the bridge are good.

g) Minor Bridge – CH.84+365

It consists of bridges on each carriageway. Both the bridge has a span arrangement of 1x17.1m+1x16.6m+1x14.75m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

A few pictures showing conditions of Minor Bridge are presented as follows:

h) Minor Bridge – CH.92+960

It consists of bridge on each carriageway. Both the bridge has Span arrangement of 1x8.1m+1x8.3m. The general condition of both the bridge is good. It requires regular repair works like repairing of drainage spouts, replacement of wearing coat etc. is required.

i) Minor Bridge – CH.104+085

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x10.2m+1x16.5m+1x10.2m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

j) Minor Bridge – CH.104+480

It consists of bridge on LHS of the carriageway. LHS Bridge has a span arrangement of 1x17m. As periodic maintenance, replacement of joint filler and wearing coat is required

k) Minor Bridge – CH.104+480

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x17.2m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

l) Minor Bridge – CH.124+490

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x6.3m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

m) Minor Bridge – CH.141+600

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x7.6m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

n) Minor Bridge – CH.154+965

It consists of bridge on RHS of the carriageway. Bridge has a span arrangement of 1x13.2m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

o) Minor Bridge – CH.171+091

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x46.7m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

p) Minor Bridge – CH.179+110

It consists of bridge on RHS of the carriageway. Bridge has a span arrangement of 1x7m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

q) Minor Bridge – CH.198+552

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 1x7.1m. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

A few pictures showing the conditions of Minor Bridges are presented as follows:

Minor Bridge at Ch. 34+530	Minor Bridge at Ch. 141+600

r) Underpasses

There are 23 Nos of VUP's with a single span of 1 x 20 m and 9 Nos of PUPs with single span of 1 x 4 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages. A few pictures to ascertain the conditions of VUP and PUPs are presented as follows:

VUP @ Ch. 71+750

VUP @Ch 134+555

VUP @ Ch. 122+750

PUP @ Ch. 116+500

s) Railway over Bridge (ROBs)
ROB at Ch. 36+800

It consists of two bridges each on both the carriageway. Both Bridge has a span arrangement of 2 x 11.70m + 1 x 10.5m + 1 x 9.5m. The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc. A few pictures to ascertain the conditions of ROB are presented as follows: -

t) ROB at Ch. 103+250

It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 10.4m + 1 x 14.2m.

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

u) ROB at Ch. 140+810

It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 15.4m

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

v) RUB at Ch. 141+390
It consists of a Bridges on which both the carriageway passes under the bridge. The bridges have Span arrangement of 1 1x12.2m+2x13.2m+1x12.2m. The general condition of both the RUB is good.

w) ROB at Ch. 147+600
It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 11.7m

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

x) ROB at Ch. 147+800
It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 11.2m

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

y) ROB at Ch. 148+080
It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 6.5m

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

z) ROB at Ch. 156+350
It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 14.1m

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

aa) ROB at Ch. 166+300
It consists of a two Bridges on which both the carriageway passes. The bridges have Span arrangement of 1 x 8m+ 1x 9m.

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc.

A few pictures to ascertain the conditions of ROB's are presented as follows: -

View of Carriageway

Span Arrangement

ROB at Ch. 103+250

View of Carriageway

ROB at Ch. 166+300

bb) Grade Separators (Flyover)

There are 14 Nos of Flyovers with typical Span Arrangement of 1x26m+1x46m+1x26m. The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc. A few pictures to ascertain the conditions of ROB are presented as follows: -

Flyover @ Ch 152+000

Super structure in fair condition

Super structure in fair condition

Piers

Flyover at Ch. 142+575

2.3.2.6 Culverts:

There are 203 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches	Drainage Spouts		
1	21+750	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●	●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●	●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
2	21+860	LHS	1x20.3	12.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x20.3	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
3	23+660	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
4	25+650	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
5	26+065	LHS	4 x 2.1	12.5	MNB	Y	●	●	●			●	●	●	●		●	Stable	
		RHS	4 x 2.1	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts		
6	26+950	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
7	29+5=00	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
8	31+500	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
9	32+165	LHS	1x20	12.5	VUP	NA	●	●	●				●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
10	31+500	LHS	4 x 2.1	12.5	MNB	Y	●	●	●			●	●				●	Stable	
		RHS	4 x 2.1	12.5			●	●	●			●		●			●	Stable	
11	35+050	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●				●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●			●	Stable	
12	36+800	LHS	2 x 11.70 + 1 x 10.5 + 1 x 9.5	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2 x 11.70 + 1 x 10.5 + 1 x 9.5	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
13	38+200	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
14	40+960	RHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
15	48+200	LHS	2x30	12.5	Overpass	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2x30	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
16	54+100	LHS	1 x 7	12.5	MNB	Y	●	●	●			●	●				●	Stable	
		RHS	1 x 7	12.5			●	●	●			●		●			●	Stable	
17	54+435	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
18	58+070 to 60+194	LHS	2 x 11.70 + 1 x 10.5 + 1 x 9.5	12.5	Viaduct	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2 x 11.70 + 1 x 10.5 + 1 x 9.5	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
19	63+170	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
20	65+200	LHS	1x20	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
21	68+125	RHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
22	71+750	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
23	77+300	RHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
24	83+270	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
25	84+365	LHS	1x17.1+1x16.6+ 1x14.75	12.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x17.1+1x16.6+ 1x14.75	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
26	87+875	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x4	12.5			●	●	●			●	●	●	●		●	Stable	
27	88+825	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
28	90+625	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5		NA	●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts		
29	91+900	LHS	1x34 + 1x32	12.5	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x34 + 1x32	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
30	91+900	LHS	1x8.1+1x8.3	12.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x8.1+1x8.3	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
31	101+300	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
32	103+250	LHS	1 x 10.4 + 1 x 14.2	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 10.4 + 1 x 14.2	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
33	104+085	LHS	1 x 10.4 + 1 x 14.2	12.5	MNB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 10.4 + 1 x 14.2	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
34	104+480	LHS	1 x 17.2	12.5	MNB		●	●	●	●	●	●	●	●	●		●	Stable	
35	107+670	RHS	1 x 4	12.5	PUP		●	●	●				●	●	●		●	Stable	
36	112+100	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
37	112+700	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
38	116+500	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x4	12.5			●	●	●			●	●	●	●		●	Stable	
39	118+800	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
40	122+750	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
41	124+490	LHS	1x6.3	12.5	MNB	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x6.3	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
42	125+900	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
43	128+068	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
44	134+555	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
45	137+242	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x4	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
46	139+335	LHS	1x20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x20	12.5			●	●	●			●	●	●	●		●	Stable	
47	140+810	LHS	1 x 15.4	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 15.4	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
48	141+390	LHS	1x12.2+2x13.2+ 1x12.2	12.5	RUB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x12.2+2x13.2+ 1x12.2	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
49	141+600	LHS	1 x 7.6	12.5	MNB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 7.6	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
50	142+575	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
51	145+100	LHS	1 x 20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1 x 20	12.5			●	●	●			●	●	●	●		●	Stable	
52	147+600	LHS	1 x 11.7	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 11.7	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
53	147+730	LHS	2x30	12.5	Overpass	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2x30	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
54	147+800	LHS	1 x 11.2	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 11.2	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
55	148+080	LHS	1 x 6.5	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 6.5	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
56	152+000	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
57	154+400	LHS	1 x 4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
58	154+965	RHS	1x13.2	12.5	MNB	NA	●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
59	156+350	LHS	1 x 14.1	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 14.1	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
60	157+775	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
61	166+300	LHS	1 x 8 + 1 x 9	12.5	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 8 + 1 x 9	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
62	167+600	LHS	1 x 20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1 x 20	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
63	170+460	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x4	12.5			●	●	●			●	●	●	●		●	Stable	
64	171+091	LHS	1x46.7	12.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x46.7	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
65	172+990	LHS	1x4	12.5	PUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x4	12.5			●	●	●			●	●	●	●		●	Stable	
66	175+730	LHS	1 x 20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1 x 20	12.5			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts		
67	179+110	RHS	1 x 7	12.5	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
68	183+527	LHS	1 x 20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
69	189+900	RHS	1 x 20	12.5	VUP	NA	●	●	●			●	●	●	●		●	Stable	
70	195+680	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
71	198+415	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
72	198+552	LHS	1x7.1	12.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x7.1	12.5			●	●	●	●	●	●	●	●	●		●	Stable	
73	199+800	LHS	1x26+1x46+ 1x26	12.5	Flyover	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x26+1x46+ 1x26	12.5			●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Farakka-Raiganj Highways Limited

Report Number:

ACM-60655667-TDD-FR-001-R0

Date:

July, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Farakka-Raiganj Highways Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Farakka Raiganj Highway Limited (FRHL)**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Farakka Raiganj Highways Limited

6, Floor-2nd, Plot No. 134, Birla Mansion,
Nagindas Master Lane, Kala Ghoda, Fort,
Mumbai-400001

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

LIST OF ABBREVIATION II

1. EXECUTIVE SUMMARY 3

1.1 Basis of Preparation 3
1.2 Overview of the Project 4
1.3 Key Findings 5
1.4 Asset Condition 8
1.5 Toll Plaza and TMS 10
1.6 Change of Scope (COS) 10
1.7 Balance Work 11
1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement 11
1.9 Insurance 12
1.10 Introduction of Asset 14
1.11 Review of Pavement 16
1.12 Major Maintenance 18
1.13 Operation & Maintenance Works 19
1.14 Major Maintenance Cost 21
1.15 List of Document Reviewed 21

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS 23

2.1 Background 23
2.2 Pavement Design 23
2.3 Survey and Investigations 24
2.4 Determination of Pavement Major Maintenance 32

3 CAPEX REQUIREMENT 33

3.1 Initial Repair & Rehabilitation Work 34

4 MAJOR MAINTENANCE COST 35

4.1 Major Maintenance Cycle 35
4.2 Major Maintenance Quantity 35
4.3 Unit Rate Analysis 35
4.4 Cost Estimate 38

5 OPERATION AND MAINTENANCE COST 40

5.1 Introduction 40
5.2 Forecast Methodology 40
5.3 Requirement of CA (Schedule K and Concession Agreement) 41
5.4 Routine and Preventive Maintenance 41
5.5 Highway Lighting 42
5.6 TMS Cost and ATMS 42
5.7 Corridor Management 43
5.8 Manpower Cost 43
5.9 Office Expenses 43

6 PROJECT ROAD ANALYSIS 45

6.1 Reconnaissance Survey 45
6.2 Road Inventory and Condition Survey 45
6.3 Toll Plaza and Associated Facilities 62
6.4 Inventory and Condition Survey of Structures 70

AMC	Annual Maintenance Contract	FRHL	Farakka Raiganj Highway Limited
ATMS	Advanced Traffic Management System	FWD	Falling Weight Deflectometer
BC	Bituminous Concrete	GAD	General Arrangement Drawing
BHS	Both Hand Side	GSB	Granular Sub-base
BI	Bump Integrator	GST	Goods and Services Tax
BOQ	Bill of Quantity	HSYD	High Yielding Strength Deformed
BT	Bituminous Top	INR	Indian Rupees
CA	Concession Agreement	IRC	Indian Road Congress
CAPEX	Capital Expenditures	ITM	Integrated Traffic Management
CC	Control Centre	KVA	Kilo-Volt-Ampere
CCTV	Closed Circuit Television Systems	LCV	Light Commercial Vehicle
CMSA	Cumulative Million Standard Axles	LED	Light Emitting Diode
COS	Change of Scope	LHS	Left Hand Side
COD	Commercial Operation Date	LIU	Light Interface Units
CUP	Cattle Underpass	LVUP	Light Vehicular Underpass
DBM	Dense Bituminous Macadam	MAV	Multi Axle Vehicle
DG	Diesel Generator	MCA	Model Concession Agreement
DLC	Dry Lean Concrete	MCW	Main Carriageway
ECB	Emergency Call Box	MDS	Metrological Data System
EPC	Engineering, Procurement, and Construction	MET	Metrological
ESAL	Equivalent Standard Axle Load	MIS	Management Information System
ETC	Electronic Toll Collection	MJB	Major Bridge
EW	East West	MNB	Minor Bridge
FO	Flyover	MoRTH	Ministry of Road Transport and Highways
FOB	Foot Over Bridge	MSA	Million Standard Axles

MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Farakka - Raiganj Highway Limited ("FRHL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Farakka – Raiganj Section of NH – 34 on DBFOT Toll Basis in the State of West Bengal (herein after refer as "the Project") which is being operated by "M/s Farakka - Raiganj Highway Limited" (hereinafter refer as "the Concessionaire or Company or FRHL").

1.1.2 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope.

The present condition of the Project Highway is reviewed based on physical site visit observations and documents and test reports provided by the Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.

In this report, AECOM provides an overview of the asset from technical perspective based on survey carried on Dec 2019, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.

Further documents / test report received from Client and accordingly report is updated as Mar 2022.

1.1.3 Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

a) Project Document

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- O and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepared by IE
- Test Report
- Traffic Data

b) Test Report

- Axle Load Survey Data with VDF
- NSV Survey Data
- FWD Test Report with analysis
- Test Pit and Core Test Report

Apart from data room, information / data provided thorough email has also reviewed and included in this report.

1.1.4 Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.2 Overview of the Project

Agreement was signed between National Highways Authority of India (NHAI) and M/s Farakka – Raiganj Highway Limited, a Company promoted and incorporated by M/s Hindustan Construction Company Limited on 19 July 2010 for Four Laning of Farakka Raiganj Section of NH-34 from Km 295.000 to Km 398.000 in the state of West Bengal Under NHDP Phase-3 on DBFOT Toll Basis (hereinafter called "the Project"). The project road has been acquired by Cube Highways in Year 2019 and operating project road in the name of M/s Farakka Raiganj Highways Limited.

Project Corridor	Four Laning of Farakka - Raiganj Section of NH – 34 on DBFOT Basis in the State of West Bengal
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways
Concessionaire	Farakka -Raiganj Highways Ltd.
Independent Engineer (During O & M)	M/s URS Scott Wilson India Private Limited
EPC Contractor	M/s Hindustan Construction Company Ltd
Project Road Length	103 km

Project Cost	1078.84 Crore (as per IE MPR April 2019)
Grant	414.5 crores
Date of Concession Agreement	19 July 2010
Appointed Date	3 Feb 2011
Concession Period	30 years including Construction Period
Construction Period	30 months
Schedule Date of COD	1 August 2013
Completion Certificate	25 Mar 2022
O & M Contractor	1) Toll Plaza (Markolines Traffic Controls Pvt Ltd.) 2) O&M contractor HCC Operation and Maintenance Ltd. 3) Clifford Facility Services (P) Ltd. for Security Services
Number of Toll Plaza and Lanes	2 nos each plaza having 12 lanes including extra width
End of Concession Period	July 2040

Source: IE MPR April 2019, O & M Contracts, Concession Agreement

1.3 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (CC)	PCOD was issued on 17 October 2016 for a length of 79.57 Km before Schedule Completion Period. As per Article 14.1.1, all items in the punch list shall be completed by the concessionaire within 90 days of the date of issue of the provisional certificate and for any delay thereafter, other than reason solely attributed to the authority or due to force majeure, the authority shall be entitled to recover damages from concessionaire. It is learned that due to slow progress of work exhibited by concessionaire Balance work has not been completed yet. Completion certificate issued on 25 Mar 2022.	🟢
Operation and Maintenance	As per Article 17 of Concession Agreement, Concessionaire shall maintain project highway either by itself, or through the O & M Contractor. The concessionaire shall procure that at all time during the O & M period, the Project Highway conforms to the maintenance requirement set forth in Schedule-K. As per IE O & M Inspection Report, Concessionaire is advised to carryout day to day routine maintenance within given time frame.	🟢
Major Maintenance (MM)	Overlay/Inlay/Microsurfacing as per Pointwise Analysis for first two cycles, 30 mm BC functional overlay for last two cycle. MM cycle for balance concession period shall be: 1) Year 2022/23 - MM Cost 128.15 crore 2) Year 2029/30 – MM Cost 162.44 crore 3) Year 2036/37 – MM Cost 152.99 crore 4) Year 2040/41 – MM Cost 150.09 crore	🟠

Diligence Area	Findings	Risk
Maintenance Manual and Yearly Program	As per Article 17.4 of Concession Agreement, Concessionaire required to submit proposed Programme not later than 45 days before beginning of each accounting year.	●
Pavement Design	Pavement design was done for 10 year of design traffic as per IRC 37 – 2001 considering 8 % CBR. Key fact of pavement design is as follows: - Pavement design for 10 years - Design Traffic 65, 55 & 45 MSA - Total Traffic till year 2031 – 100 MSA Adopted Pavement thickness: BC – 45 mm, DBM 125,120 & 110 mm, WMM -250 mm and GSB – 200 mm. Pavement design for Service Road is to be designed for 5 MSA as per Schedule D and accordingly following pavement thickness was proposed for Service Road. SBDC – 25 mm, DBM – 50 mm, WMM – 250 mm, GSB – 150 mm.	●
Pavement Condition	As per Roughness survey report of Mar 2022 carried out by M/s V R Techniche , 47 km on LHS and 67 km on RHS is in Good condition (roughness less than 2500 mm / km), 25 km on LHS and 14 km on RHS is in Fair condition (roughness value more than 2500 mm / km but less than 3000 mm/ km) and 28 km on LHS and 19 km on RHS is in Poor condition. As per our site observation, existing pavement condition is in Fair to Poor condition.	●
Penalty	There is no penalty imposed / recommended by NHAI / IE.	●
Change of Scope	NHAI issued COS notices to the Company Pursuant to Article 16 of the CA for following Items: - (A) Positive COS 1) COS of Rs. 1786.44 lakh towards construction of VUP including SR and RE wall at Km 334+847. 2) COS of Rs. 156.29 lakh towards construction of VUP at Km 328+541. 3) COS of Rs. 37.77 lakh towards construction of Two nos of culvert at Km 331+100 & Km 329+600. 4) COS of Rs. 33.66 lakh towards construction of Two nos of culvert at Km 326+500 & Km 327+300. 5) COS of Rs. 982.89 lakh for Malda bypass realignment (Not Approved) 6) COS of Rs. 72.16 lakh towards construction of for ETC lane at Toll Plaza. 7) COS of Rs. 34.02 lakh for Installation of additional ROW Pillars. 8) COS of Rs. 34.11 lakh for Maintenance over Farakka Barrage. (Rejected) 9) COS of Rs. 710.65 lakh towards construction of SR and Drain at Sujapur Area. (Not Approved) 10) COS of Rs. 141.69 lakh towards construction of construction of Highway Nest near Toll Plaza. 11) COS of Rs. 76.03 lakh towards strengthening the incident management service. (Not Approved) 12) COS of Rs. 882.72 lakh towards implementation of Hybrid ETC lanes at Toll Plaza. (B) Negative COS 1) COS of Rs. 5000 lakhs towards Four Laning of Farakka barrage on extended pier.	●

Diligence Area	Findings	Risk
	2) COS of Rs. 2059.49 lakhs towards Stage construction approval of tentative cost of difference in Pavement. 3) COS of Rs. 936.17 lakhs towards construction Kaliachak bypass Realignment. 4) COS of Rs. 1744.58 lakhs related to conversion of Well Foundation to pile foundation in the Mahananda Bridge. 5) COS of Rs. 1765.57 lakhs related to Deviation in the Horizontal and vertical alignment made by the concessionaire.	
Balance Work	There is no Balance work.	🟢
Toll Plaza and TMS	There are two toll plazas along project corridor at Km 297.867 (TP 1) having 6 + 6 lanes and Km 351.440 (TP 2) having 6 + 6 lanes. Flexible pavement has provided at tapper portion and center portion of toll lanes has provided with rigid pavement. Existing Rigid Pavement at to both the Toll Plaza is in the fair condition. TMS was installed in year Dec 2019 by M/s METRO and tolling is continuing with current equipment. The existing system is in order and do not envisaged any issue. The replacement of system is expected in Year 2022, 2029 and 2036.	🟢
Major Issue Identified by IE	As per IE MPR there is no major issues in the project. Current issue as per IE MPR is as follows: 1. Concessionaire's progress is not up to the mark. 2. Delay in utility shifting work especially in Sujapur Area. 3. Damaged earthen shoulder on project highways. 4. Routine Maintenance of Road Furnitures (MBCB, Road Signs etc. 5. Adequate diversions and safety majors to be taken at under construction locations	🟠
Road Safety	Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement. As per AECOM site visit, following additional measures are recommended to enhance safety for road users: • Provide blinkers at all median • Provide missing median plant to reduce glare affect during night • Wrong placement of Sign Board • Provide PGR between MCW and SR at all locations • Antiglare arrangement at narrow median (width less than 2 m) • Closer of unauthorized openings	🟠
Geometric Design	The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows: Design Speed – 100 kmph, Minimum Radius 400 m as ruling and 250 m as absolute minimum, K value for Summit Curves 70 and Valley Curves 42 for Stopping Sight Distance. Project road confirms requirement of Schedule D.	🟢
As-Built Drawing	As per provision of Contract Sub Clause 12.3(a), the Concessionaire shall prepare and submit, with reasonable promptness and in such sequence as is consistent with the project completion schedule, three copies each of all drawing to the independent engineer to review.	🟢

Diligence Area	Findings	Risk
Handback requirement	As specified in Article 38, concessionaire shall cure all project assets, including the road, bridges, structures and equipment, of all defects and deficiencies so that the project highway in compliant with the maintenance requirements. All specific requirement has stated in Schedule K shall be followed.	

1.4 Asset Condition

In general, the condition of asset is in Fair condition as of Dec 2019. As per AECOM study, with existing arrangement for Operation and Maintenance and with every 5 or 6 years cycle of Major Maintenance (Overlay) cycle, project road will continue to fulfill Level of Service as set forth in Schedule K and requirement of Article 17 of Concession Agreement except following improvements are required:

- Safety enhancement
- Roughness Survey and BBD Survey to be conducted as per frequency stated in Schedule L

The summary of asset condition (as of Dec 2019) is tabled as follow:

S.N.	Asset	Condition
1	Main Carriageway	Project road is four lane having paved width of 2 x 8.75 m along at grade section and 2 x 11.5 m at approach of grade separated structures. The pavement condition of existing pavement is in fair to poor condition.
2	Service Road	5.50 m & 7 m width of service road has provided at approach of Grade Separated Structures and at built up area. Total one side length of 8.62 km has provided as service road. The pavement condition of service road is in fair condition. Also, routine maintenance of service road was found in poor condition.
3	Median	4.5 m raised median along rural sections and 1.5 m raised median along Built Up area and approach of grade separated structures has provided. Median plantation in rural areas (4.5 m width) is in order. NJCB provided at some places and few locations are still under construction.
4	Median Opening	34 nos of Median openings have provided out of which 26 median openings are with shelter lanes and remaining 8 nos of median opening are without shelter lanes. Solar blinkers have been provided on 9 nos of median opening and 25 nos of median openings are without blinkers. It is suggested to provide blinkers are all median opening as all median openings are safety hazard.
5	Drainage arrangement	Lined drain has provided between Main Carriageway and Service road at built up area and at outer edge of slip road at approach of grade separated structures (FO, PUP/CUP).
6	Major and Minor Junctions	8 nos of major junctions and 159 nos of minor Junctions are found along project road.
7	Safety Barrier	36.5 km of Metal Beam Crash barrier has provided along outer edge and median side and RCC Crash barrier has provided over

S.N.	Asset	Condition
		approach of GS Structure on top of RE Wall at approximately in 1.66 km length.
8	Pedestrian Guard Rail	Pedestrian Guard Rail has provided in between MCW and SR at some built up area to guide pedestrian safely to crossroad at designated location. However, PGR has not provided at complete required length i.e. between MCW and SR. As per Inventory condition survey report 3670 m is found at site.
9	Toll Plaza	Km 297.351 (TP 1): - (5+1) lanes in each direction Km 351.440 (TP 2): - (5+1) lanes in each direction Existing toll plaza including administrative building, TMS are in order and complying project requirement. Existing rigid pavement at both toll plaza is in fair condition.
10	Highway Lighting	Highway lighting has provided at approach of Toll Plaza, approach of major Junction at median. highway lighting is provided in 13.44 Km of project highway. 23 nos of High Mast has provide at Toll Plaza, ROB, Major Junctions and Flyovers. Existing condition of highway lighting is in order.
11	Bus Bays and Bus Shelters	20 nos of bus bays with shelter has observed at site and conditions of bus bays and shelters are found to be in good condition.
12	Truck Laybys	12 nos of truck laybys has been provided with facility of toilets and drinking water facilities.
13	Traffic Sign and Marking	661 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good except some of sign boards are required to be replaced with new. Road Marking was in poor condition.
14	Major Bridge	8 no of Major Bridge has provided and structural condition of bridge is fair to good. Drainage Spout cover and elastomeric strip seal are found to be defective which are required to be provided.
15	Minor Bridge	22 numbers of Minor Bridge are in fair to good condition. Maintenance / cleaning of Expansion Joint, drainage spouts and protection work are required. One Minor Bridge slab reinforcement exposed.
17	VUP	7 Nos of VUPs are structurally in good condition.
18	ROB	1 No of ROB having span arrangement of 5x40 on BHS is found in good condition. LHS side is under construction.
19	Cross Drainage	Total 80 nos of cross drainage structures has found and condition of structure are found to be in order.

Note: The project road has a long operational history and we had forecasted the operations & maintenance costs/strategies for the entire balance period primarily based on i) the original pavement design during construction phase, ii) the various investigations and surveys carried out to assess the technical performance and quality of the project road and iii) other information provided to us by the Client and we don't expect any material change in operations & maintenance costs/ strategies year on year.

1.5 Toll Plaza and TMS

Toll Plaza including collection and TMS is operated / maintained by Farakka Raiganj Highways Limited. Existing TMS is installed by M/s METRO in Year 2019. Existing system is as per requirement of applicable Manual all equipment are found to be working condition.

Item	TP 1 (Km 297.867)	TP 2 (Km 351.440)
Total Number of Lane	12	12
Total number of Regular Lane	10	10
Total Number of Extra Width Lane	2	2
Tolling Equipment		
Number of Dedicated ETC Lane	-	-
Number of Hybrid ETC Lane	12	12
Number of Reversible Lane	1	1

As per AECOM assessment total cost of TMS System is approximately 4.54 crore. The life TMS equipment is considered 7 years and 70 % of cost of TMS is forecasted as replacement cost which will occurred in every 7 year i.e. in Year 2022, 2029 and 2036.

1.6 Change of Scope (COS)

As per Article 16, Sub Clause 16.1 to 16.4, NHAI may, notwithstanding anything to the contrary contained in the Agreement, require provision of such addition / deletion to the works and services on or about the Project Highway which are beyond the scope of Project as contemplated by the Agreement. All such changes shall be made by NHAI by an order ("the Change of Scope Order"). The list of COS order is tabled below: -

A) Positive

S.N.	Description of Work	Amount	Current Status	Remarks
1	Construction of VUP including SR and RE wall at Km 334+847	1786.44 lakh	Approved	
2	construction of VUP at Km 328+541.	156.29 lakh	Approved	
3	construction of Two nos of culvert at Km 331+100 & Km 329+600.	37.77 lakh	Approved	
4	construction of Two nos of culvert at Km 326+500 & Km 327+300	33.66 lakh	Approved	
5	Malda bypass realignment	982.89 lakh	Not Approved	
6	construction of for ETC lane at Toll Plaza.	72.16 lakh	Approved	
7	Maintenance over Farakka Barrage	34.11 lakh	Rejected	
8	Installation of additional ROW Pillars	34.02 lakh	Approved	
9	construction of SR and Drain at Sujapur Area	710.65 lakh	Not Approved	
10	construction of Highway Nest near Toll Plaza.	141.69 lakh	Approved	

S.N.	Description of Work	Amount	Current Status	Remarks
11	strengthening the incident management service	76.03 lakh	Not Approved	
12	implementation of Hybrid ETC lanes at Toll Plaza	882.72 lakh	Not Approved	

B) Negative

S.N.	Description of Work	Amount	Current Status	Remarks
1	Four Laning of Farakka barrage on extended pier	5000 lakhs		
2	towards Stage construction approval of tentative cost of difference in Pavement.	2059.49 lakh		
3	construction Kaliachak bypass Realignment	936.17 lakh		
4	conversion of Well Foundation to pile foundation in the Mahananda Bridge.	1744.58 lakh		
5	Deviation in the Horizontal and vertical alignment made by the concessionaire.	1765.57 lakh		

1.7 Balance Work

There is no Balance Work.

1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule K, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

i) Ensure the safety of personnel deployed on and users of the project facilities or part thereof
ii) Keep the Project Facilities from undue deterioration and wear
iii) Permit unimpaired performance of statutory duties and functions of any party in relation to

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule K elaborates requirement various service factor desirable level and

acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (overlay) . Also, overlay is required roughness value exceeded more than 2500 mm / km.

Structural overlay is required if design MSA is less than anticipated MSA till end of Concession Period. As per Pavement design report, anticipated MSA till end of Concession Period (i.e. year 2040) is 278 MSA (maximum) and pavement design adopted during construction for 65 MSA (till Year 2023).

1.8.1 Staff Requirement

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at Toll plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.8.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	Out source
2	Preventive Maintenance	Out source
3	Operation cost of Toll Plaza and Administration Building	In house
4	Security of Toll Plaza and Cleaning	Out Source
5	Highway Lighting	In house
6	Maintenance of ATMS / TMS	Out Source - AMC
7	Corridor Management	Out Source
8	Major Maintenance	Out Source

1.8.3 Handback Requirement

As specified in Article 38, concessionaire shall cure all project assets, including the road, bridges, structures and equipment, of all defects and deficiencies so that the project highway in compliant with the maintenance requirements. All specific requirement has stated in Schedule K shall be followed.

1.9 Insurance

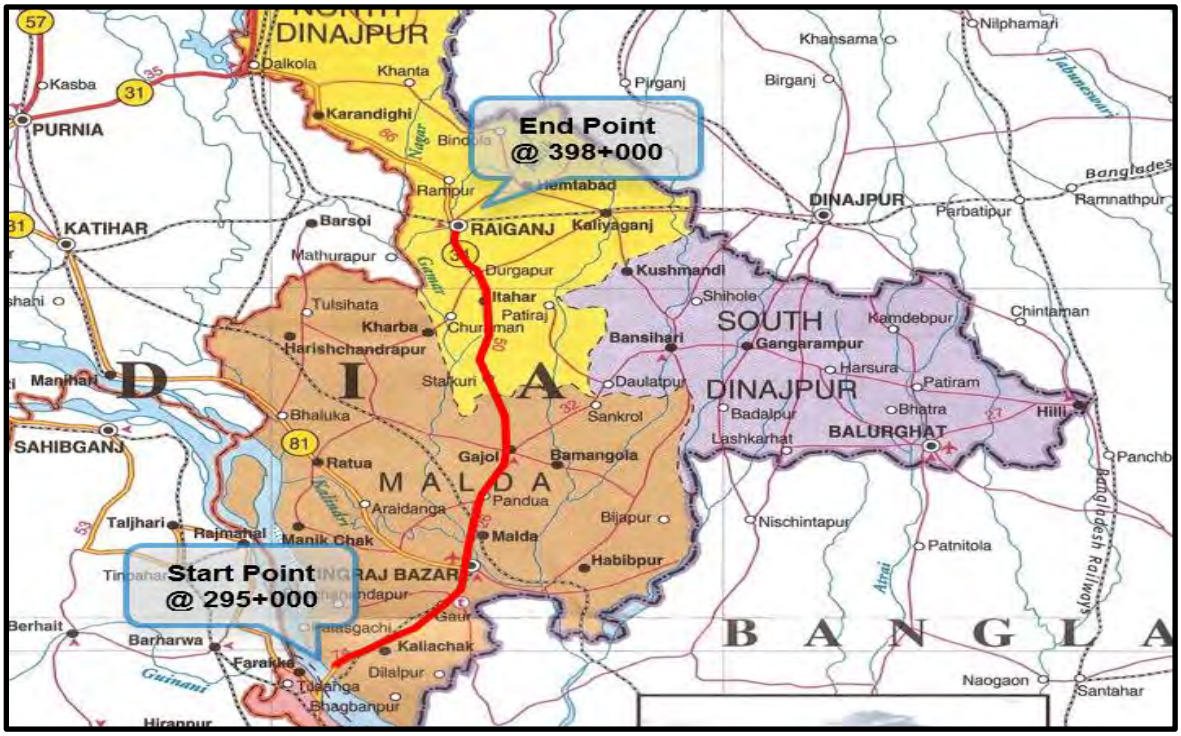
As per Sub Clause 27.2 of Concession Agreement, Concessionaire shall obtain and maintain at no cost to NHAI during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Industrial All Risk Insurance Policy Schedule
2	Burglary – Standard Policy Schedule
3	Electronic Equipment Insurance
4	Standard Fire & Special Perils Policy
5	Money Insurance Policy
6	Business Interruption (FIRE) Policy
7	Policy Schedule For Fidelity Guarantee
8	Policy Schedule for Public Liability
9	Policy Schedule for Package Insurance Policy

1.10 Introduction of Asset

1.10.1 Project Corridor

The project road is a section of National Highway No. 34 (New NH-12) start from KM 295.000 at Farakka and ends at KM 395.000 in Raiganj. In the state of West Bengal. NH 34, one of the major arterial roads of the country originates from Bakkhali and ends at Dalkhola in the state of West Bengal. The total length of highway is 100.18 km. Major cities along NH 34 are Raiganj, Malda, Sujapur and Farakka. The project road starts Km 295.000 at Farakka and ends at Km 395.000 at Raiganj. The total length of the project road is 103.000 km. The project corridor is shown in map below.



Location Map

Project Start KM 295+000

Project End KM 395+000

1.10.2 Salient Features of the Project:

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	103 km	99.750 km
Carriageway	Four Lane (2 x 8.75 Paved Width), Six lane (2 x 11.5 Paved Width) at Approach of underpasses and FO Approach	Four Lane (2 x 8.75 Paved Width), Six lane (2 x 11.5 Paved Width) at Approach of underpasses and FO Approach
Shoulder	1.0 m earthen for MCW at Rural Area	1.0 m earthen for MCW at Rural Area
Service Road / Slip Road	5.1 km one side length having width of 5.50 m	8.62 km one side length having width of 5.50 & 7 m
ROW	60 to 80 m	60 to 80 m
Major / Minor Junction	13 Major and 209 Nos Minor	8 Major and 159 Nos Minor
RCC Drain	Covered drain at Urban Section and open pucca drain between MCW and SR	RCC Covered Drain 8.75 km as per Site Inventory
Median Opening		34 Nos
Toll Plaza	2 Nos	2 Nos
Truck Lay-bys		12 Nos
Bus Bays with shelter		20 Nos
Highway Lighting	Rest Area, Toll Plaza and Interchanges	Provided as per Schedule C (Total 498 nos of Double Arm and 247 nos of Single arm lighting provided)
High Mast	At Major Junctions, ROB / Flyover	Provided as per Schedule C (21 nos of high mast provided)
Highway Patrol	2 nos	2 nos
Ambulance	2 nos	2 nos
Crane	2 nos	2 nos
Traffic Aid Post	At Toll Plaza	At Toll Plaza 2
Medical Aid Post	At Toll Plaza	At Toll Plaza 2

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	8 No	7 No
Minor Bridge	21 Nos	22 Nos
VUP & GS	6 No	4 No
ROB and RUB	1 No	1 No

1.11 Review of Pavement

1.11.1 Pavement Design

During construction of road, pavement deign was carried out for 65,55 & 45 MSA till year 2022/23 i.e. 10 years. Summary of Report is presented as below:

Section	Design Traffic in MSA for Full Concession Period	Design Traffic MSA	CBR	Pavement Thickness (mm)			Remarks
				BC	DBM	WMM + GSB	
HS 1 - Km 295 to Km 325	278	65	8 %	45	125	450	
HS 2 - Km 325 to Km 353	244	55	8 %	45	120	450	
HS 3 - Km 353 to Km 398	202	45	8 %	45	110	450	

The proposed design at the time of construction confirms requirement of Concession Agreement. It is to be noted that based on current survey data provided by the Client design traffic for HS 1 and HS2 on LHS is very high.

1.11.2 Analysis of Existing Pavement Condition

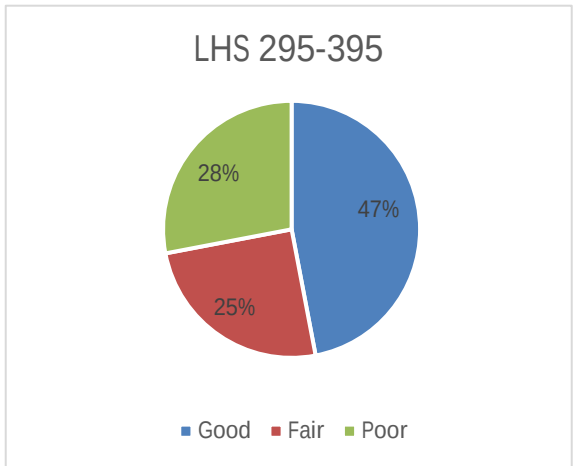
To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

a) Roughness Survey:

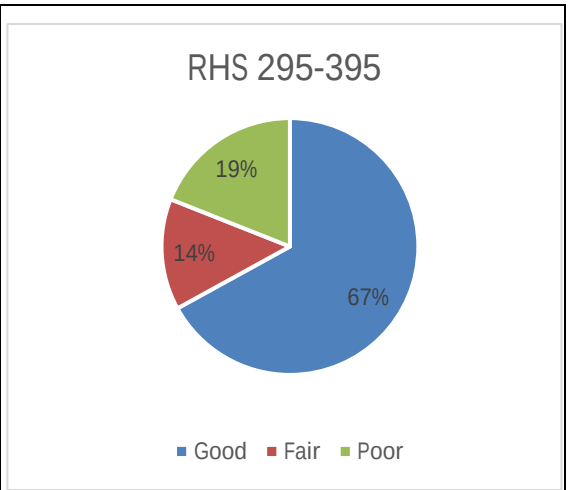
Km 295 to 395: Roughness Survey data has been provided by client based on which Pavement classification done as per following criteria:

Good - less than 2500 mm / km
Fair -2501 to 3000 mm / km
Poor – above 3000 mm / km

Graphical presentation of roughness survey report is appended below:



LHS –Farakka to Raiganj



RHS – Raiganj to Farakka

b) Analysis of Existing Pavement – FWD Test

Evaluation of existing pavement using Falling Weight Deflectometer (FWD) survey was carried out for 87 Km of the project road. Summary of FWD Survey report is presented as below:

- KM 295 to KM 395:

Description	Length in Km	
	LHS	RHS
less than 10 MSA	63	46
Greater than 10 MSA	24	40
Total Tested Length	87	86

c) Test Pit

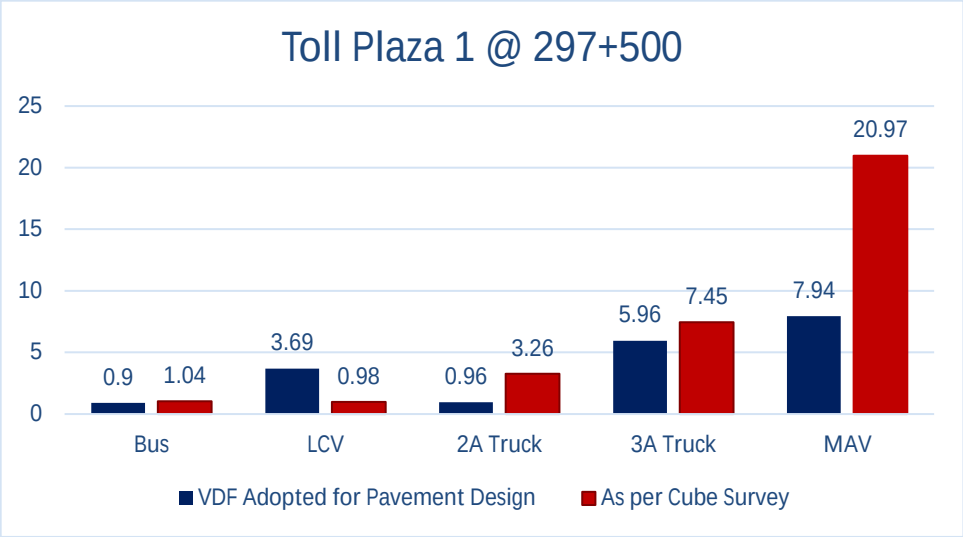
Test pit has been done in 21 locations and various test are performed. project road and is predominantly Sandy soils. The obtained maximum Plasticity Index of the subgrade soils is 19 and the degree of free swell is 40.0%. The degree of compaction along the project corridor is ranging between 87.6% - 98.9%. The 4-days soaked CBR and are ranging from 5.2% to 12.1% with an average value of 8.5%.

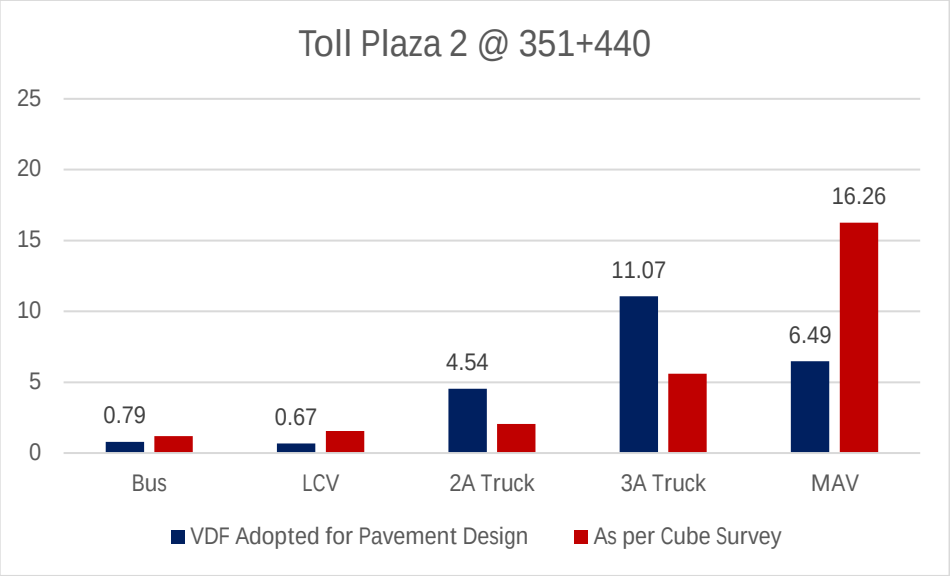
d) Core Test

Bituminous layers samples are collected by using 10 cm diameter core cutting drilling machine to obtain the bituminous core specimens. Two of these samples are slightly finer side & three are slightly coarser to the MoRTH gradation. Bitumen Content is range of 4.25 to 5.22.

e) Axle Load Survey

VDF as adopted during pavement design and VDF as per current Axle Load Survey data conducted in Year 2018 at Toll Plaza 1 (TP1 VDF) and Toll Plaza 2 (TP2 VDF) are presented as below:





f) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from Year 2019 to Year 2041

Homogenous Section	Location	Cumulative MSA	
		Farakka to Raiganj	Raiganj to Farakka
TP 1	Km 297+500	793	170.54
TP 2	Km 351+440	454.13	174.01

1.12 Major Maintenance

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K.

The above proposal is vetted by IE and consented for execution. As per Concession Agreement, Overlay is to be carried out based on the performance of the Pavement and end of Concession Period. MM Cycles for balance concession period is to be planned as follows:

Proposed MM Cycle for balance Concession Period

i) Main Carriageway

S.N.	Year	Treatment Proposed	
		LHS	RHS
1	2022/23	Major Maintenance is in progress	Major Maintenance is in progress
2	2029/30	BC Overlay – 2 % DBM + BC – 94 % DBM + Micro – 4 %	BC Overlay – 57 % DBM + BC – 17 % DBM + Micro – 26 %

S.N.	Year	Treatment Proposed	
		LHS	RHS
3	2036/37	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length
4	2040/41	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length

ii) Service Road:
   a) Year 2023 – overlay work in progress
   b) Year 2030 – 30 mm BC on 100 %
   c) Year 2037 – 30 mm BC on 100 %
   d) Year 2041 – 30 mm BC on 100 %

iii) Structure Major Maintenance
   a) Replacement of Wearing Coat with every MM Cycle

1.13 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period (21 years). O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. TMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per current NHAI Policy, all toll lanes shall have compulsory Fast Tags at all lanes and payment to be collected through ETC system only Client is expecting revenue from overloading therefore no saving in manpower is expected due to implementation of Hybrid ETC System at toll plaza.

As per AECOM calculation average yearly O & M Cost is Rs. 21.79 crore per year. Year wise cost summary is appended in next page.

Sl.No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	16,250,761
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accomodation etc.	51,831,057
3	Security Services	Includes manpower associated with security services.	13,716,789
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	30,142,015
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and street lights.	13,457,766
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	15,626,112
7	HTMS related Expenses	AMCs for HTMS and repalcement of requipment	33,567,825
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	4,325,045
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	4,610,455
10	Professional Fee	Includes secretarila expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	9,674,601
11	Community Development	Includes CSR related expenses.	3,036,314
12	Communication Expenses	Includes phone charges.	603,750
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	19,539,545
15	IE Fees	Includes IE fees.	3,951,818
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	27,559,320
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	6,189,044
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furnitures, repair of kerbs, kerbs painiting, sign borads repair, drain repair, shoulder repair, Raod Marking repair, replacement of Safety Barriers	3,221,746
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expension joint replacement, grouting, RE wall repair	350,613
		O & M Cost (2022)	257,983,894
		O & M Cost (2022) in Crores	25.80

1.14 Major Maintenance Cost

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

S.N.	Year	Cost with Escalation and GST
1	2022/23	128.15 Crore
2	2029	162.44 Crore
3	2036	152.99 Crore
4	2041	150.09 Crore

1.15 List of Document Reviewed

Documents uploaded till 17 Dec 2019 has reviewed during preparation of this DD report. The followings documents were reviewed during study:

Sn	List of Document	Status	Remarks
1	Concession Agreement – all Vols.	AVAILABLE	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	AVAILABLE	
3	Detail Highway Inventory and Condition Survey Report	NOT AVAILABLE	
4	Detail Structure Inventory and Condition Survey Report	NOT AVAILABLE	
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	NOT AVAILABLE	
6	Balance Work List with BOQ if any	AVAILABLE	31/10/2019
7	Past Technical DD Report	AVAILABLE	Jul-18
8	Change of Scope Documents	AVAILABLE	
9	Provisional COD Letter along with Punch List	AVAILABLE	PUNCH LIST AVAILABLE
10	Final COD Letter with Exclusion List if any	NOT AVAILABLE	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	AVAILABLE	
12	NCR Status	NOT AVAILABLE	
13	Operation and Maintenance Manual, Yearly Maintenance Program	MANUAL AVAILABLE	
14	Current Operation and Maintenance Arrangement / Strategy	NOT AVAILABLE	

Sn	List of Document	Status	Remarks
15	Detail of TMS and ATMS / HTMS installed at site	NOT AVAILABLE	
16	Pavement Design Report	AVAILABLE	
17	Historical Major Maintenance and Strategy	AVAILABLE	FY-16-17 Contract and FY- 17-18 Program
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	AVAILABLE	FWD, NSV, Pavement Test
19	As Built Drawing	AVAILABLE	
20	MPR during Construction Stage (only last three months)	AVAILABLE	MAR-APRIL-19
21	MPR of Independent Engineer during Maintenance stage	AVAILABLE	NOV, DEC-17 JAN, FEB,JULY,AUG -18 MARCH,APRIL-19
22	MPR Lender Report	NOT AVAILABLE	
23	Monthly Inspection Report during O and M	AVAILABLE	
24	Historical O&M and MM Cost and forecast	NOT AVAILABLE	
25	Traffic Data (Actual till now and projection till end of Concession Period)	AVAILABLE	
26	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	NOT AVAILABLE	
27	Other Documents		

2 Pavement Evaluation and Future Maintenance Requirements

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.2 Pavement Design

As per the Concession Agreement Clause 2.1 and Schedule-B the minimum pavement composition for the main carriageway will be followed as:

Pavement Composition	Thickness (mm)
BC	50
DBM	125
WMM	250
GSB	200

However, the basis of above arriving thickness is not mentioned.

During construction of road, project road has been divided into three homogeneous sections, and pavement design has been carried out based on design MSA of respective homogeneous sections. Pavement design was carried out for 10 years for an 8% Subgrade CBR. Summary of Report is presented as below:

Section	Section -I (Km 295 – Km 325)	Section -I (Km 325 – Km 353)	Section -I (Km 353 – Km 398)

Pavement Layer	Thickness in mm	Thickness in mm	Thickness in mm
Design MSA	65	55	45
BC	45	45	45
DBM	125	120	110
WMM	250	250	250
GSB	200	200	200
CBR	500	500	500

However, the proposed design has not been approved by IE / NHAI during construction (as per IE Letter 1843/2012/104 dated 08.06.2012) on the basis of consideration of old traffic volume data (Sep 2010) for pavement design.

Vehicle Type	VDF Adopted	
	Location -Km 323+000	Location -Km 357+000
LCV	0.9	0.67
2 Axle Truck	3.69	4.54
Bus	0.96	0.79
3 Axle Truck	5.96	11.07
MAV	7.94	6.49

2.3 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.3.1 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey has carried out to determine the riding quality of the existing pavement in whole Project length except those locations where balance work is pending. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer by M/s V R Techniche Consultants Private Limited in the month of Mar 2022.

Based on the Roughness value, project road was classified into following three categories:

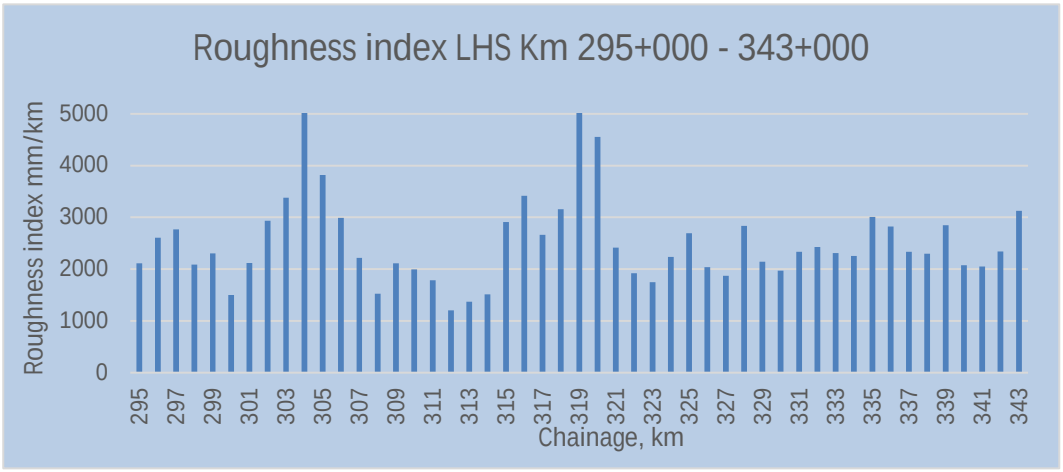
Ratings	Roughness Value (mm/km)
Good	<2500
Fair	2500 - 3000
Poor	>3000

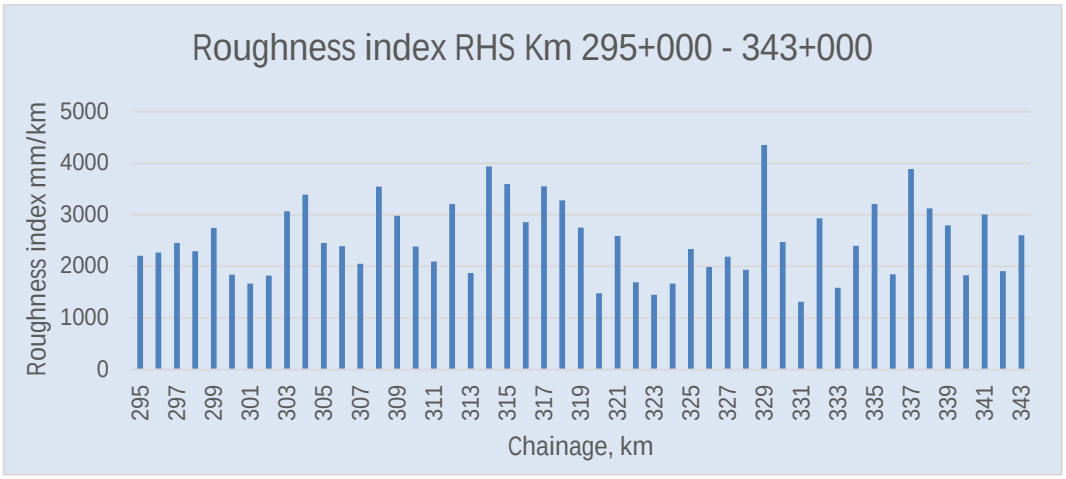
The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:

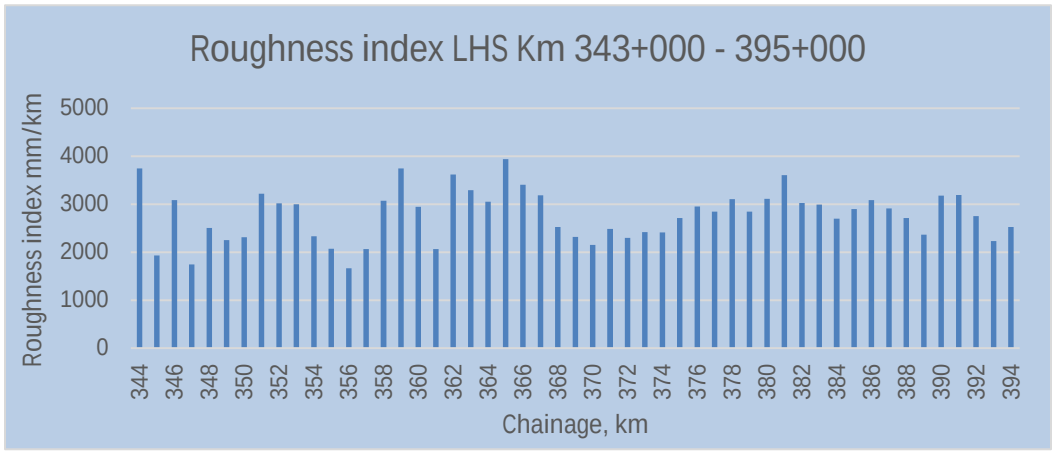
Summary of Roughness Index

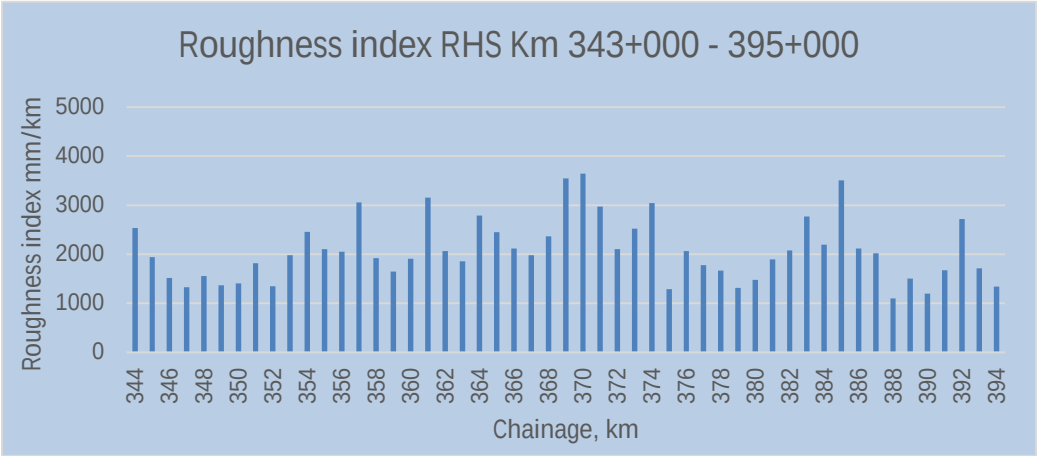
Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		Length - km	
		LHS	RHS
Good	< 2500	47	67
Fair	2500 - 3000	25	14
Poor	>3000	28	19

Source: M/s V R Techniche Consultants Private Limited, Mar 2022









2.3.2 Test Pit

Sample have been taken from 21 location and following are the results: -

S.N.	Location (Km.)	Side (LHS/RHS)	4-Days Soaked CBR (%)	Field Dry Density (gm/cc)
1	299+050	LHS	9.5	1.78
2	301+900	RHS	8.2	1.74
3	310+000	LHS	7.0	1.78
4	315+200	RHS	8.1	1.76
5	321+000	LHS	8.7	1.79
6	332+000	LHS	11.8	1.85
7	335+300	RHS	12.1	1.82
8	340+000	LHS	6.3	1.70
9	345+100	RHS	6.1	1.79
10	350+000	LHS	7.7	1.71
11	353+000(SR)	LHS	6.3	1.70
12	355+000	RHS	8.8	1.75
13	360+600	LHS	8.4	1.75
14	365+000	RHS	7.8	1.78
15	370+000	LHS	8.8	1.76
16	375+000	RHS	5.2	1.72
17	380+000	LHS	10.8	1.70
18	380+600(SR)	RHS	11.6	1.78
19	384+700	RHS	9.0	1.78
20	389+300	LHS	8.3	1.74
21	395+000	RHS	8.5	1.74

CBR is in the range of 6.1 to 12.1

2.3.3 Core Test

17 out 30 samples were tested for its gradation and binder content. Two of these samples are slightly finer side & three are slightly coarser to the MoRTH gradation. Bitumen Content is range of 4.25 to 5.22.

S.N.	Chainage	Side	Height of Core	Remark
1	300+000	RHS	160	Debonding of layer
2	303+080	LHS	180	
3	306+800	LHS	35	
4	310+000	RHS	280	Debonding of layer
5	315+000	RHS	110	Debonding of layer
6	320+000	LHS	125	
7	320+050	LHS	180	Top Down Cracking + Debonding of layer
8	324+500	RHS	75	
9	331+400	RHS	120	
10	335+300	LHS	170	
11	340+000	RHS	170	
12	344+800	LHS	165	Top Down Cracking
13	344+850	LHS	160	
14	348+500	RHS	200	Debonding of layer
15	351+900	LHS	70	
16	352+650	LHS	135	Debonding of layer
17	352+850	RHS	130	
18	355+050	LHS	135	Debonding of layer
19	360+000	RHS	130	Top Down Cracking
20	364+800	LHS	90	Top Down Cracking
21	370+000	LHS	270	
22	374+950	LHS	190	Debonding of layer
23	379+900	RHS	150	Top Down Cracking
24	380+050	LHS	160	Top Down Cracking
25	380+100	RHS	140	Debonding of layer
26	380+700	LHS	85	
27	380+900	RHS	80	
28	385+000	LHS	120	
29	389+900	RHS	190	
30	394+900	LHS	0	Fully Broken

2.3.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD for entire Project road. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented below and the detail data and calculations as provided by the Concessionaire.

SN	Chainage		LHS	RHS
	FROM	TO	REMAINING LIFE	
1	295+000	296+000	5.52	32.82
2	296+000	297+000	2.94	19.64
3	297+000	298+000	20.76	23.04
4	298+000	299+000	10.92	10.72
5	299+000	300+000	6.90	8.15
6	300+000	301+000	5.83	13.41
7	301+000	302+000	24.21	26.91
8	302+000	303+000	26.24	19.54
9	303+000	304+000	47.91	21.99
10	304+000	305+000	26.70	51.60
11	305+000	306+000	3.83	11.46
12	306+000	307+000	7.99	16.50
13	307+000	308+000		
14	308+000	309+000		
15	309+000	310+000		
16	310+000	311+000		
17	311+000	312+000		
18	312+000	313+000		
19	313+000	314+000		
20	314+000	315+000		
21	315+000	316+000	8.68	4.68
22	316+000	317+000	1.44	7.75
23	317+000	318+000	4.69	7.09
24	318+000	319+000	4.66	7.24
25	319+000	320+000	3.93	31.40
26	320+000	321+000	4.12	37.86
27	321+000	322+000	5.27	20.77
28	322+000	323+000	21.01	19.11
29	323+000	324+000	4.95	10.41
30	324+000	325+000	7.51	6.84
31	325+000	326+000		
32	326+000	327+000		
33	327+000	328+000		
34	328+000	329+000		
35	329+000	330+000	2.34	
36	330+000	331+000	4.08	
37	331+000	332+000	1.94	8.43
38	332+000	333+000	5.17	7.22
39	333+000	334+000	5.56	10.30
40	334+000	335+000	4.19	18.21
41	335+000	336+000	4.99	7.28
42	336+000	337+000	7.13	7.77
43	337+000	338+000	8.14	26.96

44	338+000	339+000	5.01	41.31
45	339+000	340+000	10.41	7.81
46	340+000	341+000	26.49	52.53
47	341+000	342+000	12.97	74.09
48	342+000	343+000	11.09	26.94
49	343+000	344+000	17.86	10.38
50	344+000	345+000	1.86	13.32
51	345+000	346+000	26.95	32.14
52	346+000	347+000	15.94	3.81
53	347+000	348+000	40.44	14.39
54	348+000	349+000	11.22	14.75
55	349+000	350+000	136.14	13.53
56	350+000	351+000	20.16	6.61
57	351+000	352+000	7.44	152.32
58	352+000	353+000	2.17	5.54
59	353+000	354+000		22.67
60	354+000	355+000	4.92	5.70
61	355+000	356+000	12.38	3.96
62	356+000	357+000	74.23	4.75
63	357+000	358+000	13.82	4.94
64	358+000	359+000	1.35	7.21
65	359+000	360+000	0.88	3.11
66	360+000	361+000	1.04	1.39
67	361+000	362+000	15.00	1.52
68	362+000	363+000	4.34	19.61
69	363+000	364+000	2.68	28.98
70	364+000	365+000	3.23	4.27
71	365+000	366+000	3.42	29.46
72	366+000	367+000	1.71	11.85
73	367+000	368+000	2.59	4.41
74	368+000	369+000	9.95	4.52
75	369+000	370+000	4.13	13.22
76	370+000	371+000	13.10	1.89
77	371+000	372+000	3.51	4.11
78	372+000	373+000	8.42	1.69
79	373+000	374+000	6.20	2.94
80	374+000	375+000	14.09	0.69
81	375+000	376+000	7.81	2.51
82	376+000	377+000	0.87	21.19
83	377+000	378+000	3.99	2.30
84	378+000	379+000	2.47	3.19
85	379+000	380+000	2.53	7.37
86	380+000	381+000	2.30	1.90
87	381+000	382+000	4.17	3.92
88	382+000	383+000	5.39	5.86
89	383+000	384+000	1.32	10.93

90	384+000	385+000	4.52	0.98
91	385+000	386+000	1.98	3.36
92	386+000	387+000	3.55	1.91
93	387+000	388+000	1.11	6.57
94	388+000	389+000	2.19	18.82
95	389+000	390+000	5.82	10.03
96	390+000	391+000	7.34	4.65
97	391+000	392+000	1.94	3.76
98	392+000	393+000	1.56	2.73
99	393+000	394+000	3.33	1.60
100	394+000	395+000	3.27	2.34

2.3.5 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

Axle Load Survey was conducted in the Month July 2018 and analysis has been provided. Comparison between VDF based on traffic survey conducted in July 2018 and VDF adopted during Pavement Design is given below:

VDF Comparison

Axle Load @ 297+500 TP1				
Vehicle Type	VDF Adopted for Pavement Design	As per Cube Survey		
		LHS	RHS	Adopted VDF
Bus	0.9	0.84	1.04	1.04
LCV	3.69	0.88	0.98	0.98
2A Truck	0.96	3.26	1.71	3.26
3A Truck	5.96	7.45	3.92	7.45
MAV	7.94	20.97	3.86	20.97
Axle Load @ 351+440 TP2				
Vehicle Type	VDF Adopted for Pavement Design	As per Cube Survey		
		LHS	RHS	Adopted VDF
Bus	0.79	0.93	1.20	1.20
LCV	0.67	0.87	1.56	1.56
2A Truck	4.54	2.05	1.71	2.05
3A Truck	11.07	5.61	3.96	5.61
MAV	6.49	16.26	5.46	16.26

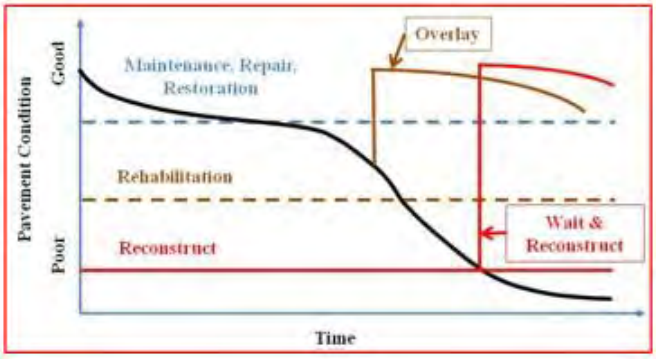
2.3.6 Homogeneous Section and Design MSA

As per current traffic pattern, two homogeneous sections considered for calculation Design MSA. However, during pavement design four homogeneous section was considered. MSA has calculated based on traffic data provided for balance Concession period and VDF as calculated above for balance Concession period. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided is tabled below.

Homogenous Section	Location		As per Pavement Design	As per Current Survey
	From	To		
HS 1	295+000	322+000	278 MSA	793.3 MSA LHS, 170.54 MSA RHS
HS 2	322+000	395+000	244 MSA	454.13 MSA LHS, 174.01 MSA RHS

2.4 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K. Concessionaire has conducted detail pavement investigation.

First MMR cycle has been done on the basis of point wise FWD analysis, data was obtained from the client. Detail analysis to calculate requirement of Overlay is provided in soft copy along with this report. Summary of MM is as below:

i) Main Carriageway

S.N.	Year	Treatment Proposed	
		LHS	RHS
1	2022/23	Overlay work is in progress	Overlay work is in progress
2	2029/30	BC Overlay – 2 % DBM + BC – 94 % DBM + Micro – 4 %	BC Overlay – 57 % DBM + BC – 17 % DBM + Micro – 26 %
3	2036/37	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length
4	2040/41	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length

ii) Service Road

a) Year 2023 – MM under progress
b) Year 2030 – 30 mm BC on 100 %
c) Year 2037 – 30 mm BC on 100 %
d) Year 2041 – 30 mm BC on 100 %

iii) Structure Major Maintenance

Replacement of Wearing Coat at every MM Cycle

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, construction of highway on the site set forth in Schedule A and as specified in Schedule B, together with provision of Project Facilities as specified in Schedule C, and in conformity with the Specifications and Standards set forth in Schedule-D. Project road has completed in compliance to Concession Agreement and there is no balance work to be considered in CAPEX. In general CAPEX is considered for following works:

1. Balance work as per Original scope of work – Not applicable
2. Immediate rehabilitation of existing pavement – Not applicable
3. Replacement of defective Equipment at Toll Plaza, software and ECB – Not Applicable
4. Penalty for due to Failure of rectification of defects and deficiency during O & M Period

3.1 Initial Repair & Rehabilitation Work

Based on our site investigation, the following repair and rehabilitation work is considered essentially to be carried out immediately therefore it is considered under CAPEX.

Sl. No.	Description of Work	Unit	Quantity	Unit Rate	Amount
	NOT APPLICABLE				

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

i) Main Carriageway

S.N.	Year	Treatment Proposed	
		LHS	RHS
1	2022/23	Work in Progress	Work in Progress
2	2029/30	BC Overlay – 2 % DBM + BC – 94 % DBM + Micro – 4 %	BC Overlay – 57 % DBM + BC – 17 % DBM + Micro – 26 %
3	2036/37	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length
4	2040/41	30 mm BC Overlay along entire length	30 mm BC Overlay along entire length

ii) Service Road
   a) Year 2023 – MM under progress
   b) Year 2030 – 30 mm BC on 100 %
   c) Year 2037 – 30 mm BC on 100 %
   d) Year 2041 – 30 mm BC on 100 %

iii) Structure Major Maintenance
   a) Replacement of Wearing Coat with milling in Year 2023, 2030, 2037 & 2041.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provided by the Client as follows applicable for 2021/22:

Bitumen Price @ 1st March 2022	IOC Haldia		
Bitumen	Base Price	Discount	Ex MI price
VG10	36660	2650	34010
VG30	37460	2650	34810
VG40	38850	2650	36200

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

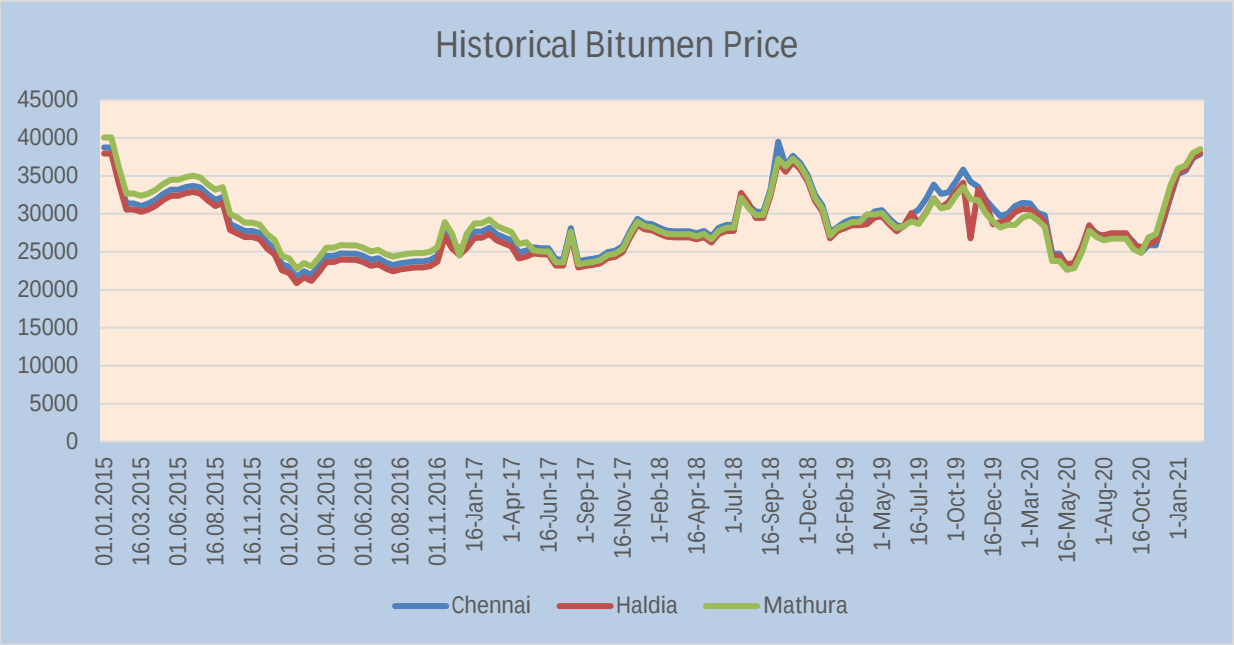
viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on FY 2022.

xii) The historical bitumen price from year 2015 to Jan 21 is present in below graph.



xiii) Client forecast Bitumen for upcoming year as follows:

a) FY 2024 onwards till end of Concession Period, Bitumen Price is considered same rate as below:

VG 40 – 32,409, VG 30 – 28,929 Rs / MT

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been

range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

FY	Growth Rate	Escalation Factor
FY 22	2.83%	1.000
FY 23	4.66%	1.047
FY 24	5.65%	1.106
FY 25	5.37%	1.165
FY 26	5.52%	1.229
FY 27	5.25%	1.294
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948
FY 38	3.98%	2.026
FY 39	4.00%	2.107
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate for FY 24 onwards considering above assumptions

Sn	Items Description	Unit	Rate (Rs) for FY 24 onwards
1	Dense Bituminous Macadam	Cum	8,235
2	Bituminous Concrete	Cum	9313
3	Microsurfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	cum	280
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1,647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimates each cycle wise is presented in next page.
Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)

Sl. No.	Activity	Unit	Unit Rate 2022	Unit Rate 2022 for 2025 onwards	Treatment Cycle 1 Qty	Treatment Cycle 2 Qty	Treatment Cycle 3 Qty	Treatment Cycle 4 Qty	Treatment Cycle 1 Amount	Treatment Cycle 2 Amount	Treatment Cycle 3 Amount	Treatment Cycle 4 Amount
					FY 22 / FY 23	FY 30	FY 37	FY 41	FY 23	FY 30	FY 37	FY 41
A	**Main Carriageway - Flexible Pavement**											
1	Tack Coat	Sqm	13	13	1,507,395	2,363,244	1,975,708	1,975,708	19,942,834	31,265,714	26,138,617	26,138,617
2	Bituminous Concrete with VG-40 Bitumen	Cum	13,945	10,589	52,469	54,146	59,271	59,271	731,692,275	573,381,809	627,652,217	627,652,217
3	Dense Bituminous Macadam (VG-40) with RAP	Cum	9,209	9,338	27,921	37,118	-		257,121,702	346,618,433	-	-
4	Milling of existing BC	Sqm	77	77	305,785	118,162.18	98,785		23,545,445	9,098,488	7,606,476	-
5	Raising of Road Kerb	m	439	439		17,100	188,931		-	7,506,900	82,940,753	-
6	Painting of Road Kerb	sqm	121	121	84,050	45,029	45,029	45,029	10,170,050	5,448,458	5,448,458	5,448,458
7	Miscrosurafacing	sqm	176	176	173,250	283,129	-		30,492,000	49,830,748	-	-
									-	-	-	-
B	**Structure(Including FO,ROB,VUP,PUP,CUP and Bridges)**								-	-	-	-
1	Tack Coat	Sqm	13	13		43,355	43,355	43,355	-	573,588	573,588	573,588
2	Bituminous Concrete with VG-40 Bitumen (30 mm)	Cum	13,945	10,589		1,301	1,301	1,301	-	13,773,261	13,773,261	13,773,261
3	Milling of existing 30mm BC	Sqm	77	77		43,355	43,355	43,355	-	3,338,345	3,338,345	3,338,345
4	Painting of Crash Barrier	sqm	121	121		15,400	15,400	15,400	-	1,863,434	1,863,434	1,863,434
C	**Toll Plaza and Truck Laybye - Rigid**								-	-	-	-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	132	132		26,200	26,200		-	3,458,400	3,458,400	-
D	**Service Road**								-	-	-	-
1	Tack Coat	Sqm	13	13		48,983	48,983	48,983	-	648,040	648,040	648,040
2	Functional Overlay using VG-30	Cum	13399	10,043		1,469	1,469	1,469	-	14,758,129	14,758,129	14,758,129
3	Miscrosurfacing	sqm	176	176					-	-	-	-
									-	-	-	-
E	**Other Works**								-	-	-	-
1	Replacement of Road Studs								-	-	-	-
	Road Studs	Nos	220	220	6,000	6,000	6,000	6,000	1,320,000	1,320,000	1,320,000	1,320,000
	Solar Studs	Nos	1,647	1,647					-	-	-	-
									-	-	-	-
2	Road Marking	Sqm	439	439	77,111	77,111	77,111	77,111	33,851,663	33,851,663	33,851,663	33,851,663
3	Maintenance of Earthen Shoulder	cum	307	307	5,337	5,337	5,337	5,337	1,638,459	1,638,459	1,638,459	1,638,459
									-			
F	**Material**								-			
1	Bitumen PMB40	MT	66,870						-			
2	Bitumen HiMA	MT	78,633						-			
3	Emulsion RS-1	MT	37,883						-			
H												
I	**Contingency - 2 % above amount**									-	-	-
A	**Major Maintenance Cost excl. GST (INR)**								1,109,774,428	1,098,373,870	825,009,841	731,004,212
B	**GST (12% of A)**								133,172,931	131,804,864	99,001,181	87,720,505
	Major Maintenance Cost incl. GST (INR)								1,242,947,359	1,230,178,734	924,011,022	818,724,718
	Escalation Factor								1.047	1.477	1.948	2.278
	Esclated Amount keping Bitumen Component w/o Escalation								1,281,507,162	1,624,409,109	1,529,869,868	1,500,933,456

5 OPERATION AND MAINTENANCE COST

5.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 17 – Operation & Maintenance & Schedule – K Maintenance Requirements of Concession Agreement. The O&M obligation of Concessionaire as per clause 17.1.1 is as follows.

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)
6. Major Maintenance (Functional Overlay and Strengthening Layer)

5.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2018, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	NSV Survey
3	Roughness Value (IRI), Rutting	NSV Survey
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	ATMS (ECB)	As per manufacturer's / supplier's recommendation
10	TMS	As per manufacturer's / supplier's recommendation

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each item.

5.3 Requirement of CA (Schedule K and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-K (the "Maintenance Requirements").

5.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine and preventive maintenance covers maintenance of following assets:

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder

- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 20,557 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 23,287 / km / month excluding GST

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light will be operated for 10 hours a day round the year
b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 10.2 Rs / Kwh.

The calculated electricity cost for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	Km	15.39	137,216	2,111,753
2	Highway Lighting Electricity Charge	Kwh	831,937	11.17524827	9,297,105
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos	17	3,293	55,984
5	Office Building	LS	24	71,352	1,712,455
	Total				13,457,766

5.6 TMS Cost and ATMS

Following consideration has made during calculation of O & M cost for TMS and ATMS:

a) AMC cost towards TMS is considered 1.5 lakh per lane per year
b) 70 % of equipment shall be replaced in every 7-year interval with the system as adopted as per Concession Agreement.
c) However, NHAI has decided to implement 100 % HYBRID ETC lane at all toll lanes, it is expected increase in AMC (considered 12 % of Total Equipment Cost) and replacement of equipment in every five year as per NHAI Policy and accordingly same has considered.

Average O & M Cost as per AECOM calculation is 1.56 crore per year and additional cost of 3.35 crore for replacement of equipment at every 6 years.

5.7 Corridor Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT
b) Traffic Aid Post with 2 nos of route patrol vehicle
c) 2 nos of Ambulance

O & M Cost estimated towards incident management with operation manpower is **Rs. 3.01 crore** per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1. Management, Administration / HR and Supervision Staff: in-house manpower
2. Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as **Rs. 7.96** core per year

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 4.09 crore** per year. Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021										-
2	2022	9,761,404	27,559,320	13,457,766	49,193,937	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	257,983,894
3	2023	12,252,719	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	226,907,384
4	2024	15,167,781	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	229,822,447
5	2025	17,296,427	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	231,951,093
6	2026	18,905,049	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	233,559,714
7	2027	20,437,853	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	235,092,519
8	2028	21,971,919	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	236,626,585
9	2029	9,761,404	27,559,320	13,457,766	49,193,937	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	257,983,894
10	2030	12,252,719	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	226,907,384
11	2031	15,167,781	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	229,822,447
12	2032	17,296,427	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	231,951,093
13	2033	18,905,049	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	233,559,714
14	2034	20,437,853	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	235,092,519
15	2035	21,971,919	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	236,626,585
16	2036	9,761,404	27,559,320	13,457,766	49,193,937	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	257,983,894
17	2037	12,252,719	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	226,907,384
18	2038	15,167,781	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	229,822,447
19	2039	17,296,427	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	231,951,093
20	2040	18,905,049	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	233,559,714
21	2041	20,437,853	27,559,320	13,457,766	15,626,112	30,142,015	1,778,318	79,625,001	4,610,455	41,855,680	235,092,519
	Total	325,407,540	551,186,391	269,155,311	413,225,716	602,840,305	35,566,360	1,592,500,015	92,209,091	837,113,592	4,719,204,323
Total Cost in		32.54	55.12	26.92	41.32	60.28	3.56	159.25	9.22	83.71	471.92

6 PROJECT ROAD ANALYSIS

6.1 Reconnaissance Survey

This project road is a section of NH 34 (New NH-12) which originated from Dalkhola in Uttar Dinajpur in the state of West Bengal and extends up to Bakkhali in South 24 Parganas in the state of West Bengal. Project road starts from Km 295+000 at Farakka and ends at Km 398+000 at Raiganj in the state of Uttar Pradesh. The total length of the project road is 103 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of December 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretch and length is given as below:

Detail of Project Stretch

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Four Laning of Farakka – Raiganj Section of NH – 34 on DBFOT Toll Basis in the State of West Bengal	295+000	398+000	103	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and cross road details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

End Point of Project Road at Km 395+000	Start Point of Project Road at Km 295+000

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 295+000 at Farakka	Km 295+200 at Farakka	
2	Project Road End	Km 398+000 at Raiganj	Km 395+000 at Raiganj	
3	Project Length	103 km	100 km	
6	Carriageway	4 lane highway with paved width 8.75 m on either side and 11.5 m paved at approach of Underpass, Flyover and ROB	4 lane highway with paved width 8.75 m on either side and 11.5 m paved at approach of Underpass, Flyover and ROB	
7	Shoulders	1.0 m earthen shoulder for main carriageway	1.0 m earthen shoulder for main carriageway	
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	
9	Service Roads	8.24 Km	8.62 Km	
10	Major Bridge	8 Nos.	7 Nos.	Farakka Barrage Negative COS
11	Minor Bridge	21 Nos.	22 Nos.	
12	Pipe, Box & Slab Culverts	89 Nos	80 Nos	
13	Major/Minor Junctions	12 Major Junction	12 Major Junction	
14	Underpass	3 Nos	11 Nos	
15	Grade Separator	1 No.	1 No.	
15	ROB/RUB	1 No.	3 No.	
16	Toll Plazas	2 Nos.	2 Nos.	
17	Truck Lay-byes/Truck Parking	1 Nos.	12 Nos	
18	Bus bays/Bus Stops	5 Nos	27 Nos	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section</td><td>Typical Section of Urban Road</td></tr>
<tr><td> </td><td>
</td></tr>
<tr><td>Typical Section at Structure</td><td>Toll Plaza</td></tr>
</table>

Six type of TCS has been proposed in Schedule-B of CA and same has adhered along project road.

6.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at Toll Plaza where Rigid Pavement has been provided. Pavement condition is generally Fair to Poor throughout the project corridor.

6.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

Comparison of Service Road Location between Schedule B and as per Site

	As per Schedule B					As Per Site				
Sn	Location		Side	Length (km)	Width (m)	Location		Side	Length (km)	Width (m)
	From	To				From	To			
1	325+600	326+150	Both	1.10	5.5	304+100	305+700	LHS	1.60	4.0
2	351+800	353+000	Both	2.40	5.5	304+100	305+700	RHS	1.60	4.0
3	380+400	381+200	Both	1.60	5.5	325+800	326+160	LHS	0.36	5.5
						325+800	326+160	RHS	0.36	5.5
						334+600	335+200	RHS	0.36	7.5
						334+600	335+200	LHS	0.60	5.5
						351+800	353+000	LHS	1.20	5.5
						351+800	353+000	RHS	1.20	7.5
						380+550	381+100	LHS	0.55	5.5
						380+550	381+100	RHS	0.55	5.5
			Total	5.10				Total	8.62	

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

New Jersey Crash Barrier Median

4.5m wide Median with Shrubs

34 nos. of authorized and 30 nos of unauthorized median openings are found along project road. Most of median openings are having storage lane and blinkers. List of authorized median openings is tabled below:

Sn	Location	Blinker	Length (m)	Storage Lanes	Remarks
1	295+750	1	30	NO	
2	297+050	0	30	NO	
3	298+950	0	30	BHS	
4	300+600	2	20	BHS	
5	302+900	0	25	BHS	
6	304+150	0	20	NO	
7	305+800	0	30	NO	
8	316+600	0	20	BHS	
9	320+600	0	40	BHS	
10	323+900	0	20	BHS	
11	324+420	0	30	BHS	
12	327+900	0	20	BHS	
13	328+000	0	30	BHS	
14	329+700	0	20	BHS	
15	330+300	0	30	BHS	
16	331+700	0	40	NO	MALDA BYPASS
17	333+700	2	20	BHS	25 m RL
18	337+850	0	20	BHS	
19	340+600	0	30	BHS	
20	346+250	0	30	BHS	
21	348+350	2	30	NO	
22	353+750	2	30	BHS	1 NF
23	357+600	0	20	BHS	
24	362+400	2	30	NO	2 NF
25	365+000	0	20	BHS	
26	368+800	0	30	BHS	
27	372+550	0	30	BHS	
28	375+000	0	30	BHS	
29	378+500	0	30	BHS	
30	381+050	2	30	NO	2 NF
31	382+700	0	30	BHS	
32	384+900	1	30	BHS	
33	390+050	1	30	BHS	
34	392+950	0	30	BHS	

Median Opening without Solar Blinker	Medain Opening with Solar Blinker

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Location and type of drain as provided is presented below:

Location of RCC Drain

Sn	Chainage		Side	Length (m)
	From	To		
1	351+150	352+975	LHS	1825
2	351+150	352+975	RHS	1825
3	334+600	335+200	RHS	600
4	334+600	335+200	LHS	600
5	380+400	381+100	LHS	700
6	380+400	381+100	RHS	700
7	325+800	326+160	LHS	360
8	325+800	326+160	RHS	360

Location of Median Cut Drain

Sn	Chainage		Length (m)	Spacing (m)	Remarks
	From	To			
1	392+300	392+500	200	5	
2	382+200	382+500	300	5	
3	375+200	375+400	200	5	
4	384+650	385+050	400	5	
5	363+450	363+650	200	5	
6	380+600	380+800	200	5	
7	358+950	359+200	250	5	

Sn	Chainage		Length (m)	Spacing (m)	Remarks
	From	To			
8	390+500	390+600	100	5	
9	319+600	320+200	600	5	
10	316+700	317+000	300	5	
11	317+400	317+500	100	5	
12	317+900	318+100	200	5	
13	295+950	296+700	750	5	
14	301+300	301+700	400	5	
15	347+600	347+900	300	5	
16	347+680	347+950	270	5	
17	338+900	339+100	200	5	
18	332+400	332+600	200	5	
19	319+400	319+600	200	5	
20	320+500	321+200	700	5	
21	330+100	330+200	100	5	Malda Bypass
22	329+400	329+600	200	5	Malda Bypass
23	329+050	329+200	150	5	Malda Bypass
24	321+500	327+050	5550	5	Malda Bypass
25	338+950	339+550	600	5	
26	333+800	333+900	100	5	
27	331+600	331+800	200	5	
28	320+800	320+900	100	5	
29	319+850	320+050	200	5	
30	319+550	319+790	240	5	
31	317+700	318+300	600	5	
32	317+400	317+500	100	5	
33	316+700	316+880	180	5	
34	301+320	301+700	380	5	
35	295+850	296+850	1000	5	
36	295+250	295+650	400	5	
37	390+500	390+700	200	5	
38	363+500	363+750	250	5	
39	382+200	382+700	500	5	

Median Drain at Project Road

Median Cut Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 8 major and 159 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	13	8
Minor Junctions	209	159

Major Junction

Minor junction

Details of Major Junctions along the project are presented in the table below.

Details of Major Junctions

Sn	Chainage	Type of Junction	LHS		RHS	
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type
1	300+560	X	5.5	BT	5.5	BT
2	320+500	T			5.5	BT
3	348+400	T	5.5	BT		
4	353+750	X	7.0	BT	7.0	BT
5	362+400	T			7.5	BT
6	372+550	X	7.0	BT	7.0	BT
7	381+050	X	7.0	BT	7.0	BT
8	390+050	X	7.0	BT	7.0	BT

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.
Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Length (km)
Metal Beam	36.705
Pedestrian Guard Rail	3.67
RCC Crash Barrier	1.66

Metal beam and RCC crash Barrier present on the project road

6.2.8 Toll Plaza and Other Facilities

As per Schedule-C, two toll plazas are proposed at following locations –

1. Km 297+867
2. Km 351+440

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

Toll Plaza 2

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at flyover (interchange) as per Schedule C. Additionally, High Mast has provided at Toll Plaza, major junction, ROBs and flyover confirming Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

S N	CHAINAGE		LENGTH	SIDE	Nos	TYPE
	FROM	TO				
1	353+200	353+600	400.0	MEDIAN	9	DOUBLE ARM
2	360+000	360+400	400.0	MEDIAN	4	DOUBLE ARM
					4	SINGLE ARM
3	362+250	362+450	200.0	MEDIAN	6	DOUBLE ARM
4	365+200	365+600	400.0	MEDIAN	9	DOUBLE ARM
5	372+400	372+600	200.0	MEDIAN	6	DOUBLE ARM
6	375+750	375+950	200.0	MEDIAN	4	DOUBLE ARM
					3	SINGLE ARM
7	381+100	381+400	300.0	MEDIAN	8	DOUBLE ARM
8	380+300	380+900	600.0	MEDIAN	20	DOUBLE ARM
				SR (LHS/RHS)	14	SINGLE ARM
9	389+950	390+150	200.0	MEDIAN	6	DOUBLE ARM

S N	CHAINAGE		LENGTH	SIDE	Nos	TYPE
	FROM	TO				
10	350+500	353+100	2600.0	MEDIAN	55	DOUBLE ARM
11	350+500	353+100	2600.0	SR (LHS/RHS)	80	SINGLE ARM
12	336+900	337+200	300.0	MEDIAN	9	DOUBLE ARM
13	334+650	335+300	650.0	SR (LHS/RHS)	40	SINGLE ARM
14	334+400	334+500	100.0	MEDIAN	2	DOUBLE ARM
15	332+600	332+900	300.0	MEDIAN	10	DOUBLE ARM
16	331+750	331+850	100.0	MEDIAN	3	DOUBLE ARM
17	331+250	331+400	150.0	MEDIAN	4	DOUBLE ARM
18	328+650	328+840	190.0	MEDIAN	5	SINGLE ARM
19	325+800	326+150	350.0	MEDIAN	9	DOUBLE ARM
20	324+800	325+200	400.0	MEDIAN	26	SINGLE ARM
21	321+400	321+550	150.0	MEDIAN	5	DOUBLE ARM
22	320+400	320+650	250.0	MEDIAN	6	DOUBLE ARM
23	316+150	316+300	150.0	MEDIAN	5	DOUBLE ARM
24	302+350	302+700	350.0	MEDIAN	4	DOUBLE ARM
					11	SINGLE ARM
25	297+000	298+500	1500.0	MEDIAN	27	DOUBLE ARM
26	295+300	295+700	400.0	MEDIAN	6	DOUBLE ARM
27	385+425	385+775	350.0	MEDIAN	6	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM
27	367+125	367+475	350.0	MEDIAN	5	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM
28	356+125	356+475	350.0	MEDIAN	6	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM
29	319+925	320+275	350.0	MEDIAN	6	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM
30	303+425	303+775	350.0	MEDIAN	6	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM
31	298+425	298+775	350.0	MEDIAN	1	DOUBLE ARM
				EDGE(LHS/RHS)	26	SINGLE ARM

High Mast Location

S.N.	Chainage	Side	Nos	Flexure	Location
1	297+800	LHS	2	16	Toll
2	297+900	RHS	2	16	Toll
3	300+600	LHS	1	16	Junction
4	305+100	RHS	1	16	Buildup
5	305+300	LHS	1	16	Buildup
6	305+500	RHS	1	16	Buildup

S.N.	Chainage	Side	Nos	Flexure	Location
7	305+800	LHS	1	16	Buildup
8	317+500	RHS	1	8	Junction
9	320+500	RHS	1	16	Junction
10	348+400	RHS	1	16	Junction
11	351+450	BHS	2	16	Toll
12	351+550	BHS	2	16	Toll
13	372+550	RHS	1	16	Junction
14	379+600	RHS	1	8	Junction
15	381+050	RHS	1	16	Junction
16	390+050	RHS	1	16	Junction
17	391+100	LHS	1	8	Junction

High Mast Light at Project Highway

Highway Lighting at Project Highway

As per requirement of Schedule C, highway lighting is to be provided at approach of Grade Separated Structure, underpasses, toll plaza and its approaches, rest areas and bus stops.

6.2.10 Bus Bays and Bus Shelter

There are 27 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter Along Project Road

The details of Bus Bays and bus shelters are provided in the table below:

S N	Chainage	Side	Type	Surface	Condition
1	394+600	RHS	Bus Bay with Shelter	BT	Good
2	394+600	LHS	Bus Bay with Shelter	BT	Good
3	391+000	RHS	Bus Bay with Shelter	BT	Good
4	372+250	RHS	Bus Bay with Shelter	BT	Good
5	365+800	LHS	Bus Bay with Shelter	BT	Good
6	365+800	RHS	Bus Bay with Shelter	BT	Good
7	362+650	RHS	Bus Bay with Shelter	BT	Good
8	358+100	LHS	Bus Bay with Shelter	BT	Good
9	358+100	RHS	Bus Bay with Shelter	BT	Good
10	353+900	RHS	Bus Bay with Shelter	BT	Good
11	351+900	RHS	Bus Bay with Shelter	BT	Good
12	353+580	LHS	Bus Bay with Shelter	BT	Good
13	357+100	LHS	Bus Bay with Shelter	BT	Good
14	362+200	LHS	Bus Bay with Shelter	BT	Good
15	372+220	LHS	Bus Bay with Shelter	BT	Good
16	380+400	LHS	Bus Bay with Shelter	BT	Good
17	348+450	RHS	Bus Bay with Shelter	BT	Good
18	346+500	RHS	Bus Bay with Shelter	BT	Good
19	340+650	RHS	Bus Bay with Shelter	BT	Good
20	332+550	RHS	Bus Bay with Shelter	BT	Good
21	300+350	RHS	Bus Bay with Shelter	BT	Good
22	295+800	RHS	Bus Bay with Shelter	BT	Good
23	295+500	LHS	Bus Bay with Shelter	BT	Good
24	300+400	LHS	Bus Bay with Shelter	BT	Good
25	340+400	LHS	Bus Bay with Shelter	BT	Good
26	346+160	LHS	Bus Bay with Shelter	BT	Good
27	348+200	LHS	Bus Bay with Shelter	BT	Good

6.2.11 Truck Lay Byes

Twelve numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. N	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	298+600	BHS	NA	AVAILABLE	AVAILABLE
2	303+600	BHS	NA	AVAILABLE	AVAILABLE
3	320+100	BHS	NA	ONLY ON RHS	AVAILABLE
4	356+300	BHS	NA	AVAILABLE	AVAILABLE
5	367+300	BHS	NA	AVAILABLE	AVAILABLE
6	385+600	BHS	NA	AVAILABLE	AVAILABLE

Toilet Block and Truck Laybye

6.2.12 Signage and Marking

Road Signs

661 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Place Identification Board on the Project Road

Sign Board fixed at Project Road

Summary of different sign board found along the project road is presented below:

Signage	Nos
Chevron	108
Keep Left	3
Merging Traffic	3
Curve Ahead	22
School Zone	21
Go Slow	1
Route Marker	0
No Overtaking	7
No Wrong Way	2
Speed Limit	5
Truck Lay Bay	8
Give Way	21
Hump Ahead	6
Petrol Pump	7
Accident Prone Area (WARNING)	3
Place Identification	0
Reassurance Sign	13

Signage	Nos
Advance Direction	17
Direction	76
Cantilever Gantry	21
Toll Plaza Sign Board	38
Overhead Gantry	13
ECB	0
Median Opening	38
Pedestrian Crossing	49
T/Y Junction	85
Bus Stop	18
No Parking	1
X/+ - Junction	8
Stop	25
Hazard Marker	23
Clearance	0
Helpline/ Emergency	16
Restaurant/ Eatery	3
Warning sign	0

Road Marking

Road Marking along the project corridor was found to be in Poor condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road Marking along the Project Road

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good to fair in both type of median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road | Plantation at 4.5 m Median

6.3 Toll Plaza and Associated Facilities

Toll Plaza and Associated Facilities

Concession Agreement Provision: As per Annexure-I of Schedule-C; maximum number of two toll plazas are proposed at below mentioned locations.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.
The locations of two Toll Plaza are as mentioned below: -

1. Toll Plaza TP1 at km.297.867
2. Toll Plaza TP2 at km.351.440

6.3.1 Toll Plaza TP1@ 297.351 km and TP2@ 351.440 km

Concessionaire Agreement Provision: The design and provisions for both Toll Plazas shall be as per "Manual of Specifications and Standards for DBOT Road Projects IRC: SP:84-2009 published by IRC as mentioned in Schedule-D."

Site Observations:

1. During the site visit, it was observed that there are two Toll Plazas located at Km 297+867 and at km 351+440 having 6 LHS+6 RHS lanes.
2. All the lanes are under Hybrid mode.
3. The Toll Plaza is equipped with the Administrative Building having all the provisions as mentioned in Concessionaire Agreement.
4. There is one reversible lane in each direction of travel in both Toll Plazas as mentioned in Clause 10.4.12 of Manual of Specifications and Standards for DBFOT Road Projects IRC: SP:84:2009 published by IRC.
5. There are 14 WIMs (7 LHS+7 RHS) and 2 SWB (1 LHS+1 RHS) as per clause 10.4.11 of Manual of Specifications and Standards for Four DBOT Road Projects IRC: SP:84-2009 published by IRC. All the WIMs and SWBs are in operational mode.
6. There is an underground tunnel for the movement of toll collectors between the toll office and toll lanes and its dimensions are sufficient to accommodate the required wiring/cabling system.
7. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc. are as per the provisions of Concessionaire Agreement.

Facilities available at Toll Plaza TP1 @297.351 km and TP2@351.440 km

The available facilities at existing Toll Plaza along with condition are presented in Table below:

Parameter	As per Manual of Specifications and Standards for DBOT Road Projects IRC: SP: 84: 2009 published by IRC.	Current Status
Hybrid ETC System	Hybrid ETC System should be installed in all the lanes.	All the lanes are under Hybrid ETC System.
AVC (Automatic Vehicle Classifier) System	Should be installed in each and every lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as	All such basic equipments are required to be installed and functional in all the lanes.	Installed and working in all the lanes.

Parameter	As per Manual of Specifications and Standards for DBOT Road Projects IRC: SP: 84: 2009 published by IRC.	Current Status
Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.		
Preventions for overloading	WIM should be installed in each and every lane. Static Weigh Bridge should be installed in each direction of travel.	All WIMs installed are installed and operational in all the lanes. One SWB each installed and operational in each direction of travel.
Availability of Tunnel	For movement of staff between Toll office and toll booth of each toll lane. Its dimension would be sufficient to accommodate the required wiring/cable system.	Underground tunnel is available and fulfills all the requirements.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Available with all basic requirements.
Reversible Lanes	At least two middle toll lanes shall be capable of being used as reversible lane to meet the demand of tidal flow.	There is one reversible lane in each direction of travel.

Highway Traffic Management System (HTMS):

Concessionaire Agreement Provision: - As per Schedule-C; Page No. 200 of Concessionaire Agreement, Concessionaire must maintain HTMS in the entire stretch.

HTMS Control Room: It is located at Toll Plaza at Chainage 351 where all the following required systems are placed in Control and Server Room: -

a) Switch
b) Server
c) Network Printer
d) Workstation for VMS, MDS, ATCC, ECB
e) LCD for CCTV
f) NVR

CCTV surveillance

Current Status:

- Out of total proposed 10 nos., 9 nos. are installed and in working mode.
- 36X Zoom
- 360-degree continuous pan & 220-degree tilt.
- Weatherproof IP66 rated.

VMS (Variable Message Sign)

Current Status:

a) Altogether 4 nos. VMS (2 nos. in each Toll Plaza; 500 m before & 500m after each Toll Plaza) are installed and all of them are in working condition.
b) VMS is installed for the display of important information related to traffic/road condition/weather conditions/ visibility etc.
c) Viewing Distance: 300m
d) Amber color display.
e) Minimum vertical clearance: 5.5 m from highest road surface
f) Different messages can be flashed in different VMS at a time.

ECB (Emergency Call Box)

Current Status:

a) GSM based ECBs are installed after every 2 kms in the entire stretch.
b) Out of the total proposed 49 ECBs, only 40 ECB are installed and all of them are in faulty mode.
c) Weatherproof box to house equipment.
d) Missed call alert feature is configured.
e) Time out cut off circuit: 3 minutes

Metrological Data System (MDS)

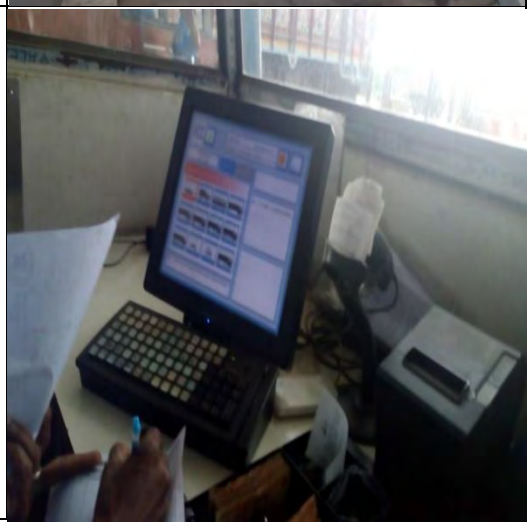
a) This system is placed at Toll Plaza at chainage 351.
b) It was found to be working satisfactorily.
c) It can detect the weather conditions such as air & surface temperature, wind speed and direction, humidity and visibility.
d) Report generation at the interval of 15 minutes.
e) As per the requirement the information can be flashed at VMS.

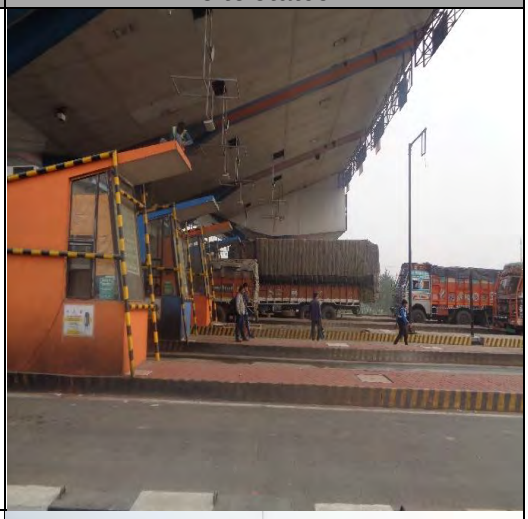
Automatic Traffic Classifier and Counter (ATCC)
Current Status: -

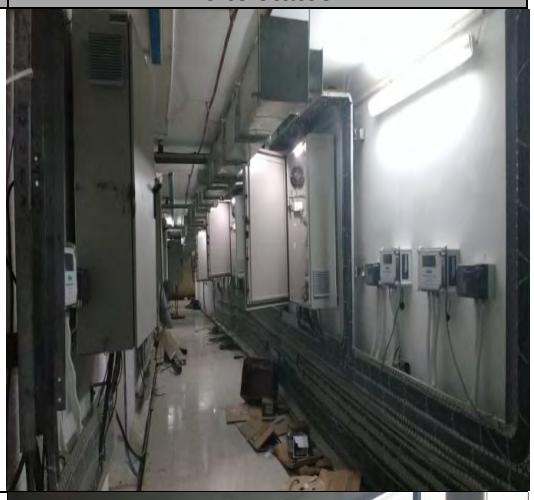
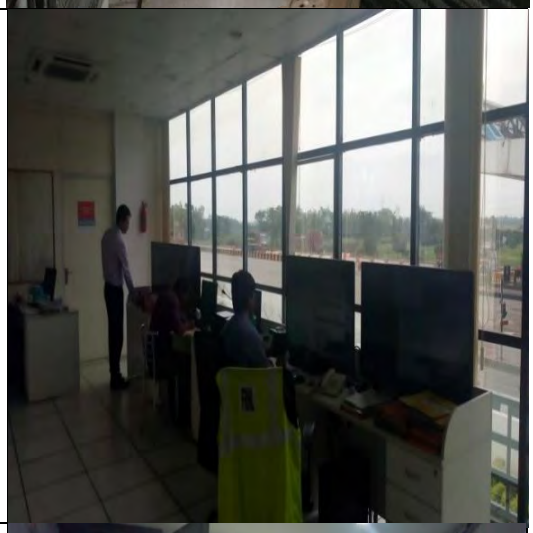
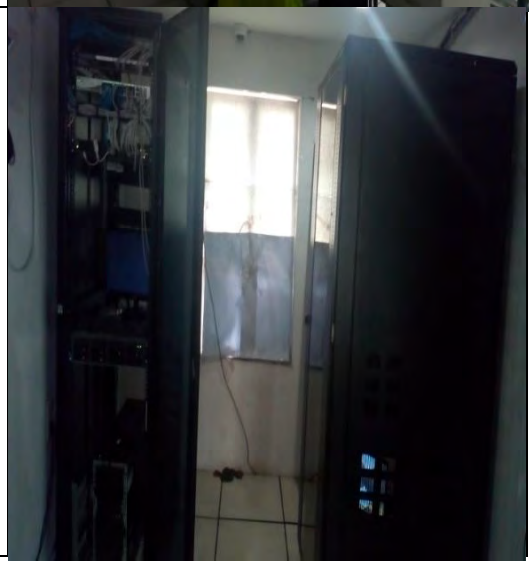
a) Location: One in each Toll Plaza
b) Both ATCC in working mode.
c) Loops installed on the road & instrument is placed on the median of the road with proper enclosure.

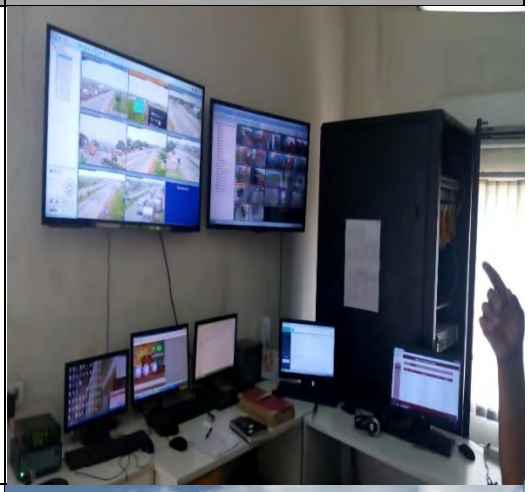
d) The data can be seen put plugging the laptop with the instrument or could be seen on the ATCC workstation placed in the HTMS Control Room.
e) It is directly connected through UPS. Hence no need of Solar panels.

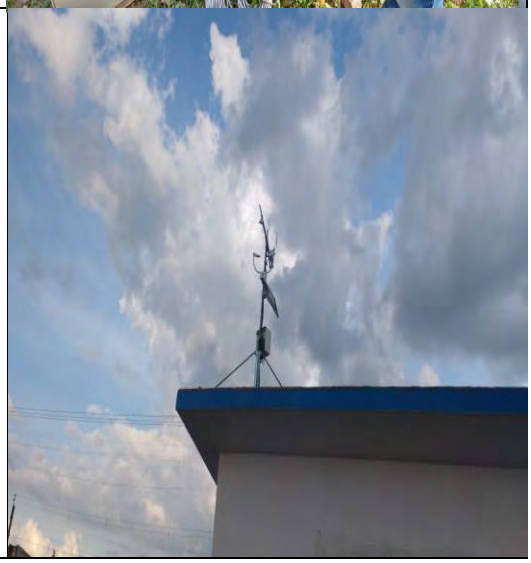
Pictorial representation for present site conditions:

S. No.	Description	Site Status
1.	Both Toll Plazas has 6 LHS+ 6 RHS lanes. All the lanes are in Hybrid mode.	
2.	Toll booths are equipped with all the required systems/equipments.	

S. No.	Description	Site Status
3.	All the required equipments are placed outside the toll booth.	
4.	WIMs are installed and operational in 7 LHS +7 RHS lanes which includes 1LHS and 1 RHS in reversible lanes.	
5.	SWB are installed and operational in each direction of travel in both Toll Plazas.	

S. No.	Description	Site Status
6.	Underground tunnel is available for movement of staff between toll office and toll lanes. Its dimension is sufficient to accommodate the required wiring/cabling.	
7.	Toll Management System (TMS) was installed by METRO in Dec 2019 and even day to day operations as well as AMC is also taken care by METRO.	
8.	TMS Server Room is equipped with all the required servers and switches.	

S. No.	Description	Site Status
9.	HTMS Control Room is located at Toll Plaza at chainage km 351.440.	
10.	9 nos. PTZ cameras are installed and operational in the entire stretch out of the total proposed 10. 4 nos. VMS (two in each Toll plazas are installed and operational).	
11.	40 nos. ECBs are installed out of the total proposed 49. All of them are in faulty mode.	

S. No.	Description	Site Status
12.	Total 2 nos. ATCC (one each in each Toll Plaza) are installed and operational	
13.	One no. MDS is installed and operational in Toll Plaza located at chainage km 351.440.	

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation

- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 7 no of Major Bridge having total length varies from 64 m to 428 m are generally found in good condition.
- 22 nos. of Minor bridges having total length varies from 6.1 m to 60 m are generally found in good condition.
- 4 nos. of Vehicular Underpass having span arrangement of 1 x 12 m, 1 x 5.5 m and 2 x 11 m are found in good condition.
- 1 no. of Railway over Bridge having span arrangement of 5 x 40 m are found in good condition.
- 80 (pipe/slab/box) nos. of culverts found at site

6.4.2 Detailed Description of Structures

1. Major bridge

Salient features of the 07 Major bridges are discussed here and detailed condition summary of Major Bridge is presented:

a. Major bridge – CH. 302+385

It consists of Major Bridge on both the carriageways. It has span arrangement of 1x20+1x50+2x40+1x50 m on LHS & 14 x 8.2 m on RHS. The super structure comprises of PSC Girder on LHS and RCC Solid Slab on RHS. Foundation is Not Visible on LHS & RHS. POT-PTFE bearings are adopted on LHS for resting of superstructure on RCC wall type abutment and pier. Tar paper bearings are adopted on RHS for resting of superstructure on RCC wall type abutment and pier.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS

View of RHS

Major Bridge at Ch. 302+385

b. Major bridge – CH. 316+155

It consists of Major Bridge on LHS and RHS. It has span arrangement of (1x7.2+1x(1.75+11)+1x24.5+ 1x(11+1.75)+1 x 7.2)m on LHS & 1 x 20 + 1 x 25 + 1 x 20m on RHS. The super structure comprises of RCC Solid Slab on LHS and PSC & RCC Girder on RHS. Rocker and Roller Bearings on LHS and Elastomeric Bearings on RHS are adopted for resting of superstructure on RCC wall type abutment and pier. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS View of RHS

Major Bridge at Ch. 316+155

c. Major bridge – CH. 325+223

It consists of Major Bridge on both the carriageways. It has span arrangement of 5 x 28 + 6 x 48m on LHS & RHS. The super structure comprises of PSC Girder on both LHS & RHS. Foundation is Well foundation; POT-PTFE bearings are adopted on LHS and RHS for resting of superstructure on RCC wall type abutment & circular pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Span arrangement View of sub structure

Major Bridge at Ch. 325+223

d. Major bridge – CH. 360+132

It consists of Major Bridge on both the carriageways. It has span arrangement of 3x40m on LHS & RHS. The super structure comprises of PSC Girder on both LHS & RHS. POT-PTFE bearings are adopted on LHS for resting of superstructure on RCC wall type abutment & pier and foundation is not visible. Elastomeric bearings are adopted on RHS for resting of superstructure on RCC wall type abutment & pier and foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS

Girder View

Major Bridge at Ch. 360+132

e. Major bridge – CH. 375+885

It consists of Major Bridge on both the carriageways. It has span arrangement of 2x20+2x26m on LHS & RHS. The super structure comprises of RCC and PSC Girders on both LHS & RHS. Foundation is not visible. Elastomeric bearings are adopted on LHS & RHS for resting of superstructure on RCC wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS

View of RHS

Major Bridge at Ch. 375+885

f. Major bridge – CH. 381+330

It consists of Major Bridge on both the carriageways. It has span arrangement of 2 x 20 + 2 x 26m on LHS & 12 X 6.2m on RHS. The super structure comprises of RCC and PSC Girder on LHS & RCC Solid slab on RHS. Foundation is not visible. Elastomeric bearings are adopted on LHS for resting of superstructure on RCC wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS

View of RHS

Major Bridge at Ch. 381+330

g. Major bridge – CH. 390+239

It consists of Major Bridge on both the carriageways. It has span arrangement of 2 x 20 + 2 x 26m on LHS & 12 x 6.4m on RHS. The super structure comprises of RCC and PSC Girder on LHS & RCC Solid Slab on RHS. Foundation is not visible and Elastomeric bearings are adopted on LHS for resting of superstructure on RCC wall type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of LHS

View of RHS

Major Bridge at Ch. 390+239

2. Minor Bridge

Salient features of the 22 Minor bridges are discussed here and detailed condition summary of Minor Bridge is presented :

i. Minor Bridge – CH.296+923

It consists of Slab bridge on LHS and RCC Box on RHS. The Bridge has a span arrangement of 1 x 6.1m on both sides. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is Not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 296+923

ii. Minor Bridge – CH.304+083

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 3 x 5m on LHS & RHS. The super structure comprises of RCC Box.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 304+083

iii. Minor Bridge – CH.304+656

It consists of PSC Girder on LHS and RCC Solid Slab on RHS. The Bridge has a span arrangement of 1 x 30m on LHS and 1 x 6.5+1 x 13+1 x 6.5m on RHS. The super structure comprises PSC Girder on LHS and RCC Solid Slab on RHS. Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment on LHS. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 304+656

iv. Minor Bridge – CH.308+489

It consists of Box on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 2 x 8.1m on LHS and 2 x 7.4m on RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is not visible. No bearings are adopted for resting of Box on LHS and superstructure on Brick Masonry Wall type Abutment & Pier on RHS.

The general condition of the bridge on LHS is good and bridge on RHS is fair. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 308+489

v. Minor Bridge – CH.311+654

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 5m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 311+654

vi. Minor Bridge – CH.315+318

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 4 x 5m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 315+318

vii. Minor Bridge – CH.320+335

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 4 x 5m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 320+335

viii. Minor Bridge – CH.321+681

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 3 x 5.75m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 321+681

ix. Minor Bridge – CH.323+150

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 6 x 5m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 323+150

x. Minor Bridge – CH.329+030

It consists of RCC Girder bridge on LHS and RHS. The Bridge has a span arrangement of 3 x 20m. The super structure comprises of RCC Girder. Foundation is not visible. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & circular Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of Median

Minor Bridge at Ch. 329+030

xi. Minor Bridge – CH.329+966

It consists of RCC Girder bridge on LHS and RHS. The Bridge has a span arrangement of 3 x 20m. The super structure comprises of RCC Girder. Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & circular Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 329+966

xii. Minor Bridge – CH.341+584

It consists of Box bridge on LHS and Slab Bridge on RHS. The Bridge has a span arrangement of 1 x 6.1m on LHS & RHS. The super structure comprises of RCC Box on LHS and RCC Solid Slab on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment on RHS. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 341+584

xiii. Minor Bridge – CH.345+221

It consists of Slab bridge on LHS and Box Bridge on RHS. The Bridge has a span arrangement of 1 x 6.1m on LHS and 2 x 5m on RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 345+221

xiv. Minor Bridge – CH.350+638

It consists of Slab bridge on LHS and Box Bridge on RHS. The Bridge has a span arrangement of 1 x 6.1m on LHS and RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

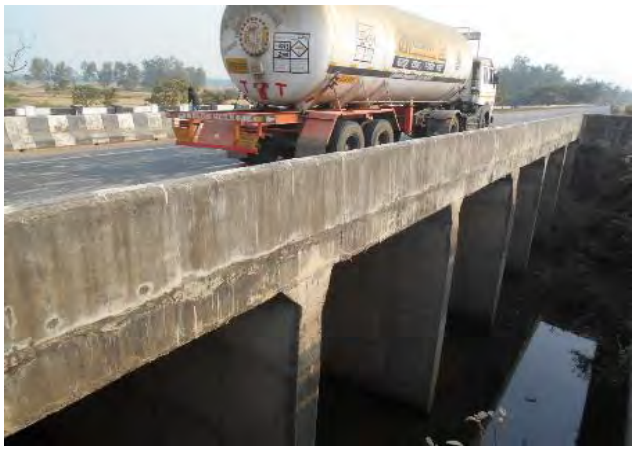
Minor Bridge at Ch. 350+638

xv. Minor Bridge – CH.357+782

It consists of Slab bridge on LHS and Box Bridge on RHS. The Bridge has a span arrangement of 6 x 4.8m on LHS and RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS



View of RHS

Minor Bridge at Ch. 357+782

xvi. Minor Bridge – CH.364+149

It consists of Girder bridge on LHS and RHS. The Bridge has a span arrangement of 3 x 20m. The super structure comprises of RCC girder on LHS and RHS. Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS and RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 364+149

xvii. Minor Bridge – CH.371+740

It consists of Slab bridge on LHS and PSC Girder RHS. The Bridge has a span arrangement of 9 x 5.1m on LHS and 2 x 26m on RHS. The super structure comprises of RCC solid slab on LHS and PSC Girder on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS and Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 371+740

xviii. Minor Bridge – CH.378+149

It consists of RCC Box bridge on LHS and Slab bridge on RHS. The bridge has a span arrangement of 4 x 4.6m on LHS & RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is

not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 378+149

xix. Minor Bridge – CH.379+963

It consists of RCC Box bridge on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 4 x 5m on LHS and RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 379+963

xx. Minor Bridge – CH.383+309

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 4 x 5m. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 383+309

xxi. Minor Bridge – CH.386+075

It consists of RCC Box bridge on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 6 x 5m on LHS and RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 386+075

xxii. Minor Bridge – CH.391+392

It consists of PSC Girder bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 26m on LHS and RHS. The super structure comprises of PSC Girder. Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS and RHS.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of LHS

View of RHS

Minor Bridge at Ch. 391+392

3. Vehicle Underpass (VUP)

There are total of 4 VUPs in the entire project road. VUPs are with vertical clearance of minimum 5.5m. The clear Span arrangement for VUPs at Ch. 326+147 is 1x12m , at Ch.328+541 is 1x5.5m, at Ch.334+847 is 1x12m and at Ch.352+457 is 2x11m.

VUPs are generally in good condition with some minor damages. Detailed condition assessment of VUP is presented .

A few pictures to ascertain the conditions of VUPs are presented as follows:

View of LHS

View of Girder

VUP at Ch. 326+147

View of LHS

View of RHS

VUP at Ch. 328+541

View of LHS

View of RHS

VUP at Ch. 334+847

View of LHS

View of Girder

VUP at Ch. 352+457

4. Railway Over Bridge (ROB)

ROB at Ch. 328+747

It consists of PSC and steel girder bridge on LHS and RHS. The bridge has a span arrangement of 5x40m on LHS and RHS. The super structure comprises of PSC and steel Girder. The Foundation is not visible. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & circular pier on LHS and RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction. Detailed condition summary of ROB's is presented. Few pictures to ascertain the conditions of ROB are presented as follows: -

View of LHS View of Sub-Structure

ROB at Ch. 328+747

5. Culverts

There are 80 numbers of culverts in entire project corridor. Detailed Condition summary of Culverts is presented.
The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection and cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box/Pipe Culverts are presented as follows:

Box Culvert at Ch. 299+740	Box Culvert at Ch. 303+375
Box Culvert at Ch. 307+595	Box Culvert at Ch. 326+500

Box Culvert at Ch. 329+360	Box Culvert at Ch. 342+900
Pipe culvert at Ch. 354+127	Box Culvert at Ch. 370+847
Box Culvert at Ch. 374+734	Box Culvert at Ch.380+366

Box Culvert at Ch. 385+295	Box Culvert at Ch.388+789

Slab /Box /Pipe Culverts

6.4.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash [illegible])	Wearing Coat	Approaches including [illegible]	Drainage Spouts		
Major Bridge	1	302+385	MJB	LHS	1x20+1x50+2x40+1x50	8.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	14x8.2	13.75		●	●	●	-	●	●	●	●	●	●	Stable	
	2	316+155	MJB	LHS	(1x7.2+1x(1.75+11)+1x24.5+ 1x(11+1.75)+1x7.2)	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x20 + 1x25 + 1x20	8.5		●	●	●	●	●	●	●	●	●	●	Stable	
	3	325+223	MJB	LHS	5x28 + 6x48	13.75	Y	●	●	●	●	●	●	●	-	-	●	Stable	LHS Construction work going on
				RHS	5x28 + 6x48	8.5		●	●	●	●	●	●	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
	4	360+132	MJB	LHS	3x40	13.75	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	3x40	8.5		●	●	●	●	●	●	●	●	●	●	Stable	
	5	375+885	MJB	LHS	1x20+1x26+1x26+1x20	14.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x20+1x26+1x26+1x20	14.5		●	●	●	●	●	●	●	●	●	●	Stable	
	6	381+330	MJB	LHS	1x20+1x26+1x26+1x20	8.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	12x6.2	13.75		●	●	●	-	-	●	●	●	●	-	Stable	
	7	390+239	MJB	LHS	1x20+1x26+1x26+1x20	13.75	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	12x6.4	8.4		●	●	●	-	-	●	●	●	●	●	Stable	
Minor Bridge	8	296+923	MNB	LHS	1x6.1	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x6.1	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	9	304+083	MNB	LHS	3x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	10	304+656	MNB	LHS	1x30	25	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1x6.5 + 1x13 + 1x6.5	21	Y	●	●	●	-	-	●	●	●	●	-	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
	11	308+489	MNB	LHS	2x8.1	21	Y	●	●	●	-	-	●	●	-	-	●	Stable	LHS Construction work going on
				RHS	2x7.4	21	Y	●	●	●	-	-	●	●	●	●	●	Not Stable	
	12	311+654	MNB	LHS	2x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2x5	21	Y	●	●	●	-	-	●	●	-	-	●	Stable	RHS Construction work going on
	13	315+318	MNB	LHS	4x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	14	320+335	MNB	LHS	4x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	15	321+681	MNB	LHS	3x5.75	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3x5.75	22.3	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	16	323+150	MNB	LHS	6x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	6x5	21	Y	●	●	●	-	-	●	●	●	●	●	Stable	
			MNB	LHS	3x20	21	Y	●	●	●	●	●	●	●	-	-	●	Stable	LHS Construction

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash [illegible])	Wearing Coat	Approaches including [illegible]	Drainage Spouts		
	17	329+030																	on work going on
				RHS	3x20	21	Y	●	●	●	●	●	●	●	●	●	●	Stable	
	18	329+966	MNB	LHS	3x20	12	Y	●	●	●	●	●	●	●	-	-	●	Stable	LHS Construction work going on
				RHS	3x20	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
	19	341+584	MNB	LHS	1x6.1	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x6.1	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	20	345+221	MNB	LHS	1x6.1	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2x5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	21	350+638	MNB	LHS	1x6.1	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1x6.1	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	22	357+782	MNB	LHS	6x4.8	9.35	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	6x4.8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	23	364+149	MNB	LHS	3x20	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	3x20	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash [illegible])	Wearing Coat	Approaches including [illegible]	Drainage Spouts		
	24	371+740	MNB	LHS	9x5.1	9.4	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	2x26	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
	25	378+149	MNB	LHS	4x4.6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4x4.6	9.4	Y	●	●	●	-	-	●	●	●	●	-	Stable	
	26	379+963	MNB	LHS	4x5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4x5	9.4	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	27	383+309	MNB	LHS	4x5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4x5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	28	386+075	MNB	LHS	6x5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	6x5	9.4	Y	●	●	●	-	-	●	●	●	●	-	Stable	
	29	391+392	MNB	LHS	2x26	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x26	12	Y	●	●	●	●	●	●	●	●	●	●	Stable	
Vehicular	30	326+147	VUP	LHS	1x12	12	-	●	●	●	●	●	●	●	-	-	●	Stable	LHS Construction work going on

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash	Wearing Coat	Approaches including	Drainage Spouts		
				RHS	1x12	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
	31	328+541	VUP		1x5.5	45	-	●	●	●	-	-	●	●	●	-	-	Stable	LHS Construction work going on
	32	334+847	VUP		1x12	25	-	●	●	●	-	-	●	-	-	-	-	Stable	Construction work going on
	33	352+487	VUP	LHS	2x11	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	2x11	12	-	●	●	●	●	●	●	●	●	●	●	Stable	
Railway Over Bridge	34	328+747	ROB	LHS	5x40	12	-	●	●	●	●	●	●	●	-	-	-	Stable	LHS Construction work going on
				RHS	5x40	12	-	●	●	●	●	●	●	●	●	●	●	Stable	

Condition Summary of Culverts based on Visual Observation is presented below:

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
1	297+963	Box	1 x 3.1	●	●		●			●	No	No	√			
2	299+740	Box	1 x 3.1	●	●		●			●	No	No	√			
3	301+945	Box	1 x 2	●	●		●			●	No	No	√			
4	302+813	Box	1 x 4.5	●	●		●			●	No	No	√	√		
5	303+375	Box	1 x 3	●	●		●			●	No	No	√	√		
6	306+954	Box	1 x 2	●	●		●			●	No	No	√	√		
7	307+595	Box	1 x 3.2	●	●		●			●	No	No				
8	308+946	Box	1 x 2	●	●		●			●	No	No	√	√		
9	309+314	Box	1 x 2	●	●		●			●	No	No	√	√		
10	309+914	Box	1 x 2	●	●		●			●	No	No	√	√		
11	310+429	Box	1 x 4.5	●	●		●			●	No	No	√	√		LHS OLD STRUCTURE
12	312+086						●			●	Yes	No	√	√		LHS NO WING WAL
13	313+269	Box	1 x 2	●	●		●			●	Yes	No	√	√		RHS NO PARAPET & NO WING WALL
14	313+860	Box	1 x 3	●	●		●			●	Yes	No	√	√		RHS CHOKED

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
15	316+336	Box	1 x 2	●	●		●			●	No	No	√	√		LHS NO PARAPET
16	317+511	Box	1 x 3	●	●		●			●	No	No	√			
17	326+500	Box	1 x 2	●	●		●			●	No	No				LHS NO PARAPET
18	328+300	Box	1 x 2	●	●		●			●	No	No				
19	329+360	Box	1 x 2	●	●		●			●	No	No				
20	331+100	Box	1 x 2	●	●		●			●	No	No	√			
21	333+582	Box	1 x 2	●	●		●			●	No	No	√			
22	333+837	Box	1 x 2	●	●		●			●	No	No	√	√		
23	334+103	Box	1 x 3	●	●		●			●	Yes	No	√	√		
24	334+544	Box	1 x 2	●	●		●			●	No	No	√	√		
25	334+937	Box	1 x 3	●	●			●		●	No	No	√			
26	335+378	Box	1 x 2	●	●		●			●	No	No	√	√		
27	335+922	Box	1 x 2	●	●		●			●	No	No				
28	336+295	Box	1 x 2	●	●		●			●	No	No				

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
29	337+426	Box	1 x 3	●	●		●			●	No	No	√			
30	338+031	Box	1 x 2	●	●		●			●	No	No	√			
31	338+494	Box	1 x 2	●	●		●			●	No	No	√			
32	339+807	Box	1 x 2.95	●	●		●			●	No	No				
33	340+532	Box	1 x 2	●	●		●			●	Yes	No	√	√		
34	341+337	Box	1 x 3	●	●		●			●	No	No				
35	342+900	Box	1 x 2	●	●		●	●		●	No	No	√			
36	344+025	Box	1 x 4.5	●	●		●			●	No	No				
37	344+989	Box	1 x 2	●	●		●			●	No	No	√			
38	345+675	Box	1 x 2	●	●		●			●	No	No				
39	345+968	Box	1 x 2	●	●		●			●	No	No	√			
40	348+576	Box	1 x 2	●	●		●			●	No	No	√	√		
41	348+776	Box	1 x 2	●	●		●			●	No	No	√			
42	349+254	Box	1 x 2	●	●		●			●	No	No				

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
43	352+992	Box	1 x 2	●	●		●			●	No	No	√			
44	353+836	Box	1 x 2	●	●		●			●	No	No	√	√		
45	354+127	HPC	1 x 0.90 Ø		●	●				●	Yes	No	√	√		
46	354+525	Box	1 x 2	●	●		●			●	No	No	√			
47	355+167	Box	1 x 2	●	●		●			●	No	No	√			
48	355+400	Box	1 x 2	●	●		●			●	No	No	√			
49	355+857	Box	1 x 2	●	●		●			●	No	No	√			
50	356+413	Box	1 x 2	●	●		●			●	No	No	√			
51	356+936	Box	1 x 2	●	●		●			●	No	No	√			
52	357+171	Box	1 x 2	●	●		●			●	No	No				
53	361+067	Box	1 x 3	●	●		●			●	No	No	√			
54	361+886	Box	1 x 3	●	●		●			●	Yes	No	√	√		
55	362+464	Box	1 x 2	●	●		●			●	Yes	No	√	√		
56	362+743	Box	1 x 2	●	●		●			●	Yes	No	√	√		RHS PARAPET TO BE REPAIRED

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
57	363+518	Box	1 x 2	●	●		●			●	No	No	√			RHS WING WALL & PARAPET TO BE REPAIRED
58	366+765	Box	1 x 3	●	●		●			●	No	No	√			
59	369+019	Box	1 x 2	●	●		●			●	No	No				
60	369+452	Box	1 x 2	●	●		●			●	No	No	√			
61	369+876	Box	1 x 2	●	●		●			●	No	No				
62	370+548	Box	1 x 2	●	●		●			●	No	No				RHS WING WALL & PARAPET TO BE REPAIRED
63	370+847	Box	1 x 2	●	●		●			●	No	No				
64	372+415	Box	1 x 2	●	●		●			●	No	No	√			
65	373+398	Box	1 x 2	●	●		●			●	No	No				RHS PARAPET TO BE REPAIRED
66	374+178	Box	1 x 2	●	●		●			●	No	No				
67	374+734	Box	1 x 2	●	●		●			●	No	No	√			
68	375+380	Box	1 x 2	●	●		●			●	No	No	√			
69	377+039	Box	1 x 2	●	●		●			●	No	No	√			RHS PARAPET TO BE REPAIRED

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
70	377+605	Box	1 x 2	●	●		●			●	Yes	No	√	√		
71	378+791	Box	1 x 2	●	●		●			●	No	No	√	√		RHS PARAPET TO BE REPAIRED
72	380+366	Box	1 x 2	●	●		●			●	No	No	√	√		
73	382+258	Box	1 x 2	●	●		●			●	No	No	√			
74	382+750	Box	1 x 2	●	●		●			●	No	No	√	√		
75	383+879	Box	1 x 2	●	●		●			●	No	No	√	√		
76	385+295	Box	1 x 2	●	●		●			●	No	No	√			
77	386+430	Box	1 x 2	●	●		●			●	No	No	√	√		
78	387+603	Box	1 x 2	●	●		●			●	No	No	√			
79	388+789	Box	1 x 2	●	●		●			●	No	No	√	√		
80	392+782			●	●		●			●	Yes	No	√	√		RHS NO PARAPET

TECHNICAL DUE DILIGENCE REPORT

Ghaziabad Aligarh Expressways Private Limited

Report Number:

ACM-60655667-TDD-DR-001-R0

Date:

June, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Ghaziabad Aligarh Expressway Private Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Ghaziabad Aligarh Expressway Private Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Ghaziabad Aligarh Expressway Private Limited

Office no. 102, First Floor,
Sagar Plaza Distt. Cen Laxmi Nagar,
Delhi 110092

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **2**

Project Background 2
Project Salient Features 2
Project Principle Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 7
1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 11
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Pavement Design 14
2.3 Estimation of Design Traffic 14
2.3 Test Pit 15
2.4 Core Test 16
2.5 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 17
2.6 Pavement Condition Survey using Network Survey Vehicle (NSV) 19
2.7 Roughness Survey using Network Survey Vehicle (NSV) 19
2.8 Determination of Pavement Major Maintenance 20
2.9 Base Year Pavement Rehabilitation Requirement 21
2.10 Future Maintenance Requirements 24

3 CAPEX REQUIREMENT **25**

3.1 Methodology 26
3.2 Six Laning Work 26
3.3 Unit Rate Analysis 29
3.4 Six Laning Cost Estimate 30
3.5 Cost for Rehabilitation of Pavement 31

4 MAJOR MAINTENANCE COST **33**

4.1 Major Maintenance Cycle 33
4.2 Major Maintenance Quantity 33
4.3 Unit Rate Analysis 33
4.4 Cost Estimate 35
5.1 O & M Requirement as per CA 40
5.2 O & M Strategy 40
5.3 Routine and Preventive Maintenance 41
5.4 Highway Lighting 41
5.5 ATMS and TMS Cost 42
5.6 Incident Management 42
5.7 Manpower Cost 42
5.8 Office Expenses 42

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **45**

6.1 Reconnaissance Survey 45
6.2 Road Inventory and Condition Survey 45
6.3 Inventory and Condition Survey of Structures 81

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BOT	Built Operate and Transfer
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GAEPL	Ghaziabad Aligarh Expressways Private Limited
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System

MJB	Major Bridge
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Ghaziabad Aligarh Expressway Private Limited ("GAEPL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Due Diligence, CAPEX (6 laning work), OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period.

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Design, Engineering, Construction, Development, Finance, Operation and Maintenance of Ghaziabad to Aligarh Section of NH-91 from KM 23+600 to KM 149+900 (Length 126.30 km) in the State of Uttar Pradesh
Project Length	126.30 Km
Execution Type	Build, Operate and Transfer (BOT)
Name of SPV	Ghaziabad Aligarh Expressway Pvt. Ltd.
Signing of Agreement	20 May 2010
Appointed Date	25 Feb 2011
Schedule Completion Date	22 Aug 2013 (EOT up to 27 July 2017)
PCOD I	103.89 km on 23 Jun 2015
PCOD II	19.41 km on 25 Nov 2016
Balance Length for COD	3 km
Completion Certificate	Yet to obtain for Four Lane
Six Laning to be completed	12th Anniversary from Date of Appointment (24 Feb 2023)
Concession Period	24 years including 910 days of Four Lane Construction
End of Concession Period	24 Feb 2035
EPC Contractor for Six laning	EPC Contractor yet to be determined

Number of Toll Plaza	2 nos having 10 lanes at each Toll Plaza

* - as per information provided by the Client

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Ghaziabad Aligarh Expressway Pvt. Ltd.
3	Independent Engineer	MSV International Inc. In Association with MS Park Futuristic & Associates
4	Maintenance Contractor	
5	EPC Contractor for Schedule B and C (Six Laning)	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

A. Balance Work during Four Laning

The following works which was required to complete during Four Laning but not completed.

S.N.	Description of work	Unit	Quantity
1	Main Carriageway	km	1.66
2	Service Road - 8 m width	km	26.54
3	Slip Road - 7.65 m width	km	0.46
4	RE Wall at Approach of GS Km 34 and VUP Km 62+410	Sqm	9239
5	RCC Drain	km	25.26
6	Bus Bays	Nos	15.00
7	Bus Shelter	Nos	30.00
8	ECB	Nos	126.00
9	Traffic Aid Post	Sqm	50.00
10	Medical Aid Post	Sqm	60.00
11	Vehicle Rescue Post	Sqm	20.00
12	Toll Building	Sqm	1500.00
13	Retaining Wall at Approach of VUP at Aligarh Bypass	km	8.760
14	Widening of Existing Minor Bridge Km 46+805	Nos	1

The estimated cost for above balance work is 186.04 crore without GST.

As per Information provided by the Concessionaire and Cube Highways, the above balance work is due to non-availability of ROW and NHAI is in process of descoping of above balance work. Therefore, above amount is not considered in CAPEX.

B. Capex for Six Laning as per Schedule B and Schedule C

As per Concession Agreement, Six Laning Work is to be completed by 12th Anniversary i.e. by 24 Feb 2021. The following are major work to be carried out during six laning:

1. Widening from Four Lane to Six Lane – 94.695 km
2. Widening from existing 2 Lane + 3 Lane to Six Lane – 1.99 km
   (Existing Aligarh Bypass and existing 6 Lane at approach of Grade Separated Structures to be retained as it is)
3. Widening of Existing Culvert – 30 nos of Box Culvert and 24 nos of Pipe Culvert
4. Widening of Existing Minor Bridges – 6 nos
5. Earthen Drain
6. Slope Protection
7. Retaining Wall in between MCW and existing Service Road – 12.75 km
8. Junction Improvement
9. Road Furniture (Sign board, marking, road studs, Metal Beam Crash Barrier)
10. Widening at Bus Bays – 32 nos
11. Widening of Truck Laybys – 4 nos
12. Construction of Operation and Maintenance Centre
13. ATMS
14. Highway Lightings
15. Addition of two lane at either side of Toll Plaza Km 47.500

Total Cost for Six Laning including BC for entire Six Lane – 636.02 crore including GST

C. Rehabilitation of Existing Pavement

The existing pavement is in poor condition which required immediate rehabilitation. The rehabilitation of work is planned to execute along with six laning work. The following work is required based on site investigation and analysis of test report carried out:

1. 50 mm BC from Km 23.600 to 129.000 (Start of Aligarh Bypass)
2. 40 mm BC in Aligarh Bypass
3. 50 mm DBM with 110 Cold-in-Place Recycling from Km 23.600 to 129.000
4. 50 mm to 85 mm DBM based on FWD result for Aligarh Bypass

The Cost of rehabilitation excluding BC – 231.11 crore including GST. Cost towards BC has considered in Six Laning Cost above.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2021/22	Rehabilitation of Pavement as per current Survey and Investigation	Considered in CapEX

Sr. No	Year	Particular	Estimated Cost in crore
2.	2028/29	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	227.43
3.	2034/35	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	266.81

The above cost of MM is based on Cube Input for rate of bitumen and escalation factor. The bitumen rate is considered flat from 2024 onwards till end of concession period and escalation is applied only for other component of MM works i.e. except bitumen cost.

c) Operation and Maintenance (OpEX)

As per Schedule K, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule K elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2021/22 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	13,084,909
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	45,712,183
3	Security Services	Includes manpower associated with security services.	12,874,954
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	27,648,920
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	36,710,453

Sl. No.	Description	Remarks	Amount (in INR)
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	14,759,400
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	-
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	4,325,045
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	5,927,727
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	8,781,818
11	Community Development	Includes CSR related expenses.	5,488,636
12	Communication Expenses	Includes phone charges.	603,750
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	13,912,290
15	IE Fees	Includes IE fees.	17,124,545
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	32,971,848
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	23,894,967
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	16,611,093
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	2,023,685

Sl. No.	Description	Remarks	Amount (in INR)
		O & M Cost for Year 2021-22	282,785,544

A total of Rs. 28.279 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 22.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 5.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

INTRODUCTION

1.1 Project Background

Project road starts from KM 23.600 (Existing KM 23.600) at Lal Kuan near Ghaziabad Town and ends at KM 149.900 (Existing KM 140.200) at Aligarh is being operated by SPV M/s Ghaziabad Aligarh Expressway Pvt. Ltd. under BOT. (hereinafter referred to as GAEPL or the Concessionaire). M/s Cube Highways and Infrastructure Pte. Ltd. (herein after refer as Cube Highways or the Company) intend to acquire this operational asset and shall undertake Tolling, Operation, Maintenance & Transfer (BOT Model) for balance Concession Period.

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Due Diligence, CAPEX (6 laning work), OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period.

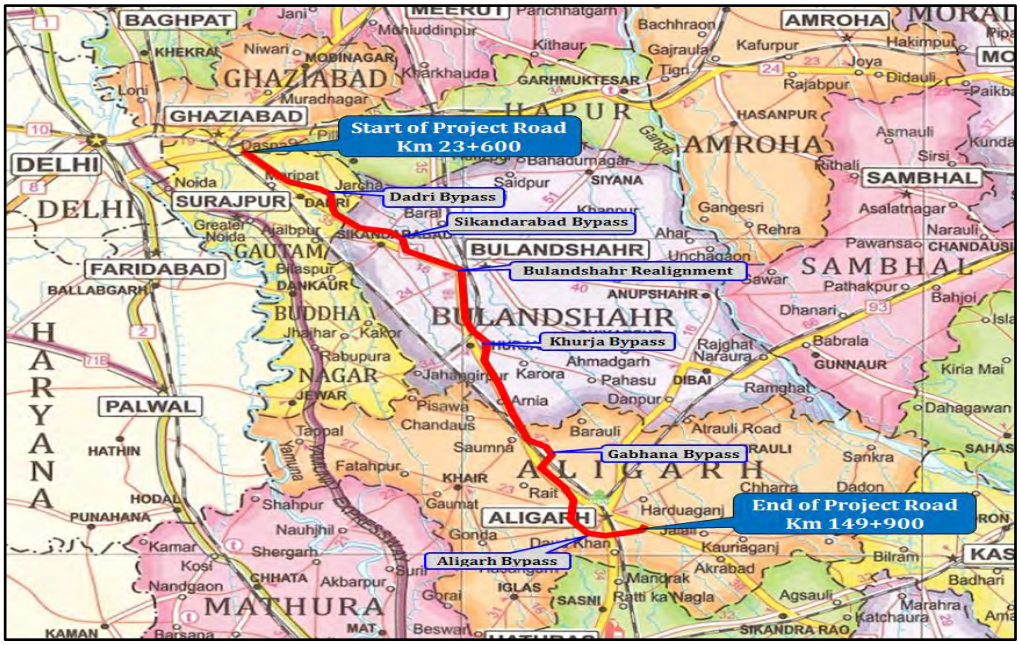
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B and C during six laning work as per Concession Agreement, Pavement Rehabilitation Work, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic Overlay (Major Maintenance) to maintain performance level as per requirement of the project.

Project Corridor

National Highway - No. 91 starts from Delhi and ends at Kanpur. Major cities along NH 91 area Ghaziabad, Dadri, Sikanderabad , Bulandshahr, Khurja, Amiya, Aligarh, Etah, Chhibramau, Kannauj. The project road starts Km 23.600 (Existing KM 23.600) at Lal Kuan near Ghaziabad Town and ends at Km 149.900 (Existing KM 140.200) at Aligarh. The total length of the project road is 126.300.

The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	126.30 km
Carriageway	Four Lane (2 x 8.75), Six lane (2 x 11.5 to 13.5) at Approach of Grade Separated Structure Approach
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1.5 m earthen for MCW
Service Road / Slip Road	As per CA: 55.08 km of 8 m width and 18.00 km of 7.65 m width and as per IE Letter during construction *: 51.38 km of 8 m width, 9.52 km of 3 m width and 18.00 km of 7.65 m width Actual Constructed: 25.13 km of 8 m width, 22.14 km of 3 m width and 15.24 km of 7.65 m width
Major / Minor Junction	14 Nos Major & 111 Nos Minor
RCC Drain	Covered drain between MCW and SR of length of 50.490 Km as per CA and 32.400 Km as constructed
Median Opening	82 Nos
Toll Plaza	2 Nos each plaza having 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	4 Nos

Description	Project Features
Bus Bays with shelter	35 Nos Bus Bay and 43 Nos Bus Shelter
Highway Lighting	45.2 km at median
High Mast	14 nos
Highway Patrol	2 nos
Ambulance	2 nos
Crane	2 nos

b) Structure

Description	Project Features
Major Bridge	Nil
Minor Bridge	18 Nos
ROB	4 Nos
Flyover	6 Nos (1 nos under construction)
VUP	19 Nos (15 found as per Schedule & 4 additional structures) (9 VUPs as per schedule not found on field) (4 nos of VUP deleted under -ve COS) 3 Lane VUP constructed on RHS and 3 Lane construction balance
Culverts	151 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B and C during Six Laning, Immediate Rehabilitation of existing Pavement, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of December 2020. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads

  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any

- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A to D for Four Laning and Six Laning Work
- As Built Drawing
- Pavement Design Report
- IE MPR
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Pavement Design

Concessionaire proposal of stage construction was approved by IE vide letter dated 4 Apr 2011 with note that proposed pavement design confirms IRC SP: 84 -2009. Design parameter and thickness of pavement is summarized as follows:

a. Design Life and Design Traffic

- Total Design Traffic upto end of Concession Period– 110 MSA
- Design traffic for 1st Stage Pavement – 55 MSA which is traffic upto Year 2022 corresponding to compulsory six lane of project date.
- Homogeneous Section - One
- VDF adopted for calculation of design traffic by concessionaire is given below:

Vehicle Type	VDF Adopted
Standard Bus	0.18
LCV	0.18
2A Truck	4.37
3A Truck	7.26
MAV	5.76

b. Subgrade

As per the Pavement Design Note provided to the consultant, it is mentioned that the Subgrade CBR for all the subgrade samples along the project road was found to be more than 6%. Hence the CBR of 6% has been adopted for the design of pavement.

c. Design Thickness

Thickness of pavement as per IRC: 37 – 2001

Section	20 Years Design Traffic	Design CBR	BC	DBM	WMM	GSB
Km 23.6 –37.0	94 MSA	6%	50mm	130mm	250mm	260mm
Km 37.0 –71.0	83 MSA	6%	50mm	125mm	250mm	260mm
Km 71.0– 140.20 including Aligarh Bypass	98 MSA	6%	50 mm	140 mm	250 mm	260 mm

2.3 Estimation of Design Traffic

Based on current traffic pattern, project road is divided into two homogeneous section as follows:

Homogeneous Section	Location		As per Current Traffic Survey	
	From	To	LHS MSA	RHS MSA
HS -1	23.600	84.000	82	73
HS-2	84.000	126.900	42	60

Adopted Design Traffic for Structural Overlay as 82 MSA for HS 1 and 60 MSA for HS 2.

2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S. No	Existing Chainage (km)	Side	4 day soaked CBR in %
1	25+550	RHS	8.6
2	30+000	LHS	8.9
3	35+200	RHS	7.4
4	35+300	RHS	8.5
5	35+400	RHS	9.3
6	40+000	LHS	7.7
7	45+100	RHS	6.7
8	50+100	LHS	9.5
9	52+000	LHS	6.9
10	52+100	LHS	5.8
11	52+200	LHS	6.7
12	56+050	RHS	8.9
13	58+000	RHS	6.9
14	59+550	LHS	7.3
15	59+650	LHS	6.9
16	59+790	LHS	4.7
17	61+350	LHS	8.7
18	62+000	LHS	8.9
19	65+000	RHS	11.4
20	67+000	LHS	8.6
21	70+000	LHS	8.3
22	74+900	RHS	8.7

S. No	Existing Chainage (km)	Side	4 day soaked CBR in %
23	80+420	LHS	9.3
24	82+500	LHS	10.2
25	85+000	RHS	7.8
26	88+250	RHS	8.6
27	90+000	LHS	8.5
28	92+520	RHS	7.9
29	93+000	LHS	9.9
30	95+060	RHS	9.1
31	95+120	RHS	8.2
32	95+300	RHS	8.3
33	95+400	RHS	8.2
34	100+450	LHS	8.8
35	105+000	RHS	7.9
36	108+000	LHS	8.0
37	115+000	RHS	9.5
38	120+000	LHS	8.7
39	125+000	LHS	6.7
40	128+000	RHS	6.3
41	131+000	LHS	11.6
42	135+000	RHS	11.4
43	139+600	LHS	12.3

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from 100 mm to 340 mm and granular layer thickness varies from 280 mm to 520 mm.

2.4 Core Test

Core test was conducted at 21 locations on the existing pavement to measure the actual thickness of existing bituminous layer. Furthermore, the core samples were also taken for laboratory test in order to determine various material properties such as bitumen content, aggregate properties of bituminous layers etc. Thickness of bituminous cores obtained from the core cutting is summarized as below:

Location (Km.)	Side	Lane Position	BT Thickness (mm)
31+200	LHS	IL	170
35+050	RHS	IL	170
35+050	RHS	OL	190
35+200	RHS	IL	210
35+300	RHS	IL	170
35+400	RHS	IL	180
35+500	RHS	IL	190
40+030	LHS	OL	120
43+000	RHS	OL	Pulverized
43+020	LHS	IL	150
49+000	LHS	IL	160
51+800	RHS	IL	180
51+900	LHS	IL	370
52+000	LHS	IL	320
52+100	LHS	IL	400
52+200	LHS	IL	255
52+200	LHS	OL	220
52+300	LHS	IL	300
55+500	LHS	ML	170
57+000	RHS	OL	145
59+200	LHS	IL	160
59+450	LHS	IL	185
59+550	LHS	IL	135
59+650	LHS	IL	180
59+750	LHS	IL	160
59+750	LHS	OL	150
59+970	LHS	IL	160
62+500	RHS	ML	Pulverized
63+200	LHS	OL	215
66+050	RHS	ML	150
66+100	LHS	ML	190
70+500	RHS	IL	Pulverized
71+850	LHS	ML	185

Location (Km.)	Side	Lane Position	BT Thickness (mm)
74+600	LHS	OL	170
77+400	LHS	OL	170
86+200	RHS	IL	170
89+000	RHS	IL	Pulverized
90+500	LHS	OL	205
92+650	RHS	IL	Pulverized
95+030	RHS	OL	210
95+060	RHS	IL	Pulverized
95+120	RHS	IL	Pulverized
95+300	RHS	IL	110
95+400	RHS	IL	Pulverized
95+500	RHS	IL	140
96+800	RHS	OL	235
98+000	LHS	OL	190
99+000	RHS	IL	190
105+000	RHS	IL	180
106+000	LHS	IL	185
108+500	RHS	OL	170
111+800	RHS	IL	135
115+000	LHS	OL	170
116+800	RHS	OL	Pulverized
117+500	LHS	IL	210
120+000	RHS	OL	130
126+900	RHS	IL	215
127+000	LHS	OL	180
133+200	LHS	IL	140
134+000	RHS	IL	165
137+000	LHS	IL	145
138+000	LHS	IL	170
139+000	LHS	IL	120
144+000	RHS	OL	135
147+000	RHS	OL	180
149+500	RHS	IL	170

IL – Inner Lane, ML – Middle Lane and OL – Outer Lane

2.5 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result (KM wise) is presented in table below:

Sn	Chainage		Remaining Life (MSA)	
	From	To	LHS	RHS
	23+600	24+000	11	13
1	24+000	25+000	11	13
2	25+000	26+000	11	13
3	26+000	27+000	60	13
4	27+000	28+000	60	36
5	28+000	29+000	20	36
6	29+000	30+000	20	40
7	30+000	31+000	14	40
8	31+000	32+000	14	40
9	32+000	33+000	14	24
10	33+000	34+000	11	24
11	34+000	35+000	11	24
12	35+000	36+000	5	24
13	36+000	37+000	5	6
14	37+000	38+000	4	6
15	38+000	39+000	4	6
16	39+000	40+000	6	6
17	40+000	41+000	6	4
18	41+000	42+000	5	4
19	42+000	43+000	5	10
20	43+000	44+000	3	10
21	44+000	45+000	3	6
22	45+000	46+000	3	6
23	46+000	47+000	3	4
24	47+000	48+000	3	4
25	48+000	49+000	3	17
26	49+000	50+000	5	17
27	50+000	51+000	5	5
28	51+000	52+000	4	5

Sn	Chainage		Remaining Life (MSA)	
	From	To	LHS	RHS
29	52+000	53+000	4	25
30	53+000	54+000	3	25
31	54+000	55+000	3	3
32	55+000	56+000	9	3
33	56+000	57+000	9	3
34	57+000	58+000	3	3
35	58+000	59+000	3	3
36	59+000	60+000	3	3
37	60+000	61+000	3	9
38	61+000	62+000	3	9
39	62+000	63+000	3	3
40	63+000	64+000	3	3
41	64+000	65+000	3	3
42	65+000	66+000	3	3
43	66+000	67+000	4	3
44	67+000	68+000	5	3
45	68+000	69+000	5	4
46	69+000	70+000	5	4
47	70+000	71+000	5	3
48	71+000	72+000	5	3
49	72+000	73+000	5	3
50	73+000	74+000	4	3
51	74+000	75+000	4	3
52	75+000	76+000	4	3
53	76+000	77+000	4	7
54	77+000	78+000	49	7
55	78+000	79+000	49	7
56	79+000	80+000	7	7
57	80+000	81+000	7	7

Sn	Chainage		Remaining Life (MSA)	
	From	To	LHS	RHS
58	81+000	82+000	4	7
59	82+000	83+000	4	7
60	83+000	84+000	4	7
61	84+000	85+000	4	7
62	85+000	86+000	4	7
63	86+000	87+000	4	9
64	87+000	88+000	4	9
65	88+000	89+000	4	6
66	89+000	90+000	4	6
67	90+000	91+000	5	5
68	91+000	92+000	6	5
69	92+000	93+000	6	7
70	93+000	94+000	6	7
71	94+000	95+000	6	6
72	95+000	96+000	6	6
73	96+000	97+000	6	6
74	97+000	98+000	3	6
75	98+000	99+000	3	3
76	99+000	100+000	3	3
77	100+000	101+000	6	8
78	101+000	102+000	7	8
79	102+000	103+000	7	7
80	103+000	104+000	9	7
81	104+000	105+000	9	17
82	105+000	106+000	6	17
83	106+000	107+000	6	20
84	107+000	108+000	10	20
85	108+000	109+000	10	7
86	109+000	110+000	6	7
87	110+000	111+000	6	6
88	111+000	112+000	5	6
89	112+000	113+000	5	7
90	113+000	114+000	5	7
91	114+000	115+000	5	5
92	115+000	116+000	6	5
93	116+000	117+000	6	5
94	117+000	118+000	10	5
95	118+000	119+000	10	5
96	119+000	120+000	7	5
97	120+000	121+000	7	20
98	121+000	122+000	7	20

Sn	Chainage		Remaining Life (MSA)	
	From	To	LHS	RHS
99	122+000	123+000	7	15
100	123+000	124+000	7	15
101	124+000	125+000	6	37
102	125+000	126+000	6	37
103	126+000	127+000	6	5
104	127+000	128+000	6	5
105	128+000	129+000	7	15
106	129+000	130+000	14	15
107	130+000	131+000	14	11
108	131+000	132+000	14	11
109	132+000	133+000	14	14
110	133+000	134+000	14	14
111	134+000	135+000	17	12
112	135+000	136+000	12	12
113	136+000	137+000	12	4
114	137+000	138+000	27	4
115	138+000	139+000	27	6
116	139+000	140+000	8	6
117	140+000	141+000	8	6
118	141+000	142+000	7	14
119	142+000	143+000	7	22
120	143+000	144+000	9	22
121	144+000	145+000	9	24
122	145+000	146+000	25	24
123	146+000	147+000	25	10
124	147+000	148+000	9	10
125	148+000	149+000	9	10
126	149+000	150+000	12	10

Based on remaining life of pavement, structural overlay is required and same is planned in FY 2021/22.

2.6 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	Cracks	a. Type: Longitudinal, Transverse, Block, Alligator b. Extent: % of Pavement Area Influenced by distress c. Severity: High (> 3mm wide), Low (<3mm wide)
2	Pothole	d. Extent: % of Pavement Area Influenced by distress e. No. of Potholes f. Depth Severity: Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	Raveling	g. Extent: % of Pavement Area Influenced by distress h. Severity: Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	Patching	i. Extent: % of Pavement Area Influence by distress j. Severity: Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	Shoving	k. Extent: % of Pavement Area Influence by distress l. Severity: Low (<15mm), High (>15mm)
6	Flushing/Bleeding	m. Extent: % of Pavement Area Influence by distress n. Severity: Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	Depression	o. Extent: % of Pavement Area Influence by distress p. Severity
8	Delamination	q. Extent: % of Pavement Area Influence by distress r. Severity: Low (<1 sq.m area), High (>1 sq.m area)
9	Edge Break	s. Extent: % of Pavement Area Influence by distress t. Severity: Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	Pavement Missing	u. Extent: % of Pavement Area Missing
11	Rutting	v. Rut Depth

2.7 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser

Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

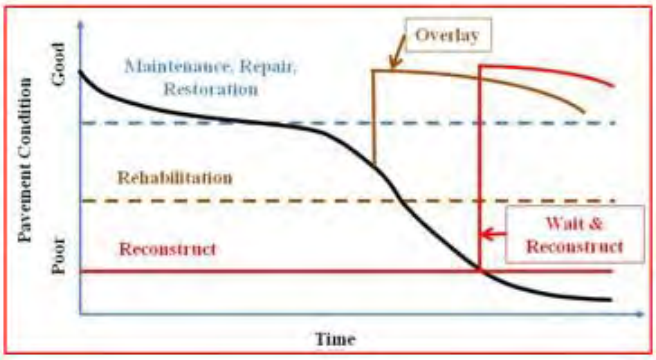
IRI = International Roughness Index

Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

Ratings	Roughness Value (mm/km)	LHS in km	RHS in km
Good	<2000	36	20
Fair	2000 - 3000	63.4	62.4
Poor	>3000	27	44

2.8 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Construction of project road stared in Year 2011 and 80% of project length completed in Year 2015 and 20 % completed in Year 2016. As explained in above chapters, existing pavement condition is poor in substantial length, immediate major maintenance is required. As a thumb rule, major maintenance is required after 5 to 7 years of construction however in this project major maintenance is required before 5 years of construction.

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.9 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, immediate structural overlay is required. The requirement of overlay is calculated for design MSA till end of Concession Period with 82 MSA for HS 1 and 60 MSA for HS 2. In addition of overlay requirement as per FWD Test, it is recommended to carryout CIPR of 110 mm thickness at along distress pavement locations. The Km wise proposed rehabilitation proposal is tabled below:

Location		Remaining Life in MSA		Design Life in MSA		Overlay Requirement		Adopted Overlay in mm		CIPR in mm	
From	To	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
23+600	24+000					20		50	50		
24+000	25+000	60	163	82	82	20		50	50		
25+000	26+000	61	166	82	82	15		50	50		
26+000	27+000		165					50	50		
27+000	28+000		36				40	50	50		
28+000	29+000		13				75	50	100		110
29+000	30+000	15	58	82	82	70	20	100	50	110	
30+000	31+000	16	10	82	82	70	80	100	100	110	110
31+000	32+000	4	9	82	82	110	85	100	100	110	110
32+000	33+000	18	19	82	82	65	60	100	100	110	110
33+000	34+000							50	50		
34+000	35+000	2	2	82	82	130	125	100	100	110	110
35+000	36+000	2	3	82	82	125	115	100	100	110	110
36+000	37+000	1	3	82	82	135	115	100	100	110	110
37+000	38+000	2	3	82	82	130	115	100	100	110	110
38+000	39+000	2	4	82	82	125	105	100	100	110	110
39+000	40+000		4				110	50	100		110
40+000	41+000	2	4	82	82	125	110	100	100	110	110
41+000	42+000	2	2	82	82	125	120	100	100	110	110
42+000	43+000	2	2	82	82	130	115	100	100	110	110
43+000	44+000	6	2	82	82	100	115	100	100	110	110
44+000	45+000	1	2	82	82	130	120	100	100	110	110
45+000	46+000		3				115	50	100		110
46+000	47+000	1	3	82	82	130	115	100	100	110	110
47+000	48+000	17	3	82	82	70	110	100	100	110	110
48+000	49+000	7	4	82	82	90	110	100	100	110	110
49+000	50+000	73	2	82	82	5	125	100	100	110	110
50+000	51+000	10	1	82	82	85	135	100	100	110	110
51+000	52+000	761	1	82	82	0	130	50	100		110
52+000	53+000	770	5	82	82	0	105	50	100		110
53+000	54+000	11	1	82	82	80	135	100	100	110	110
54+000	55+000	10	1	82	82	85	135	100	100	110	110
55+000	56+000	11	1	82	82	85	140	100	100	110	110
56+000	57+000	11	1	82	82	85	140	100	100	110	110
57+000	58+000	11	1	82	82	85	135	100	100	110	110
58+000	59+000	11	1	82	82	85	140	100	100	110	110
59+000	60+000		2				125	50	100		110

Location		Remaining Life in MSA		Design Life in MSA		Overlay Requirement		Adopted Overlay in mm		CIPR in mm	
From	To	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
60+000	61+000	17	2	82	82	70	120	100	100	110	110
61+000	62+000	13	2	82	82	80	125	100	100	110	110
62+000	63+000		2				125	50	100		110
63+000	64+000	18	2	82	82	70	120	100	100	110	110
64+000	65+000	1	2	82	82	145	125	100	100	110	110
65+000	66+000	1	4	82	82	150	105	100	100	110	110
66+000	67+000	1	2	82	82	150	125	100	100	110	110
67+000	68+000	2	2	82	82	130	125	100	100	110	110
68+000	69+000	1	2	82	82	150	120	100	100	110	110
69+000	70+000	0	2	82	82	145	120	100	100	110	110
70+000	71+000	0	2	82	82	150	120	100	100	110	110
71+000	72+000	0	2	82	82	150	120	100	100	110	110
72+000	73+000	1	2	82	82	150	120	100	100	110	110
73+000	74+000	0	2	82	82	145	120	100	100	110	110
74+000	75+000	3	2	82	82	110	120	100	100	110	110
75+000	76+000	19	2	82	82	65	115	100	100	110	110
76+000	77+000	99	2	82	82	0	120	50	100		110
77+000	78+000	7	3	82	82	95	115	100	100	110	110
78+000	79+000	3	2	82	82	110	115	100	100	110	110
79+000	80+000	2	2	82	82	115	120	100	100	110	110
80+000	81+000	3	2	82	82	110	115	100	100	110	110
81+000	82+000	3	2	82	82	110	115	100	100	110	110
82+000	83+000	3	2	82	82	110	115	100	100	110	110
83+000	84+000	3	2	82	82	115	120	100	100	110	110
84+000	85+000	4	3	60	60	100	110	100	100	110	110
85+000	86+000	2	3	60	60	110	105	100	100	110	110
86+000	87+000	2	3	60	60	110	105	100	100	110	110
87+000	88+000	2	3	60	60	110	105	100	100	110	110
88+000	89+000	2	2	60	60	110	105	100	100	110	110
89+000	90+000	2	3	60	60	110	105	100	100	110	110
90+000	91+000		1				125	50	100		110
91+000	92+000	2	1	60	60	110	125	100	100	110	110
92+000	93+000	2	1	60	60	110	125	100	100	110	110
93+000	94+000	2	1	60	60	110	125	100	100	110	110
94+000	95+000	5		60	60	95		100	50	110	
95+000	96+000	3		60	60	105		100	50	110	
96+000	97+000	5		60	60	95		100	50	110	
97+000	98+000	4		60	60	95		100	50	110	
98+000	99+000	25	1	60	60	45	120	50	100		110
99+000	100+000	3	1	60	60	100	120	100	100	110	110
100+000	101+000	3	2	60	60	105	110	100	100	110	110
101+000	102+000	2	4	60	60	115	95	100	100	110	110
102+000	103+000	3	2	60	60	105	115	100	100	110	110
103+000	104+000	2	2	60	60	110	115	100	100	110	110

Location		Remaining Life in MSA		Design Life in MSA		Overlay Requirement		Adopted Overlay in mm		CIPR in mm	
From	To	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
104+000	105+000	4		60	60	100		100	50	110	
105+000	106+000	4	2	60	60	100	110	100	100	110	110
106+000	107+000	3	2	60	60	105	115	100	100	110	110
107+000	108+000	3	1	60	60	105	115	100	100	110	110
108+000	109+000	3	2	60	60	105	110	100	100	110	110
109+000	110+000	3	8	60	60	105	80	100	100	110	110
110+000	111+000	2	2	60	60	110	115	100	100	110	110
111+000	112+000	3	2	60	60	105	115	100	100	110	110
112+000	113+000	20	2	60	60	50	115	50	100		110
113+000	114+000	3	2	60	60	100	110	100	100	110	110
114+000	115+000	3	1	60	60	110	120	100	100	110	110
115+000	116+000	1		60	60	120		100	50	110	
116+000	117+000		1				120	50	100		110
117+000	118+000	2	2	60	60	115	115	100	100	110	110
118+000	119+000	2		60	60	115		100	50	110	
119+000	120+000	1	2	60	60	120	120	100	100	110	110
120+000	121+000	3	1	60	60	100	100	100	100	110	110
121+000	122+000	1	1	60	60	120	100	100	100	110	110
122+000	123+000	2	5	60	60	120	95	100	100	110	110
123+000	124+000	4	22	60	60	95	45	100	50	110	
124+000	125+000	14	6	60	60	60	90	100	100	110	110
125+000	126+000	8	9	60	60	80	75	100	100	110	110
126+000	127+000	4	6	60	60	100	85	100	100	110	110
127+000	128+000	7	28	60	60	85	35	100	50	110	
128+000	129+000	4	4	60	60	95	95	100	100	110	110
129+000	130+000	8	23	60	60	80	45	90	50		
130+000	131+000	3	7	60	60	110	85	110	90		
131+000	132+000	1	3	60	60	125	100	125	100		
132+000	133+000	2	2	60	60	115	110	115	110		
133+000	134+000	4	3	60	60	100	110	100	110		
134+000	135+000	2	5	60	60	110	95	110	95		
135+000	136+000	3	2	60	60	105	110	105	110		
136+000	137+000	3	2	60	60	105	110	105	110		
137+000	138+000	5	3	60	60	95	105	95	105		
138+000	139+000	5	2	60	60	90	110	90	110		
139+000	140+000	5	8	60	60	90	80	90	90		
140+000	141+000	3	5	60	60	105	90	105	90		
141+000	142+000	3	6	60	60	105	85	105	90		
142+000	143+000	3	7	60	60	105	85	105	90		
143+000	144+000	4	7	60	60	100	80	100	90		
144+000	145+000	2	5	60	60	105	90	105	90		
145+000	146+000	3	5	60	60	105	90	105	90		
146+000	147+000	2	5	60	60	105	90	105	90		
147+000	148+000	3	5	60	60	105	90	105	90		

Location		Remaining Life in MSA		Design Life in MSA		Overlay Requirement		Adopted Overlay in mm		CIPR in mm	
From	To	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
148+000	149+000	4	5	60	60	100	90	100	90		
149+000	150+000	5	7	60	60	90	85	90	90		

2.10 Future Maintenance Requirements

Periodic overlay is considered at every 7 years to maintain roughness requirement as per Schedule K. Since structural Overlay is not required till end of balance concession period, therefore 30 mm BC with 10 % length with 50 mm DBM shall hold good for satisfying CA requirement.

Handback Requirement

As specified in Schedule K, all defects and deficiencies specified in this Schedule –K shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2021/22	Structural Overlay	As per Section 2.10	30 mm BC entire length
2	2028/29	Functional Overlay	30 mm BC in 100 % Length + 50 mm DBM in 10 % Length	30 mm BC in 50 % and Microsurfacing in 50 %
3	2034/35	Functional Overlay	30 mm BC in 100 % Length + 50 mm DBM in 10 % Length	30 mm BC in 50 % and Microsurfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, construction of highway on the site set forth in Schedule A and as specified in Schedule B, together with provision of Project Facilities as specified in Schedule C, and in conformity with the Specifications and Standards set forth in Schedule-D. However due to various reason, some work has not completed as of now. Therefore, provision of initial CAPEX has considered for execution of balance work. Other than balance work CAPEX has considered for following work:

A. Balance work as per Original scope of work
B. Immediate rehabilitation of existing pavement
C. Six Laning Cost (for Year 2021/22 and 2022/23)

The summary of all work and cost considered under Initial CAPEX is tabled as below:

A. Balance Work during Four Laning

The following works which was required to complete during Four Laning but not completed.

S. N.	Description of work	Unit	Quantity
1	Main Carriageway	km	1.66
2	Service Road - 8 m width	km	26.54
3	Slip Road - 7.65 m width	km	0.46
4	RE Wall at Approach of GS Km 34 and VUP Km 62+410	Sqm	9239
5	RCC Drain	km	25.26
6	Bus Bays	Nos	15.00
7	Bus Shelter	Nos	30.00
8	ECB	Nos	126.00
9	Traffic Aid Post	Sqm	50.00
10	Medical Aid Post	Sqm	60.00
11	Vehicle Rescue Post	Sqm	20.00
12	Toll Building	Sqm	1500.00
13	Retaining Wall at Approach of VUP at Aligarh Bypass	km	8.760
14	Widening of Existing Minor Bridge Km 46+805	Nos	1

The estimated cost for above balance work is 186.04 crore without GST.

As per Information provided by the Concessionaire and Cube Highways, the above balance work is due to non-availability of ROW and NHAI is in process of descoping of above balance work. Therefore, above amount is not considered in CAPEX.

B. Capex for Six Laning as per Schedule B and Schedule C

As per Concession Agreement, Six Laning Work is to be completed by 12th Anniversary i.e. by 24 Feb 2021. The following are major work to be carried out during six laning:

1. Widening from Four Lane to Six Lane – 94.695 km
2. Widening from existing 2 Lane + 3 Lane to Six Lane – 1.99 km
   (Existing Aligarh Bypass and existing 6 Lane at approach of Grade Separated Structures to be retained as it is)
3. Widening of Existing Culvert – 30 nos of Box Culvert and 24 nos of Pipe Culvert
4. Widening of Existing Minor Bridges – 6 nos
5. Earthen Drain
6. Slope Protection

7. Retaining Wall in between MCW and existing Service Road – 12.75 km
8. Junction Improvement
9. Road Furniture (Sign board, marking, road studs, Metal Beam Crash Barrier)
10. Widening at Bus Bays – 32 nos
11. Widening of Truck Laybys – 4 nos
12. Construction of Operation and Maintenance Centre
13. ATMS
14. Highway Lightings
15. Addition of two lane at either side of Toll Plaza Km 47.500

Total Cost for Six Laning including BC for entire Six Lane – 595.15 crore including GST

C. Rehabilitation of Existing Pavement

The existing pavement is in poor condition which required immediate rehabilitation. The rehabilitation of work is planned to execute along with six laning work. The following work is required based on site investigation and analysis of test report carried out:

1. 50 mm BC from Km 23.600 to 129.000 (Start of Aligarh Bypass)
2. 40 mm BC in Aligarh Bypass
3. 50 mm DBM with 110 Cold-in-Place Recycling from Km 23.600 to 129.000
4. 50 mm to 85 mm DBM based on FWD result for Aligarh Bypass

The Cost of rehabilitation excluding BC – 231.11 crore including GST. Cost towards BC has considered in Six Laning Cost above.

3.1 Methodology

The methodology adopted for cost estimate is as follows:

i) Computation of unit rates of the principal work items based on SCHEDULE OF RATES and current market rates. The rates of cement, steel and bitumen which have been provided as per current market rates.
ii) ECB, TMS cost is based on offer from vendor.
iii) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways.
iv) Labor rates have been considered as per Minimum Wage Policy of GOI.
v) Items has breakdown in such a way that cost estimate can be easily established
vi) Computation of quantities for all items covering all the works to be carried out
vii) Calculation of repair and rehabilitation required for structure based on site condition.
viii) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.
ix) Cost Analysis is based on Year 2021.

3.2 Six Laning Work

As per Concession Agreement, six laning is to be completed by Feb 2023. Following scope of work is considered during Six Laning:

Scope of Six Laning Work

The detail scope of work is specified in Annex -II of Schedule B for Six- Laning. Six laning is not required at Aligarh Bypass from Km 129.600 to Km 149.900. During Four Laning, all structures (Minor Bridge, VUP, PUP, Flyover and ROB) including approach of Grade Separated Structures

(VUP, PUP, ROB, FO) has been constructed for six laning therefore during Six Laning, widening is not required. Based on Type of widening required, following type of widening is required.

Sn	Description of Work	Length	TCS Type
1	New Six Lane MCW from Existing Four Lane at Built Up without Service Road	10000	TCS 01
2	New Six Lane MCW from Existing Four Lane without Service Road	68515	TCS 02
3	Existing Four Lane without Service Road to be Retained	11530	TCS 02A
4	New Six Lane from Existing Four Lane with Existing Service Road Both Side to be retained	9070	TCS 03
5	New Six Lane MCW from Existing Four Lane with Existing Service Road LHS to be retained	890	TCS 03A
6	New Six Lane MCW from Existing Four Lane with Existing Service Road RHS to be retained	1195	TCS 03B
7	New Six Lane MCW from Existing Four Lane with Existing EPE Ramp and Retaining Wall on Both Side	800	TCS 03C
8	Existing Six Lane ROB Approach with RE Wall without Slip Road to be retained	1800	TCS 04
9	Existing Six Lane ROB Approach with RE Wall and with Slip Road to be retained	1300	TCS 04A
10	Existing Six Lane ROB Approach without RE Wall without Slip Road to be retained	1080	TCS 04B
11	Existing Six Lane VUP / FO Approach with RE Wall with Slip Road to be retained	6460	TCS 05
12	Existing Single Side FO approach for Entry / Exit of Bypass with Existing Service Road on Both Side	2730	TCS 05A
13	Existing Six Lane VUP / FO Approach with Partial RE Wall with Slip Road to be retained	4940	TCS 05B
14	Existing Six Lane VUP Approach on RHS and Existing Two Lane on LHS to be widened to Three Lane with RE Wall with Slip Road to be retained	750	TCS 05C
15	Existing Six Lane VUP Approach without RE Wall without Service Road to be retained	4290	TCS 06
16	Transition from TCS 05 to TCS 01	200	Transition
17	Existing Toll Plaza	750	TP
	Total Length		

The major items to be carried out for six laning is as follows

1. Embankment Filling / Excavation
2. Subgrade
3. Granular Subbase
4. Wet Mix Macadam
5. Raising of existing Kerb
6. Dense Bituminous Macadam
7. Bituminous Concrete
8. Widening of Cross Drainage Structure – Pipe and Box Culvert
9. Widening of Major Structures
   - Minor Bridge: 10 nos constructed six lane during four lane
   - Major Bridge: Not Applicable
   - ROB: 4 nos constructed six lane during four lane hence not required widening
   - VUP: 24 nos constructed six lane during four lane hence not required widening
   - FO: 3 nos one side FO three lane hence not required widening
     3 nos both side FO constructed Six Lane hence not required widening
10. Drainage and Protection: a) Roadside Drain b) Turfing c) Stone Pitching d) Retaining / Toe wall
11. Road Furniture – road sign, road marking, crash barrier
12. Truck Laybys
13. Bus Bays
14. ATMS
15. Street Lighting
16. Miscellaneous
17. Shifting of Bus Bays if space is not sufficient for construction of Bus Bays
18. Junction development cost during six laning

Brief methodology for Quantity Calculation

1. Widening Schedule and Typical Cross Section for widening to six lane has developed based on site condition. Typical Cross along with applicable location.
2. For embankment calculation OGL has taken from Plan and Profile and FRL from As Build FRL provided in excel sheet.
3. Replacement of existing shoulder subgrade has considered.
4. To avoid vertical joint benching has considered in existing pavement layers by 100 mm in each layer (GSB, WMM and DBM/BC).
5. Pavement Design:
   Existing Crust on Four lane – 40 mm BC, 165 mm DBM, 250 mm WMM and 200 mm GSB
   New Pavement for Widening Lane as follows:
   BC/DBM – 200 mm for HS 1 and 185 mm for HS 2
   WMM – 250 mm
   GSB – 215 mm for HS 1 and 230 mm for HS 2 for continuity of sub-surface drainage system.
   SG -500 mm
   PMB for BC and VG 40 for DBM is considered.
6. DBM and BC is considered for widening portion due to reason that MMR and Six Lane shall be done together.
7. Widening of Cross Drainage Structures: Pipe Culverts – 24 nos
   Box Culverts – 30 Nos
8. Minor Bridge: 9 minor bridges are considered for widening during six laning.
9. Earthen drain has considered after six laning (TCS 02)
10. Slope protection by turfing after six laning (TCS 02)

11. RCC Retaining wall has considered between MCW and Service Road where existing Service Road is constructed below than MCW.
12. Widening / reconstruction of Service Road has not considered during six laning as existing service road has constructed keeping space in between MCW and Service Road during four laning.
13. Additional Junction development has considered during six laning due to widening of MCW.
14. Relocation of Bus bays during six lane has considered.
15. All sign boards are to be replaced with new sign board after six laning
16. Widening of Toll Lane TP 1 – additional 6 lanes to be considered.
17. ATMS has considered during six lane.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 1st March 2021/22	Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG10	46612	2650	43962
VG30	47412	2650	44762
VG40	50112	2650	47462

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on FY 21/22.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	289
2	Granular Subbase	Cum	2,561
3	Wet mix macadam	Cum	2,917
4	Dense Bituminous Macadam – CAPEX	Cum	10,580
5	Bituminous Concrete	Cum	12,851

Note: above unit rates are excluding GST.

3.4 Six Laning Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2021/22

S.no	Description	Cost in Rs
1	SITE CLERANCE AND DISMANTLING	9,391,487
2	EARTH WORK	376,624,918
3	GRANULAR SUB-BASE AND BASE COURSES	1,120,818,011
4	BITUMINOUS COURSES	2,984,668,513
5	CROSS DRAINAGE WORKS	67,551,682
6	BRIDGE'S, UNDERPASS, FLYOVER ETC. & RE Wall (NOT IN SIX LANE SCHEDULE B, POTENTIAL COS)	51,592,437
7	DRAINAGE AND PROTECTIVE WORKS	329,968,163
8	TRAFFIC SIGNS, MARKINGS AND ROAD APPURTENCES.	285,014,102
9	BUS LAY BYE APPROACHES	67,629,380
10	TRUCK LAY BYE APPROACHES	18,409,562
11	MISCELLAENOUS WORK	172,576,460
12	TOLL PLAZA	83,212,820
	6 LANE COST	5,567,457,535
	Contingencies - 2 %	111,349,151
	GST - 12 % of above Cost	681,456,802

S.no	Description	Cost in Rs
	TOTAL COST Including GST	6,360,263,488

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

3.5 Cost for Rehabilitation of Pavement

Cost Estimate along with back up calculation for immediate rehabilitation of pavement for exiting pavement has submitted in soft copy. The cost estimate is tabled below:

Sl. No.	Activity	Unit	Rehabilitation of Existing Pavement		
			Quantity	Unit Rate	Amount
	Main Carriageway - Flexible Pavement				
1	Tack Coat	Sqm	1,905,111	10	19,051,106
2	Bituminous Concrete - PMB 40	Cum	2,227	12,851	28,625,229
3	Dense Bituminous Macadam - VG 40	Cum	92,194	10,580	975,409,161
4	Providing CIPR	Cum	134,847	5000	674,237,410
5	Milling of existing 40 mm BC	Sqm		71	
	Reconstruction of MCW				
	GSB	Cum	5,130	2561	13,137,930
	WMM	Cum	6,413	2917	18,705,263
	Prime Coat	Sqm	25,650	23	589,950
	Tack Coat	Sqm		10	
	DBM	Cum		9437	
					-
	Service Road				
4	Tack Coat	Sqm		9	
5	DBM	Cum		9437	
6	BC - VG 30	Cum	9,567	11,433	109,385,222
7	Microsurfacing	Sqm		160	-
	Structure (Including Flyover, Elevated, VUP, PUP and bridges)				
1	Tack Coat	Sqm		9	
2	Bituminous Concrete - PMB 40	Cum		12,851	

Sl. No.	Activity	Unit	Rehabilitation of Existing Pavement		
			Quantity	Unit Rate	Amount
3	Dense Bituminous Macadam VG-40	Cum			-
4	Milling of existing Wearing Coat	Sqm	1615495	71	114,861,721
5	Painting of Crash Barrier	sqm		83	-
6	Microsurfacing	Sqm		160	-
	Other Works				
1	Raising of Road Kerb	m		400.00	-
2	Replacement of Road Studs				-
	Road Studs	Nos		200	-
	Solar Studs	Nos		1500	-
3	Painting of Road Kerb	Sqm	-	83	-
4	Road Marking - MCW	Sqm	136,825	505	69,096,625
5	Shoulder Filling (40 to 50 mm)	Sqm		47	-
	Major Maintenance Cost Per Year				1,901,085,447
	Contingencies - 2 %	-	-	-	40,461,992
	Major Maintenance Cost Per Year with GST				2,311,189,002

Total CAPEX – 867.14 crore

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2021/22	Structural Overlay	As per Section 2.10	30 mm BC entire length
2	2028/29	Functional Overlay	30 mm BC in 100 % Length + 50 mm DBM in 10 % Length	30 mm BC in 50 % and Microsurfacing in 50 %
3	2034/35	Functional Overlay	30 mm BC in 100 % Length + 50 mm DBM in 10 % Length	30 mm BC in 50 % and Microsurfacing in 50 %

Cost towards MM Cycle 2021/22 is considered in CAPEX.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

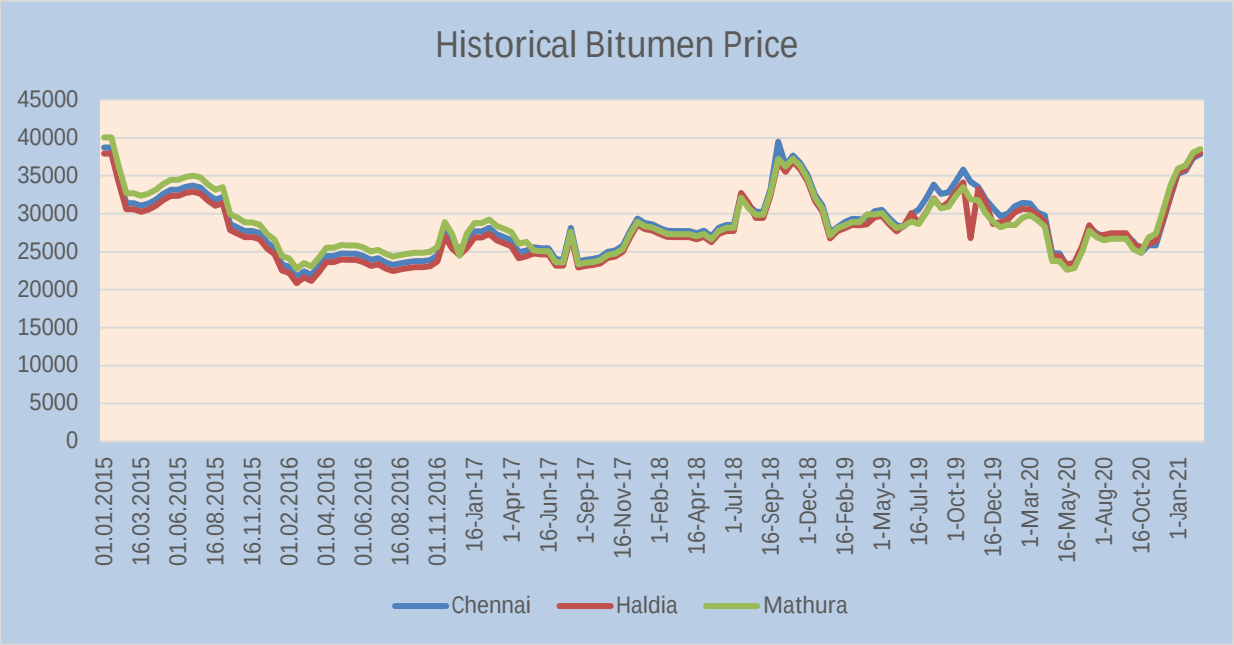
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	28,874	2650	26,225
VG40	30,264	2650	27,614

Basis of projection of Bitumen Price do not vetted by AECOM and any fluctuation on MM Cost due to changes in bitumen price to be covered by the Company.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Year	Growth Rate	Escalation Factor
Mar-22	2.83%	1.000
Mar-23	4.66%	1.047
Mar-24	5.65%	1.106
Mar-25	5.37%	1.165
Mar-26	5.52%	1.229
Mar-27	5.25%	1.294

Year	Growth Rate	Escalation Factor
Mar-28	4.86%	1.357
Mar-29	4.44%	1.417
Mar-30	4.24%	1.477
Mar-31	4.13%	1.538
Mar-32	4.08%	1.601
Mar-33	4.01%	1.665

Year	Growth Rate	Escalation Factor
Mar-34	4.00%	1.732
Mar-35	4.03%	1.801
Mar-36	4.01%	1.874
Mar-37	3.98%	1.948
Mar-38	3.98%	2.026
Mar-39	4.00%	2.107
Mar-40	3.99%	2.191
Mar-41	3.99%	2.278
Mar-42	3.99%	2.369

Year	Growth Rate	Escalation Factor
Mar-43	3.99%	2.464
Mar-44	3.99%	2.562
Mar-45	3.99%	2.664
Mar-46	3.99%	2.771
Mar-47	3.99%	2.881
Mar-48	3.99%	2.996
Mar-49	3.99%	3.116
Mar-50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2021/22 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – CAPEX	Cum	8,948
2	Bituminous Concrete	Cum	10,136
3	Micro surfacing	Sqm	160
4	Replacement of Joint Sealant in PQC	m	200
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	400
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	20
9	Road Studs - Normal	nos	200
10	Road Studs - Solar	nos	1500

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented BELOW:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Quantity				Unit Rate 2021#	Amount		
			2021/22	2028/29	2034/35			2021/22	2028/29	2034/35
	Main Carriageway - Flexible Pavement									
1	Tack Coat	Sqm		3,447,576	3,447,576		12	-	40,267,691	40,267,691
2	Bituminous Concrete - VG 40 / CRMB	Cum		94,025	94,025		10136	-	953,033,561	953,033,561
3	Dense Bituminous Macadam - VG 40	Cum		15,671	15,671		8948	-	140,217,000	140,217,000
4	Providing Insitu RAP	Cum					6038	-		
	Main Carriageway - Rigid									
1	Joint sealant replacement every 5th Year (5 %)	m					200.00	-	-	-
	Service Road									
1	Tack Coat	Sqm		159,458	159,458		12	-	1,862,473	1,862,473
2	DBM - VG 30	Cum						-	-	-
3	BC - VG 30	Cum		4,784	4,784		9675	-	46,284,357	46,284,357
4	Microsurfacing	Sqm		159,458	159,458		160	-	25,513,332	25,513,332
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)									
1	Tack Coat	Sqm		55687	55687		12	-	650,422	650,422

Sl. No.	Activity	Unit	Quantity				Unit Rate 2021#	Amount		
			2021/22	2028/29	2034/35			2021/22	2028/29	2034/35
2	Bituminous Concrete - VG 40 / CRMB	Cum		1671	1671		10136	-	16,933,201	16,933,201
3	Dense Bituminous Macadam VG-40	Cum						-	-	-
4	Milling of existing Wearing Coat	Sqm					70	-	-	-
5	Painting of Crash Barrier	sqm		15022	15022		121	-	1,813,965	1,813,965
6	Microsurfacing	Sqm					160	-	-	-
	Other Works							-	-	-
1	Raising of Road Kerb	m		252,000			439	-	110,650,909	-
2	Replacement of Road Studs							-	-	-
	Road Studs	Nos		42,100	42,100		200	-	8,420,000	8,420,000
	Solar Studs	Nos		6,315	6,315		1500	-	9,472,500	9,472,500
3	Painting of Road Kerb	Sqm		100,800	100,800		121	-	12,171,600	12,171,600
4	Road Marking - MCW	Sqm		112968	112968		400	-	45,187,333	45,187,333
5	Shoulder Filling (40 to 50 mm)	Sqm		227175	227175		20	-	4,543,500	4,543,500
6	Median Filling	Cum		30240			439			
7	Cost for fixing Other CA Issue at Handback Time	LS								

Sl. No.	Activity	Unit	Quantity				Unit Rate 2021#	Amount		
			2021/22	2028/29	2034/35			2021/22	2028/29	2034/35
8	PMC Cost for Overlay @ 20 lakh per month	Month		8	8		2,000,000		16,000,000	16,000,000
	Major Maintenance Cost Per Year							-	1,433,021,844	1,322,370,935
	Major Maintenance Cost Per Year with GST							-	1,604,984,465	1,481,055,447
						Amount in Crore			160.498	148.106
	Escalation Factor								1.417	1.801
	Esclated Amount keping Bitumen Component w/o Escalation								227.433	266.806

OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 17 – Operation &Maintenance & Schedule – K Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 17 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 19,424 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 16,386 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 250 watt light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 9 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	45.20	164,659	7,442,591
2	Highway Lighting Electricity Charge	Kwh	2,909,415	9.88	28,743,698

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos	74	3,293	243,695
	Total				36,710,453

5.5 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is 1.42 crore per year and additional cost of 36.57 crore for replacement of equipment at every 7 (seven) years.

5.6 Incident Management

The following equipments along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 2.76 crore per year including GST.

5.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.
   As per Company, overloading shall not be collected from this asset therefore only six (6) Toll Collector is considered for 10 lane plaza from FY 2023 onwards.
   The cost of manpower is estimated as Rs. 6.93 core for FY 2021/22 an Rs. 5.63 crore per year from FY 2022/23 onwards.

5.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 5.11 crore per year.

Year wise O & M Cost (OPEX) is presented in next page.

Major Maintenance Cost

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost- Ghaziabad Aligarh Expressway Pvt. Ltd.											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Head Office and Admin Office*	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22	42,529,745	32,971,848	36,710,453	14,759,400	27,648,920	1,778,318	69,337,470	5,927,727	51,121,662	282,785,544
2	2022-23	16,444,170	32,971,848	36,710,453	77,302,382	27,648,920	1,778,318	56,363,006	5,927,727	51,121,662	306,268,486
3	2023-24	17,424,110	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	264,001,227
4	2024-25	32,200,455	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	278,777,572
5	2025-26	42,699,599	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	289,276,716
6	2026-27	48,457,393	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	295,034,510
7	2027-28	16,444,170	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	263,021,287
8	2028-29	16,444,170	38,874,940	42,708,639	126,435,604	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	374,697,491
9	2029-30	17,424,110	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	264,001,227

10	2030-31	32,200,455	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	278,777,572
11	2031-32	42,699,599	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	289,276,716
12	2032-33	48,457,393	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	295,034,510
13	2033-34	48,457,393	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	295,034,510
14	2034-35	16,444,170	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	263,021,287
15	2035-36	17,424,110	38,874,940	42,708,639	126,435,604	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	375,677,431
16	2036-37	32,200,455	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	278,777,572
17	2037-38	42,699,599	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	289,276,716
18	2038-39	48,457,393	38,874,940	42,708,639	14,759,400	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	295,034,510
19	2039-40	16,444,170	38,874,940	42,708,639	94,528,117	27,648,920	1,778,318	63,757,511	5,927,727	51,121,662	342,790,004
	Total	595,552,659	726,817,682	799,467,773	646,092,706	525,329,480	33,788,045	1,209,578,156	112,626,818	971,311,572	5,620,564,891
	Total Cost in Crore	60	73	80	65	53	3	121	11	97	562.06

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

The project road starts from Ghaziabad City (Km 23.600 of NH-91) and ends at Aligarh Bypass near Aligarh (Km 149.900 of NH-91 section) in the state of Uttar Pradesh. The project road has been jointly visited by Consultant's and Client's team of Engineers on the month of July 2020 and made detailed assessment of road features, pavement, toll plazas, structures etc.

Also, separate teams comprising of Highway/Pavement Engineers, Quantity Surveyors, HTMS Expert and Bridge Engineers from consultant visited the project road and conducted detailed inventory survey of the project road.

Detail of Project Stretch

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
4/6 Laning of Ghaziabad-Aligarh Section of NH-91 from Km. 23.600 to Km 149.900 in the State of Uttar Pradesh under NHDP Phase - III on Design, Build, Finance, Operate and Transfer (DBFOT) Basis.	23.600	149.900	126.300	4 lane / 6 lane As per CA, project length is 126.300 km.
Total			126.300	

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

In addition to the manual inventory, Network Survey Vehicle (NSV) was also deployed for carrying out the detailed inventory of the site. NSV is the globally used technology for carrying out the high accuracy inventory and condition survey of road assets. It uses the combination of highly sophisticated instruments such as Hawkeye cameras, GPS trackers, Laser Profilometers etc. to capture the complete information of highway and pavement. The captured data is later analyzed with the help of computer software to extract inventory data in spreadsheet formats. For the current project road, mainly three types of data were obtained from NSV:

I. Asset Inventory
II. Road Profile and Geometry Data
III. Detailed Pavement Condition Data

Start Point of Project Road at Km 23+600 of NH-91

End Point of Project Road at Km 149+900 of NH-91

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 23+600 of Ghaziabad-Aligarh Section of NH-91	Km 23+600 of Ghaziabad-Aligarh Section of NH-91	
2	Project Road End	Km 149+900 of Ghaziabad-Aligarh Section of NH-91	Km 149+900 of Ghaziabad-Aligarh Section of NH-91	
3	Project Length	126.300 km	126.30 km	(2.4 km of one side length of MCW is yet to complete)

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
6	Carriageway	4 lane highway with paved width 8.75 m on either side & 6 lane GS approaches	4 lane highway with paved width 8.75 m on either side & 6 lane GS approaches	
7	Shoulders	1.5m Paved for main carriageway. 1.5m earthen shoulder for main carriageway & 1.0 m for Service Roads.	1.5m Paved for main carriageway. 1.5 m earthen shoulder for main carriageway & 1.0 m for Service Roads.	
8	Median	4.50 m wide in rural areas and 1.2 m in Urban Stretches.	4.50 m wide in rural areas and 1.2 m in Urban Stretches.	
9	Service/Slip Roads	<u>Service Road – 8 m width</u> LHS: 27.540 km RHS: 27.540 km <u>Slip Road – 7.65 m width</u> LHS: 9.000 km RHS: 9.000 km	<u>Service Road – 8 m width</u> LHS: 11.840 km RHS: 13.290 km <u>Service Road – 3 m width</u> LHS: 11.070 km RHS: 14.770 km <u>Slip Road – 7.65 m width</u> LHS: 7.650 km RHS: 7.590 km	Completed length of service / slip road is as found during field survey.
11	Bypass/Realignment	Bypass - 4 Nos. Realignments - 1 Nos.	Bypass - 4 Nos. Realignments - 1 Nos.	
12	Major Bridge	Nil	Nil	
13	Minor Bridge	New Construction: - 5 Nos. Rehabilitation/Widening/Repair:- 5 Nos.	18 Nos.	Found:7; Not found 3; Additional-11
14	Pipe, Box & Slab Culverts	Reconstruction - 62 nos. New Construction - 89 nos.	123 Nos.	Found-105
15	Major/Minor Junctions	14 Major Junction + 111 Minor Junction	14 Major Junction + 90 Minor Junction	
16	Vehicular Underpass (VUP)	24 Nos.	19 Nos.	Found-15
17	Pedestrian/Cattle Underpass (PUPs)	Nil	Nil	
18	Grade Separator	6 Nos.	6 Nos.	

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
19	ROB/RUB	ROB - 4 Nos.	ROB - 4 Nos.	
20	Toll Plazas	2 Nos.	2 Nos.	
21	Truck Lay-byes/Truck Parking	Truck Lay-byes:- 2 Nos. Truck Parking:- 2 Nos.	Truck Lay-byes:- 4Nos.	
22	Bus bays/Bus Stops	<u>Bus Bays:</u> LHS - 26 Nos. RHS - 26 Nos. <u>Bus Stops:</u> LHS - 12 Nos. RHS - 12 Nos.	<u>Bus Bay with Shelter:</u> LHS - 18 RHS - 17 <u>Bus Bay without Shelter:</u> RHS - 1 <u>Bus Shelter:</u> LHS - 2 RHS - 6	
23	Rest Areas	Nil	Nil	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

MCW View at KM 29+000 LHS	MCW View at KM 64+000 RHS
Toll Plaza at KM 47+800	Slip Road & RE Wall at KM 55+400 to KM 56+300

6.2.2 Pavement Type

Flexible pavement is present along the entire length of project road except at two Toll Plazas where Rigid Pavement has been provided on 400 m length at each Toll Plaza. Pavement condition is generally poor throughout the project corridor.

Details regarding existing pavement is given in the subsequent section.

6.2.3 Service/Slip Roads

Schedule B has proposed service roads and slip roads at built up stretches and structure locations to segregate the local and diverging traffic from main carriageway. During, execution of work IE through letter dated 24 Jun 2014 and 26 Aug 2018, revised service road locations. Comparison of service Road as per Schedule B and IE instruction is as follows:

COMPARISON OF SERVICE / SLIP ROAD LOCATION BETWEEN SCHEDULE B AND IE INSTRUCTION

Sl. No	As per Schedule B					As per Revised Location by IE				
	Chainage		Side	Width (m)	One Side Length (km)	Chainage		Side	Width (m)	One Side Length (km)
	From	To				From	To			
	Service Road									
1	23.600	33.650	BHS	8.000	20.100	28.900	32.670	Both	8.00	7.540
2						36.400	41.160	Both	3.00	9.520
3						42.525	43.330	Both	8.00	1.610
4	44.590	45.600	BHS	8.000	2.020	44.625	45.635	Both	8.00	2.020
5	48.780	54.000	BHS	8.000	10.440	48.780	53.050	Both	8.00	8.540
6						55.450	56.350	Both	8.00	1.800
7	61.800	63.300	BHS	8.000	3.000	62.150	63.650	Both	8.00	3.000
8	65.300	66.300	BHS	8.000	2.000	65.600	66.600	Both	8.00	2.000
9						71.530	72.250	Both	8.00	1.440
10	78.950	79.950	BHS	8.000	2.000	79.300	80.300	Both	8.00	2.000
11						87.280	88.150	Both	8.00	1.740
12	98.450	99.900	BHS	8.000	2.900	99.850	100.340	LHS	8.00	0.490
13						99.850	100.400	RHS	8.00	0.550
14	104.550	106.650	BHS	8.000	4.200	105.660	106.270	Both	8.00	1.220
15						106.640	107.750	Both	8.00	2.220
16	122.700	124.800	BHS	8.000	4.200	122.700	123.100	RHS	8.00	0.400
17						123.200	123.950	LHS	8.00	0.750
18						123.200	124.200	RHS	8.00	1.000
19						124.700	125.300	Both	8.00	1.200

Sl. No	As per Schedule B					As per Revised Location by IE				
	Chainage		Side	Width (m)	One Side Length (km)	Chainage		Side	Width (m)	One Side Length (km)
	From	To				From	To			
20	125.550	127.660	BHS	8.000	4.220	125.750	126.400	Both	8.00	1.300
21						126.900	127.250	Both	8.00	0.700
22						127.800	128.440	LHS	8.00	0.640
23						127.800	128.600	RHS	8.00	0.800
24						131.080	131.780	Both	8.00	1.400
25						132.100	132.780	Both	8.00	1.360
26						134.210	134.900	Both	8.00	1.380
27						135.300	135.600	LHS	8.00	0.300
28						137.650	138.350	Both	8.00	1.400
29						145.430	145.900	Both	8.00	0.940
30						146.630	147.450	Both	8.00	1.640
	Total Length of Service Road				55.080					60.900*
	Slip Road									
1	33.400	35.200	BHS	7.65	3.600	33.600	35.080	Both		2.960
2	41.100	41.900	BHS	7.65	1.600	41.160	42.040	Both		1.760
3	73.700	74.650	BHS	7.65	1.900	72.800	73.750	Both		1.900
4	92.600	93.550	BHS	7.65	1.900	91.390	92.380	Both		1.980
5	129.400	130.300	BHS	7.65	1.800	129.800	130.850	LHS		1.050
6						129.850	130.840	RHS		0.990
7	140.150	140.600	BHS#	7.65	2.900	139.420	141.150	Both		3.460
8	141.250	141.700	RHS#	7.65	2.100	141.150	142.050	Both		1.800
9	143.400	144.500	BHS	7.65	2.200	143.050	144.100	Both		2.100
	Total Length of Slip Road				18.000					18.000

Note: *- increase in length of service road is due to addition of service road of 3 m width for 9.52 km

- Location and side of slip road is error and length of service road mentioned in Schedule B has considered as obligation of concessionaire.

As per the site inventory service/slip road has been constructed at following locations:

Sl. No.	Design Chainage (Km)		Balance Location		Width	Length (m)	TCS	Side	Balance Length
	From	To	From	To					
Service Road									
1	28900	32670	28900	32670	8.00	7,540	TCS 01	Both	7,540
2	36400	41160	36400	36500	3.00	9,520	TCS 04A	Both	200
3	36400	41160	39500	39700	3.00	9,520	TCS 04A	Both	400
4	36400	41160	40100	41160	3.00	4,760	TCS 04A	RHS	1,060
3	42525	43330	42525	42800	8.00	805	TCS 03B	LHS	275
4	44625	45635			8.00	2,020	TCS 03	Both	-
5	48780	53050	48780	49000	8.00	4,270	TCS 03B	LHS	220
6	48780	53050			8.00	4,270	TCS 03B	RHS	-
6	55450	56350			8.00	1,800	TCS 05	Both	-
7	62150	63650	62150	63650	8.00	1,500	TCS 05C	LHS	1,500
8	62150	63650	63500	63650	8.00	1,500	TCS 05C	RHS	150
8	65600	66600			8.00	2,000	TCS 05	Both	-
9	71530	72250			8.00	1,440	TCS 05	Both	-
10	79300	80300	80200	80300	8.00	2,000	TCS 05	Both	200

Sl. No.	Design Chainage (Km)		Balance Location		Width	Length (m)	TCS	Side	Balance Length
	From	To	From	To					
11	87280	88150			8.00	1,740	TCS 03	Both	-
12	99850	100340	99850	100200	8.00	490	TCS 03B	LHS	350
13	99850	100400			8.00	550	TCS 03B	RHS	-
14	105660	106270			8.00	1,220	TCS 03	Both	-
15	106640	107750			8.00	2,220	TCS 05	Both	-
16	122700	123100	122700	123100	8.00	400	TCS 02	RHS	400
17	123200	123950	123200	123950	8.00	750	TCS 02	LHS	750
18	123200	124200	123200	124200	8.00	1,000	TCS 02	RHS	1,000
19	124700	125300	124700	125300	8.00	1,200	TCS 02	Both	1,200
20	125750	126400	125750	126400	8.00	1,300	TCS 02	Both	1,300
21	126900	127250	126900	127250	8.00	700	TCS 02	Both	700
22	127800	128440	127800	128440	8.00	640	TCS 02	LHS	640
23	127800	128600	127800	128600	8.00	800	TCS 02	RHS	800
24	131080	131780	131080	131780	8.00	1,400	TCS 06	Both	1,400
25	132100	132780	132100	132780	8.00	1,360	TCS 06	Both	1,360
26	134210	134900	134210	134900	8.00	1,380	TCS 06	Both	1,380
27	135300	135600	135300	135600	8.00	300	TCS 02A	LHS	300

Sl. No.	Design Chainage (Km)		Balance Location		Width	Length (m)	TCS	Side	Balance Length
	From	To	From	To					
28	137650	138350	137650	138350	8.00	1,400	TCS 02A	Both	1,400
29	145430	145900	145430	145900	8.00	940	TCS 06	Both	940
30	146630	147450	146630	147450	8.00	1,640	TCS 02A	Both	1,640
				Total		74,375			27,105
	Slip Road								
1	33600	35080	33600	33900		2,960	TCS 04	Both	600
2	41160	42040				1,760	TCS 04	Both	-
3	72800	73750				1,900	TCS 04	Both	-
4	91390	92380				1,980	TCS 04	Both	-
5	129800	130850				1,050	TCS 04	LHS	-
6	129850	130840				990	TCS 04	RHS	-
7	139420	141150	139420	140500		3,460	TCS 04	Both	2,160
8	141150	142050				1,800	TCS 04	Both	-
9	143050	144100				2,100	TCS 04	Both	-
				Total		18,000			2,760

Sl. No.	Design Chainage (Km)		Balance Location		Width	Length (m)	TCS	Side	Balance Length
	From	To	From	To					
				Total		92,375			29,865

Summary of Service Road / Slip Road to be provided as CA provision, IE Instruction and as constructed at site is presented below:

Description	As per CA			As per IE Instruction			As Constructed Length (km)		
	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
Service Road (Width - 8.0)	27.540	27.540	55.080	25.405	25.975	51.380	11.840	13.290	25.13
Service Road (Width - 3.0)	-	-	-	4.760	4.760	9.520	11.070	14.770	25.84
Slip Road	9.000	9.000	18.000	9.030	8.970	18.000	7.650	7.590	15.24
Total			73.080			78.900			66.21

Balance Length of Service to be Constructed

Description	As per CA			As per IE Instruction			As Per AECOM		
	LHS	RHS	Total	LHS	RHS	Total	LHS	RHS	Total
Service Road (Width - 8.0)	15.77	15.67	30.94	13.665	14.105	27.74	13.565	11.880	25.445
Service Road (Width - 3.0)	-3.90	-3.90	-7.80	0.86	0.86	1.72	0.300	1.360	1.660
Slip Road (Width – 7.65)	1.655	1.715	3.37	1.655	1.715	3.37	1.380	1.380	2.760

Total		27.01		32.83			29.865

Service Road between KM 41+100 to KM 42+100	Slip Road constructed upto WMM between KM 62+100 to KM 62+300
Slip Road between KM 73+000 to KM 73+900	Service Road between KM 36+500 to KM 41+000 at Dadri Bypass

6.2.4 Median

Throughout the project corridor median width of 4.5 m and 1.2 m were observed in the Rural and built-up stretches respectively. 4.5 m wide median was found to be mostly covered with bushes or shrubs. Median on the built-up stretches had metal beam installed in it on most part.

All along the project road, 82 nos. of Median Openings were found in total. Eight numbers of these openings were unauthorized ones and possess accident hazard.

A typical 1.2m wide median with Metal Beam Crash Barrier on Urban Section

4.5m wide Median with Shrubs on Rural Section of Project Road

Medain Opening with Solar Blinker on Major Junction at Km 54+170

Details of Median Openings found along project road are presented in the table below:

SN	Chainage	Length (m)	Details		
			Authorised Opening	Reserve Lane	Solar Blinkers
1	29+900	20m	YES	No	
2	30+050	6 m	YES	No	
3	30+250	20m	YES	No	
4	30+500	6m	YES	No	
5	30+750	20m	YES	No	

SN	Chainage	Length (m)	Details		
			Authorised Opening	Reserve Lane	Solar Blinkers
6	30+900	6m	YES	No	
7	31+050	8m	YES	No	
8	31+150	5m	YES	No	
9	31+250	5m	YES	No	
10	31+300	8m	YES	No	
11	31+500	10m	YES	No	
12	31+550	25m	YES	No	
13	31+800	30m	YES	No	
14	32+050	5m	YES	No	
15	32+550	6m	YES	No	
16	33+050	20m	YES	No	
17	33+250	5m	YES	No	
18	33+300	5m	YES	No	
19	35+500	20m	YES	Yes	
20	37+010	10m	No		
21	39+450	20m	YES	Yes	
22	42+650	20m	YES	Yes	
23	45+200	15m	YES	Yes	
24	45+300	10m	YES	No	2 Nos
25	45+900	6m	No		
26	47+700	20m	YES	Yes	
27	52+750	35m	YES	Yes	
28	54+075	30m	YES	Yes	
29	54+500	5m	No		

SN	Chainage	Length (m)	Details		
			Authorised Opening	Reserve Lane	Solar Blinkers
30	57+050	5m	YES	No	
31	57+150	5m	YES	No	
32	58+050	15m	YES	Yes	
33	58+400	20m	YES	Yes	
34	59+950	30m	YES	Yes	
35	61+650	20m	YES	Yes	
36	63+850	30m	YES	Yes	2 Nos
37	65+100	10m	YES	No	
38	67+100	10m	YES	No	
39	69+100	20m	YES	Yes	
40	76+500	10m	YES	No	
41	78+850	15m	YES	Yes	
42	80+800	15m	YES	Yes	
43	82+600	15m	YES	Yes	2 Nos
44	86+300	15m	YES	Yes	
45	89+400	15m	YES	Yes	
46	90+900	10m	YES	No	
47	91+100	10m	YES	No	
48	93+650	20m	YES	Yes	
49	94+000	6m	No		
50	95+150	5m	YES	No	
51	95+600	5m	YES	No	
52	97+600	15m	YES	Yes	
53	99+600	15m	YES	Yes	

SN	Chainage	Length (m)	Details		
			Authorised Opening	Reserve Lane	Solar Blinkers
54	100+850	15m	YES	Yes	
55	104+950	15m	YES	Yes	
56	108+450	15m	YES	Yes	2 Nos
57	110+300	15m	YES	Yes	
58	111+350	6m	No		
59	112+300	15m	YES	Yes	
60	112+600	15m	YES	Yes	
61	114+300	20m	YES	Yes	
62	116+450	20m	YES	Yes	
63	118+200	15m	YES	Yes	
64	119+250	15m	YES	Yes	
65	120+000	20m	YES	Yes	
66	121+200	10m	No		
67	122+150	15m	YES	Yes	
68	124+150	20m	YES	Yes	
69	125+775	20m	YES	Yes	
70	127+350	6m	No		
71	128+600	15m	YES	Yes	
72	129+750	15m	YES	Yes	
73	133+200	5m	No		
74	133+750	15m	YES	Yes	
75	135+750	15m	YES	Yes	
76	136+350	15m	YES	Yes	
77	136+500	15m	YES	Yes	2 Nos

SN	Chainage	Length (m)	Details		
			Authorised Opening	Reserve Lane	Solar Blinkers
78	137+550	15m	YES	Yes	
79	139+250	15m	YES	Yes	
80	144+800	15m	YES	Yes	
81	146+650	15m	YES	Yes	
82	149+300	20m	YES	Yes	

6.2.5 Drains

There are two types of drains has been constructed along the project road: Lined drains on the edge of service road on the built-up stretch and earthen drain at few locations on the rural stretch. Earthen drains were generally buried and not distinctly visible. As far as lined drains is concerned, it has been found that in multiple locations drains were not constructed as per the scope of works stipulated in CA.

Location of drain required as per CA and as constructed at site is given in the tables below:

SN	Design Chainage (Km)		Length of RCC Drain Required - m	
	From	To	LHS	RHS
1	28.900	32.670	3,770	3,770
4	44.625	45.635	1,010	1,010
5	48.780	53.050	4,270	4,270
7	62.150	63.650	1,500	1,500
8	65.600	66.600	1,000	1,000
10	79.300	80.300	1,000	1,000
12	99.850	100.340	490	
13	99.850	100.400		550
14	105.660	106.270	610	610
15	106.640	107.750	1,110	1,110

SN	Design Chainage (Km)		Length of RCC Drain Required - m	
	From	To	LHS	RHS
16	122.700	123.100		400
17	123.200	123.950	750	
18	123.200	124.200		1,000
19	124.700	125.300	600	600
20	125.750	126.400	650	650
21	126.900	127.250	350	350
22	127.800	128.440	640	
23	127.800	128.600		800
	Slip Road			
1	33.600	35.080	1,480	1,480
2	41.160	42.040	880	880
5	129.800	130.850	1,050	-
6	129.850	130.840	-	990
7	139.420	141.150	1,730	1,730
8	141.150	142.050	900	900
9	143.050	144.100	1,050	1,050
	Total		24,840	25,650

List of Drain
(Median and Road Side)

LHS					
SN	Chainage		Side	Length m	Type of Drain
	From	To			
1	24000	25800	LHS	1800	RCC
2	42800	43400	LHS	600	

3	44400	45500	LHS	1100	RCC
4	49000	53900	LHS	4900	RCC
5	62000	63500	LHS	1500	RCC
6	65500	66500	LHS	1000	RCC
7	79300	80200	LHS	900	RCC
8	100000	100300	LHS	300	RCC
9	105600	106200	LHS	600	RCC
10	106700	107800	LHS	1100	RCC
11	130000	131150	LHS	1150	RCC
12	141000	141400	LHS	400	RCC
13	141600	141900	LHS	300	RCC
14	143500	144200	LHS	700	RCC
	Total (m)			16350	

RHS					
SN	Chainage		Side	Length m	Type of Drain
	From	To			
1	24200	26000	RHS	1800	RCC
2	44400	45500	RHS	1100	RCC
3	48700	53900	RHS	5200	RCC
4	62000	63500	RHS	1500	RCC
5	65500	66500	RHS	1000	RCC
6	79300	80200	RHS	900	RCC
7	99800	100400	RHS	600	RCC
8	105600	106450	RHS	850	RCC
9	106700	107800	RHS	1100	RCC
10	130600	130900	RHS	300	RCC
11	141500	142400	RHS	900	RCC
12	143400	144200	RHS	800	RCC

Total (m)	16050
Total length Drain constructed (m)	32400

As per the CA, total 50.490 km of drain was to be constructed whereas during the site inventory it was found that only 32.400 km was constructed in the project road. Following table shows the detail comparison between drain as per CA provision and as constructed on site:

Description	Length as per CA (km)			As Constructed Length (km)		
	LHS	RHS	Total	LHS	RHS	Total
Length of Drain	24.840	25.650	50.490	16.350	16.050	32.400

There is no instruction issued by IE for revised location / quantity of RCC change in RCC Drain during construction therefore quantity to be provided as per CA (Schedule B) is final.

RCC Drain at KM 44+700

RCC Drain at KM 42+800

6.2.6 Major and Minor Junctions

As per the site inventory, 14 major and 90 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Major Junction at KM 54+000	Minor Junction at KM 58+200

Details of Major and Minor Junctions along the project are presented in the table below:

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	14	14
Minor Junctions	111	90

Details of Major Junctions

Sn	Chainage	Type of Junction	LHS		RHS		Remarks
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
1	23+600	X	4 lane	BT	4 lane	BT	Intersection of NH-24 & NH-91 Under Construction
2	33+800	Y	7.0m	BT			Old NH-34 (RHS)
3	44+300	X	6 lane	CC	6 lane	CC	Eastern Peripheral Expressway Interchange
4	54+100	Y	10.0m	BT			Sikandrabad Bypass Start
5	59+950	+	7.5m	BT	3.5m	BT	End of Sikandrabad Bypass (RHS Major Junction)
6	69+000	Y	10.0m	BT			Start of Bulandshahr Realignment

Sn	Chainage	Type of Junction	LHS		RHS		Remarks
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
7	74+600	Y	7.0m	BT			End of Bulandshahr Realignment
8	84+800	Y	10.0m	BT			Start of Khurja Bypass
9	91+000	X	5.5m	BT	5.5m	BT	Sikandarpur (LHS) & Khurja (RHS)
10	93+650	Y	7.0m	BT			End of Khurja Bypass
11	114+300	Y	7.5m	BT			Ghabana Bypass Start
12	122+150	Y	7.5m	BT			To Chuharpur
13	135+750	+	7.5m	BT	7.5m	BT	LHS Towards Aligarh City & RHS Towards Palwal
14	149+300	Y			7.5m	BT	Aligarh Bypass End

Details of Minor Junctions

Sn	Existing Chainage	Type of Junction	LHS		RHS		Median Opening Provided (Y/N)
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
1	26+200	T	6m	BT			No
2	29+300	T	3.5m	BT			No
3	29+700	T	3.5m	BT			No
4	30+350	T	3.5m	BT			No
5	30+750	T			3.5m	CC	Yes
6	30+950	T	3.5m	BT			Yes
7	31+450	+		BT	4.5m	BT	No
8	33+250	+	4.5m		3.5m	CC	Yes
9	34+500	T	3.5m	BT			No

Sn	Existing Chainage	Type of Junction	LHS		RHS		Median Opening Provided (Y/N)
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
10	35+100	+	3.5m	BT	3.5m	BT	No
11	42+950	+			5.5m	BT	No
12	43+050	T	5.5m	BT			No
13	46+780	T			3.5m	BT	No
14	46+900	T			5.5m	BT	No
15	47+200	T	3.5m	BT			
16	48+050	T	3.5m	BT			No
17	48+300	T			3.5m	BT	No
18	50+030	T			5.5m	BT	No
19	51+830	T			7m	BT	No
20	52+900	T	5.5m	BT			No
21	52+950	T			5.5m	BT	No
22	55+500	T			3.5m	BT	No
23	57+100	+	3.5m	BT	3.5m	BT	Yes
24	58+200	+		BT	5.5m	BT	No
25	60+400	T			3.5m	BT	No
26	60+600	T			3.5m	BT	No
27	60+900	T	3.5m	BT			No
28	61+300	T			3.5m	BT	No
29	62+400	T			5.5m	BT	No
30	64+050	T	3.5m	BT			No
31	64+450	T			3.5m	BT	No
32	64+600	T	3.5m	BT			No
33	64+750	+	3.5m	BT	3.5m	BT	No
34	67+900	T			3.5m	BT	No

Sn	Existing Chainage	Type of Junction	LHS		RHS		Median Opening Provided (Y/N)
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
35	69+100	+			3.5m	BT	Yes
36	74+800	T	3.5m	BT			No
37	77+150	T	3.5m	BT			No
38	78+750	T			3.5m	BT	No
39	78+900	T	3.5m	BT			Yes
40	81+200	T			3.5m	BT	No
41	82+020	T	3.5m	BT			No
42	83+350	T			3.5m	BT	No
43	84+700	T			3.5m	BT	No
44	93+900	T			3.5m	BT	No
45	94+000	T			3.5m	BT	No
46	94+200	T			3.5m	Paver block	No
47	94+500	T	3.5m	BT			No
48	95+000	T	3.5m	BT			No
49	95+300	T			3.5m	BT	No
50	95+600	T	3.5m	BT			Yes
51	95+900	T	3.5m	BT			No
52	96+400	T			3.5m	BT	No
53	96+600	T	3.5m	BT			No
54	98+600	T			3.5m	BT	No
55	99+800	T	3.5m	BT			No
56	100+200	T			3.5m	BT	No
57	100+650	T			3.5m	BT	No
58	102+850	T			3.5m	BT	No
59	102+990	T			3.5m	BT	No

Sn	Existing Chainage	Type of Junction	LHS		RHS		Median Opening Provided (Y/N)
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
60	103+500	T	3.5m	BT			No
61	104+400	T	3.5m	BT			No
62	105+750	T			3.5m	BT	No
63	107+200	T			3.5m	BT	No
64	108+400	T	3.5m	BT			Yes
65	108+700	T	3.5m	BT			No
66	109+500	T	3.5m	BT			No
67	109+750	T			3.5m	BT	No
68	110+200	T	3.5m	BT			No
69	111+500	T	5.5m	BT			No
70	112+650	T			3.5m	BT	No
71	112+900	T			3.5m	BT	No
72	114+000	T	5.5m	BT			No
73	115+500	T	3.5m	Paver block			No
74	116+450	+		BT	3.5m	BT	Yes
75	118+900	+	3.5m	BT	3.5m	BT	No
76	119+700	Y	5.5m	BT			No
77	120+000	T	3.5m		3.5m	BT	Yes
78	120+600	Y	5.5m	BT			No
79	121+500	Y	5.5m	BT			No
80	122+900	T	3.5m	CC			No
81	126+300	T			3.5m	BT	No
82	126+400	T	3.5m	BT			No
83	127+100	T			3.5m	BT	No
84	127+400	+	3.5m	BT	3.5m	BT	No

Sn	Existing Chainage	Type of Junction	LHS		RHS		Median Opening Provided (Y/N)
			Width of Cross Road (m)	Surface Type	Width of Cross Road (m)	Surface Type	
85	128+250	T			3.5m	BT	No
86	129+700	T	3.5m	BT			Yes
87	133+700	T	3.5m	BT			Yes
88	144+600	T	3.5m	BT			No
89	146+900	T			3.5m	CC	No
90	146+950	T	3.5m	BT			No

6.2.7 Safety Barriers

Mainly two types of safety barriers were present in the project road. Metal Beam Crash barriers were present at carriageway edges at high embankment areas as well as in the median of urban stretches with 1.2 m wide median. Similarly, RCC Crash Barriers were present in the structure approaches and bridges.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	17.550
	Median	61.670
RCC Crash Barrier	Carriageway Edge	16.800
	Median	1.700

RCC Crash Barriers (LHS) and Metal Beam on Median (RHS) present on the project road

Detail location of existing metal beam crash barrier and RCC Crash barrier is presented in Annexure 2.1.

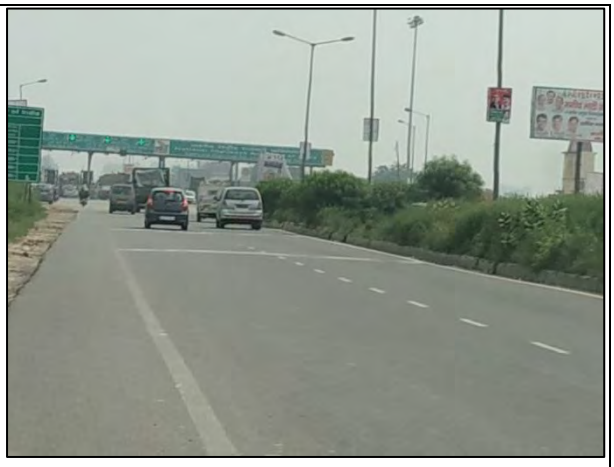
6.2.8 Toll Plaza and Other Facilities

There are 2 nos. of toll plaza in present project road at following locations.

I. Km 47+300 at Luharli:- *(4+1) lanes in each direction*

II. Km 113+300 at Somna:- *(4+1) lanes in each direction*

Details regarding the both the toll plaza has been discussed in the subsequent section.



Luharli Toll Plaza at Km 47+500

6.2.9 Highway Lighting

Highway Lighting has been provided at urban stretches, structure approaches and approaches to toll plaza. Additionally, High Mast Lamps are provided at major junctions of the project road.

Lighting location along the project road is presented in the table below:

Locations with Highway Lighting

S. No	Chainage		No. of Poles	Type of Pole (Single Arm / Double Arm)
	From	To		
1	147+000	148+000	19	Double Arm
2	145+000	147+000	29	Double Arm
3	143+400	144+200	22	Double Arm
4	139+800	142+300	77	Double Arm
5	138+000	138+600	19	Double Arm
6	134+600	135+200	20	Double Arm
7	132+500	133+000	18	Double Arm
8	131+500	132+000	19	Double Arm
9	130+000	131+300	39	Double Arm & Single Arm
10	127+200	129+000	56	Double Arm
11	123+000	126+700	115	Double Arm
12	120+500	122+000	40	Double Arm & Single Arm
13	106+600	107+300	24	Double Arm
14	91+200	92+400	36	Double Arm
15	87+000	88+000	35	Double Arm
16	83+700	84+700	18	Double Arm
17	79+000	80+000	21	Double Arm
18	73+000	74+000	19	Double Arm
19	71+500	72+200	26	Double Arm
20	65+750	66+400	20	Double Arm
21	55+400	56+400	38	Double Arm
22	48+650	54+000	167	Double Arm
23	47+050	47+600	18	Double Arm (Toll Plaza)

S. No	Chainage		No. of Poles	Type of Pole (Single Arm / Double Arm)
	From	To		
24	44+600	45+650	32	Double Arm
25	42+000	43+000	33	Double Arm
26	41+000	42+000	26	Single Arm
27	38+500	39+400	36	Double Arm
28	36+000	37+000	21	Double Arm
29	25+000	33+500	243	Double Arm
30	Toll Plaza-1		12	Double Arm & Single Arm
31	Toll Plaza-2		28	Double Arm & Single Arm
Total Lights			1326	
Total Single Arm			107	
Total Double Arm			1219	

Locations with Mast Light

S. No	Chaiange	No. of High Mast Light
1	23+600	1
2	54+100	1
3	59+950	1
4	69+000	1
5	74+600	1
6	84+800	1
7	91+000	1
8	93+650	1
9	135+750	1
10	149+300	1
11	Toll Plaza-1	2
12	Toll Plaza-2	2
Total		14

Highway Lighting at Km 138+000 to Km 139+000	Highway Lighting at Km 145+000 to Km 147+000
High Mast at Km 54+100	High Mast at Km 135+750

As per requirement of Schedule C, highway lighting is to be provided at approach of Grade Separated Structure, underpasses, toll plaza and its approaches, rest areas and bus stops. As per site assessment, missing lighting quantity is as follows:

Main Carriageway – 4.22 km
Entire Service / Slip Road, Bus Bays and Shelter – 91.20 km (46.07 km one side length of service / slip road has completed)

Also, following numbers of highway lighting is nonfunctional.

- 786 numbers of highway light post
- 5 nos of highway mast

6.2.10 Bus Bays and Bus Shelter

There are 36 Bus bays and 8 bus shelters along the project road. All bus shelters present in the project road are either damaged or are in poor conditions.

Bus Shelter at Km 51+800

Bus Shelter at Km 76+900

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay

LHS			RHS		
S. No	Chainage	Passenger Shelter (Y/N)	S. No	Chainage	Passenger Shelter (Y/N)
1	61+030	Yes	1	61+000	Yes
2	64+800	Yes	2	64+850	Yes
3	73+500	Yes	3	74+300	Yes
4	74+200	Yes	4	76+900	Yes
5	76+900	Yes	5	78+800	Yes
6	78+700	Yes	6	83+200	Yes
7	83+000	Yes	7	90+900	Yes
8	90+800	Yes	8	101+700	Yes
9	101+400	Yes	9	104+300	Yes
10	103+400	Yes	10	109+600	Yes

11	109+600	Yes	11	111+600	Yes
12	111+500	Yes	12	114+200	No
13	116+500	Yes	13	116+600	Yes
14	119+200	Yes	14	119+020	Yes
15	123+030	Yes	15	123+100	Yes
16	125+900	Yes	16	125+950	Yes
17	136+000	Yes	17	136+000	Yes
18	142+800	Yes	18	142+800	Yes

Locations of Bus Shelters

LHS			RHS		
S. No	Chainage	Passenger Shelter (Y/N)	S. No	Chainage	Passenger Shelter (Y/N)
1	51+800	Yes	1	31+400	Yes
2	124+300	Yes	2	51+800	Yes
			3	64+900	Yes
			4	66+700	Yes
			5	124+600	Yes
			6	136+175	Yes

As per Schedule C, 50 numbers of Bus bays and 76 numbers of shelters are to be provided.

6.2.11 Truck Lay Byes

Three numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay byes

S. No	Chainage	Side	Lighting	Condition of Toilet Block
1	60+400	LHS	Present	Poor
2	94+500	LHS	Present	Poor
3	55+000	RHS	Present	Poor
4	85+800	RHS	Present	Poor

As per Schedule C, total four numbers is to be provided.

Truck Laybye and Toilet Block at Km 85+800 RHS

6.2.12 Signage and Marking

Road Signs

1021 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be fair.

Advanced Sign on the Project Road	Hazard Sign and Pass Either Side Sign Board near GS Approach

Summary of different sign board found along the project road is presented below:

Summary of Traffic Signs on the Project Road

Type	LHS	RHS
	Number	Number
Right Curve	15	12
Left Curve	13	17
Median Opening	72	64
Destination Board	43	48
Direction Board	30	22
Hazard Marker	32	34
Speed Limit	25	34
Cross Road	22	17
Bus Bay	19	17
Gantry Board	12	17
Petrol Pump	12	7
Merging Traffic	0	0

Type	LHS	RHS
	Number	Number
Toll Board	18	19
Chevron	143	111
School Sign Board	7	11
Pass Either Side	5	2
Double Hazard Marker	3	1
Vertical Limit Sign Board	1	0
No Entry	23	21
Stop Sign	8	6
Go Slow	3	2
No Horn	5	8
S Curve	1	2
Route Marker	9	8
Truck lay bye	1	1
Merging Traffic Ahead	2	2
Speed Braker	1	1
Give way	1	1
Miscellaneous Sign	5	3
No U Turn	0	1
Vup Limit	0	1
Total	531	490

Kilometer wise numbers of road signs provided at site is presented in Annexure 2.1.

Road Marking

Road Marking along the project corridor was found to be in Fair to Poor condition. Marking were fairly present on the main carriageway but was found to be lacking on bus bays, junctions, service/slip roads etc. Apart from this, it was also observed that no remarking was done on overlaid sections.

Fair Marking on Six Lane GS Approach (Km 37+000 to Km 38+000 LHS)	Absense of Lane Marking (Km 68+000 to Km 69+000 LHS)

6.2.13 Landscaping and Tree Plantation

Apart from shrubs and bushes planted on 4.5 m wide median, no specific plantation or landscaping were observed on the project corridor. As per IE letter dated 24 May 2018, 20,000 numbers of median plants is required to be provided.

6.2.14 Drainage System

Existing drainage system of highway is poor at following locations:

a) KM 23.600 to Km 33.000
   FRL of existing carriageway is at same level of ground level and road side drain is absent.
b) Super elevated portion – median drain are not functional
c) RCC Drain along service road, slip road (31.280 km length balance)
d) At high embankment section: approach of VUP, ROB where partial RE Wall or free slope is provided. The following location has provided partial RE Wall or free slope:

   Approach of VUP at Km 87.724

   Approach of VUP at Km 145.425

   Approach of VUP at Km 73.341

   Approach of VUP at Km 91.866

   Approach of VUP at Km 139.712, Km 139.927

   Approach of VUP at 143.536

   Approach of ROB at Km 120.169

   Approach of ROB at Km 145.825

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of senior bridge engineers and junior engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc**.** and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation.
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- ✓ 4 nos. of Railway over Bride were found during site inspection (matching as per schedule –B).
- ✓ 18 nos. of Minor bridges total found at site (10 as per schedule – B). As per inventory 7 nos found are in Schedule location and 1 no is found as culvert. 11nos new minor bridges found at locations not matching with Schedule.
- ✓ 6 nos. of Flyover/Grade separators were found during inventory (matching as per schedule – B)
- ✓ 19 nos. of VUPs were found at site. As per schedule – B there are 24 nos. of VUP out of which 15nos found at same location and 4nos at location not matching with Schedule.
- ✓ 105 (box/slab/Pipe) Culverts found at site, (151 as per schedule – B). In addition to location mentioned in schedule 18 nos. new culvers exists. Structures summary listed in table below.

The detailed inventory and condition survey of the culverts and Bridges are presented in **Annexure 2.3 and 2.4** of this report.

TABLE 1: SUMMARY OF STRUCTURES

Particulars	Unit	Schedule B	As per inventory	Remarks
VUP	Nos	24	19	15 VUPs mentioned in Schedule B are found and 4 Additional VUPs are also found.
Culverts	Nos	151	105	105nos. Culverts found at locations mentioned in Schedule B and 18nos. additional Culverts are also found (i. e. at locations not matching with Schedule).
Minor Bridge	Nos	10	18	8 MNBs mentioned in Schedule B are found (out of 8, 7 are MNB and 1 Culvert) and 11 Additional MNBs are also found.
ROB	Nos	4	4	
Grade separator	Nos	6	6	

6.3.2 Detailed Description of Structures

6.3.2.1 FLYOVER

As per site investigation, 6 Flyover were observed. The Flyovers were in structurally fair condition however few defects were observed. Salient features of Flyover are discussed as follows.

TABLE 2: LIST OF FLY OVERS

	AS PER SCHEDULE			AS PER SITE	
S.NO.	Design Chainage		Span Arrangement	Span Arrangement as per Site	Remarks
1	33+650	LHS	-	-	
		RHS	1 x 30.00	1 x 30.00	
2	41+800	LHS	-	-	
		RHS	1 x 30.00	1 x 30.00	

3	129+700	LHS	1 x 30.00	1 x 30.00	
		RHS	-	-	
4	140+620	LHS	2 x 30.00	2 x 30.00	
		RHS	2 x 30.00	2 x 30.00	
5	141+260	LHS	1 x 30.00	1 x 30.00	
		RHS	1 x 30.00	1 x 30.00	
6	143+980	LHS	1 x 30.00	1 x 30.00	
		RHS	1 x 30.00	1 x 30.00	

For Detailed Condition Survey refer **Annexure 2.4**.

1. Flyover – At CH. 33+650

It consists of new bridge on RHS. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.

No Such measures are required as structure is in under construction state.

A few pictures to ascertain the conditions of Flyover are presented as follows:

Carriage Way

Span Arrangement

2. Flyover – At CH. 41+800

It consists of new bridge on RHS. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.

The flyover is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.

Following measures are required

1. Debris shall be removed from the deck.

A few pictures to ascertain the conditions of Flyover are presented as follows

Carriage Way

Span Arrangement

3. Flyover – At CH. 129+700

It consists of new bridge on LHS. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.
The flyover is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.

A few pictures to ascertain the conditions of Flyover are presented as follows

Carriage Way

Span Arrangement

4. Flyover – At CH. 140+620

It consists of new bridge on LHS & RHS. The new bridge has a span arrangement of 2 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.
The flyover is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.
Structure is found in fair condition.

A few pictures to ascertain the conditions of Flyover are presented as follows

Carriage Way

Span Arrangement

5. Flyover – At CH. 141+260

It consists of new bridge on LHS & RHS. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.
The flyover is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.
Structure is found in fair condition.
A few pictures to ascertain the conditions of Flyover are presented as follows

Carriage Way **Super Structure in fair condition**

6. Flyover – At CH. 143+980

It consists of new bridge on LHS & RHS. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.
The flyover is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.

Structure is found in fair condition.

A few pictures to ascertain the conditions of Flyover are presented as follows

Carriage Way

Span Arrangement

6.3.2.2 MINOR BRIDGES (MNB)

As per site investigation, 18 Minor bridges were observed. The Minor bridges are in structurally fair condition however few defects were observed. Salient features of Minor bridges are discussed as follows.

Table 3: List of Minor Bridge

	AS PER SCHEDULE			AS PER SITE	
S.NO.	**Design Chainage**		**Span Arrangement**	**Span Arrangement as per Site**	**Remarks**
1	35+720	LHS	2 x 5.0m	2 x 5.0m; Skew= 15˚	
		RHS	2 x 5.0m	2 x 5.0m; Skew= 15˚	
2	36+840	LHS	2 x 5.0m	2 x 5.0m; Skew= 20˚	
		RHS	2 x 5.0m	2 x 5.0m; Skew= 20˚	
3	40+501	LHS	1 x 21.6m	1 x 21.6m; Skew= 40˚	
		RHS	1 x 21.6m	1 x 21.6m; Skew= 40˚	
4	44+908	LHS	2 x 5.0m	2 x 5.0m+1x3.0m	
		RHS	2 x 5.0m	2 x 5.0m+1x3.0m	
5	46+805	LHS	3 x 25.0m	3 x 25.0m	
		RHS	2 x 25.0m	3 x 25.0m	
6	59+500	LHS	-	2 x 5.0m	Additional
		RHS	-	2 x 5.0m	
7	61+900	LHS	3 x 5.0m	3 x 5.0m	
		RHS	3 x 5.0m	3 x 5.0m	
8	73+950	LHS	-	1 x 14.5m; Skew= 50˚	Additional
		RHS	-	1 x 14.5m; Skew= 50˚	
9	86+700	LHS	-	1 x 11.0m; Skew= 70˚	Additional
		RHS	-	1 x 11.0m; Skew= 70˚	
10	86+750	LHS	-	1 x 8.0m; Skew= 50˚	Additional
		RHS	-	1 x 8.0m; Skew= 50˚	
11	88+520	LHS	-	1 x 10.0m; Skew= 60˚	Additional

	AS PER SCHEDULE			AS PER SITE	
S.NO.	Design Chainage		Span Arrangement	Span Arrangement as per Site	Remarks
		RHS	-	1 x 10.0m; Skew= 60˚	
12	100+545	LHS	-	1 x 12.6m; Skew= 60˚	Additional
		RHS	-	1 x 12.6m; Skew= 60˚	
13	109+682	LHS	-	1 x 8.0m; Skew= 40˚	Additional
		RHS	-	1 x 8.0m; Skew= 40˚	
14	111+490	LHS	7 x 7.5m	7 x 7.5m	
		RHS	4 x 15.0m	4 x 15.0m	
15	117+190	LHS	-	1 x 8.2m; Skew= 30˚	Additional
		RHS	-	1 x 8.2m; Skew= 30˚	
16	136+100	LHS	-	2 x 5.0m	Additional
		RHS	-	2 x 5.0m	
17	140+600	LHS	-	3 x 5.0m; Skew= 40˚	Additional
		RHS	-	3 x 5.0m; Skew= 40˚	
18	149+160	LHS	-	2 x 5.0m	Additional
		RHS	-	2 x 5.0m	

For Detailed Condition Survey refer **Annexure 2.4**.

1. Minor bridge – CH. 35+720

It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, stone pitching etc.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

2. Minor bridge – CH. 36+840

It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, stone pitching etc.

Following measures shall be performed

1. Debris from deck slab shall be removed.
2. Vegetation growth around structure shall be removed.
3. Stone pitching shall be repaired (4 quadrant) to protect slope.
4. All drainage spouts shall be cleaned for better functioning (7 Nos).

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

3. Minor bridge – CH. 40+501

It consists of new bridge on carriageway. The new bridge has a span arrangement of 1 x 30.00m. The super structure comprises of PSC T Beam-Girder. POT-PTFE bearings are adopted for resting of superstructure on wall type pier abutment and foundation not visible.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joints etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. All drainage spouts shall be cleaned for better functioning (6 Nos).
3. Epoxy grouting for girders (50 sqm).

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

Super Structure in poor condition

4. Minor bridge – CH. 44+908

It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50+ 1x3x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

5. Minor bridge – CH. 46+805

It consists of old bridge on LHS and new bridge on RHS. The old bridge has a span arrangement of 3 x 25.0m. The super structure comprises of RCC Girder & Arch bridge. The Foundation is not visible. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and wall type pier.
The new bridge has a span arrangement of 3 x 25.0m. The super structure comprises of PSC Girder. The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearings, expansion joints etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. Parapet on LHS Bridge shall be repaired (25rm).
3. All drainage spouts shall be cleaned for better functioning (6 Nos).
4. Wearing course shall be provided (322 sqm)

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way on LHS

Span Arrangement on LHS

Vegetation growth on LHS

Carriage Way on RHS

6. Minor bridge – CH. 59+500

   It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50 m RCC Box with raft foundation.
   The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and stone pitching, expansion joints etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

   A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

7. Minor bridge – CH. 61+900

It consists of new bridge on both carriageways. It has a span arrangement of 3x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and stone pitching, expansion joints etc.
.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. Stone pitching shall be provided (2 quadrant)

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

8. Minor bridge – CH. 73+950

It consists of new bridge on both carriageways. It has a span arrangement of 1 x 14.50m. The super structure comprises of Solid slab. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC wall type abutment.

The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearings, expansion joints etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

9. Minor bridge – CH. 86+700

It consists of new bridge on both carriageways. It has a span arrangement of 1x11x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

10. Minor bridge – CH. 86+750

It consists of new bridge on both carriageways. It has a span arrangement of 1x8x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

11. Minor bridge – CH. 88+520

It consists of new bridge on both carriageways. It has a span arrangement of 1x10x1.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. Stone Pitching shall be restored (4 Quadrant).

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

12. Minor bridge – CH. 100+545

It consists of new bridge on both carriageways. It has a span arrangement of 1x12.6x1.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

13. Minor bridge – CH. 109+682

It consists of new bridge on both carriageways. It has a span arrangement of 1x8.0x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. Stone pitching shall be restored (4 quadrant)
3. All drainage spouts shall be cleaned for better functioning (6 Nos).

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

14. Minor bridge – CH. 111+490

It consists of old bridge on LHS and new bridge on RHS. The old bridge has a span arrangement of 7 x 7.50m. The super structure comprises of RCC Solid slab. The Foundation is not visible. Tarpaper bearings is adopted for resting of superstructure on RCC wall type abutment and wall type pier.
The new bridge has a span arrangement of 4 x 15.0m. The super structure comprises of RCC Girder. The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearings, expansion joints etc.

Following measures shall be performed

1. Vegetation growth around structure shall be removed.
2. Elastomer of Expansion joint shall be replaced (2 x 27.5m) on RHS.
3. Wearing coat shall be repaired (20 sqm on RHS).

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way on LHS

Carriage Way on RHS

Damaged Expansion Joint

Span Arrangement on RHS

15. Minor bridge – CH. 117+190

It consists of new bridge on both carriageways. It has a span arrangement of 1x8.2x2.50 m RCC Box with raft foundation.

The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc. Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

16. Minor bridge – CH. 136+100

It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc. Following measures shall be performed

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

17. Minor bridge – CH. 140+600

It consists of new bridge on both carriageways of service road. It has a span arrangement of 3x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

18. Minor bridge – CH. 149+160

It consists of new bridge on both carriageways. It has a span arrangement of 2x5x2.50 m RCC Box with raft foundation.
The general condition of the bridge is good and only requires regular repair works such as painting and fixing of crash barrier etc. Following measures shall be performed

Following measures shall be performed

1. Vegetation growth around structure shall be removed.

A few pictures to ascertain the conditions of Minor Bridges are presented as follows

Carriage Way

Span Arrangement

6.3.3 RAILWAY OVER BRIDGES (ROB)

A structure provided over the railway lines to carry the Project Highway termed as Road over Bridge (ROB).As per site investigation, 4 Railway over Bridges (ROB) are observed. The ROBs are in structurally fair condition however a few defects were observed. Salient features of ROBs are discussed as follows.

TABLE 4: LIST OF ROB

AS PER SCHEDULE				AS PER SITE	
S.NO.	Design Chainage		Span Arrangement	Span Arrangement as per Site	Remarks
1	36+340	LHS	1x31.0 + 1x40.0 + 1x15.0m	1x31.0 + 1x39.0 + 1x15.0m	
		RHS	1x31.0 + 1x40.0 + 1x15.0m	1x31.0 + 1x39.0 + 1x15.0m	
2	83+955	LHS	3x36.0 + 2x23.0m	1x66+1x64+1x40m	
		RHS	3x36.0 + 2x23.0m	1x66+1x64+1x40m	
3	120+169	LHS	1x40.0 + 2x15.0m	1x40.0 + 2x15.0m	
		RHS	-	1 x 28.0m	
4	145+825	LHS	1x40.0 + 2x15.0m	1x40.0 + 2x15.0m	
		RHS	1x40.0 + 2x15.0m	1x40.0 + 2x15.0m	

For Detailed Condition Survey refer **Annexure 2.4**.

1. ROB – CH. 36+340

   It consists of new bridge on over Railway tracks both sides. The bridge has a span arrangement of 1x31.0 + 1x39.0 + 1x15.0m. The super structure comprises of steel composite girder. The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.

   The ROB is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joint etc

   Following measures are required

1. Vegetation growth around abutments and deck slab shall be removed.
2. LHS Side approach slope is damaged due to which one lane is closed for traffic.

3. Elastomer of Expansion Joint shall be replaced both side.

A few pictures to ascertain the conditions of ROB are presented as follows

Carriage Way on LHS

Span Arrangement on LHS

Carriage Way on RHS

Damaged Expansion Joint

2. ROB – CH. 83+955

It consists of new bridge on over Railway tracks both sides. The bridge has a span arrangement of 1x66+1x64+1x40m. The super structure comprises of steel composite girder. The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.

The ROB is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joint etc

Following measures are required

1. Vegetation growth around abutments and deck slab shall be removed.
2. All the drainage spouts shall be Cleaned
3. Debris shall be removed from deck slab

A few pictures to ascertain the conditions of ROB are presented as follows

Carriage Way on LHS

Span Arrangement on LHS

3. ROB – CH. 120+169

It consists of old bridge on RHS and new bridge on LHS over Railway track. The old bridge has a span arrangement of 1x28.0m. The super structure comprises of PSC Pipe Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC wall type abutment.

The ROB is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier and periodic maintenance of bearing, expansion joint
Etc.

The new bridge has a span arrangement of 1x40.0 + 2x15.0m. The super structure comprises of steel girder and I girder.The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.

The ROB is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spout and periodic maintenance of bearing, expansion joint etc.
Following measures are required

1. Vegetation growth around abutments and deck slab shall be removed.
2. All the drainage spouts shall be Cleaned
3. Debris shall be removed from deck slab

A few pictures to ascertain the conditions of ROB are presented as follows

Carriage Way on LHS

Span Arrangement on LHS

Carriage Way on RHS

Span Arrangement on RHS

4. ROB – CH. 145+825

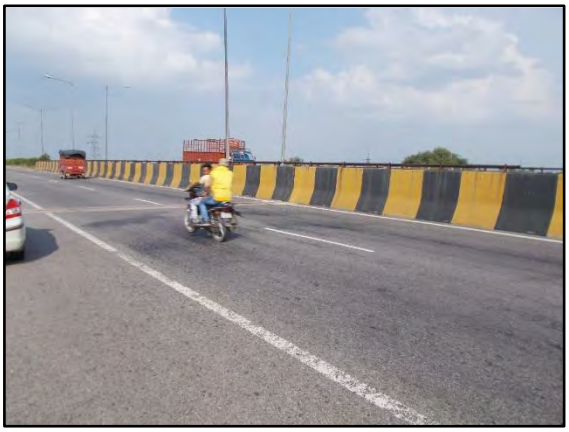
It consists of new bridge on over Railway tracks both sides. The bridge has a span arrangement of 1x40.0 + 2x15.0 m. The super structure comprises of steel composite girder. The Foundation is not visible. POTPTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier.

The ROB is generally in good condition and only requires regular repair works such as painting and fixing of crash barrier, cleaning of drainage spouts and periodic maintenance of bearing, expansion joint etc.

Following measures are required

1. Vegetation growth around abutments and deck slab shall be removed.

A few pictures to ascertain the conditions of ROB are presented as follows



Carriage Way on LHS

Span Arrangement on LHS

Carriage Way on RHS

Super Structure in fair condition

6.3.4 VEHICULAR UNDERPASS (VUP)

A grade separated structure which is provided for crossing of vehicles under the Project Highway is called as Vehicular Underpass (VUP). As per site investigation, 19 VUPs are observed in which mostly structures are constructed as Box structure. The VUPs are in structurally fair condition however a few defects were observed. Salient features of VUP are discussed below.

For Detailed Condition Survey refer **Annexure 2.4**.

TABLE 5: LIST OF VUPS

S. No.	Chainage (km)		Span Arrangement (m)	Carriageway (m)	Deck Width (m)	Remarks	Measures to be taken
1	37+705	LHS	1 x 10.0 x 5.5	10.5	14.50	Fair	**1. Vegetation shall be removed around structure.**
		RHS	1 x 10.0 x 5.5	10.5	14.50	Fair	
2	38+705	LHS	1 x 10.0 x 5.5	10.5	14.50	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	14.50	Fair	
3	50+600	LHS	1 x 10.0 x 5.5	10.5	25.20	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	25.20	Fair	
4	55+905	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	1. Approach slab & Crash barrier to be repaired
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
5	62+250	-	-	-	-	-	2. Debris shall be removed around structure.
		RHS	1 x 10.0 x 5.5	10.5	12.50	Fair	
6	65+870	LHS	1 x 10.0 x 5.5	10.5	25.20	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	25.20	Fair	

S. No.	Chainage (km)		Span Arrangement (m)	Carriageway (m)	Deck Width (m)	Remarks	Measures to be taken
7	71+800	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	1. Approach slab & to be repaired
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
8	73+240	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
9	79+500	LHS	1 x 10.0 x 5.5	10.5	25.20	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	25.20	Fair	
10	87+360	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
11	91+330	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	Structure is in fair condition.).
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
12	106+450	LHS	1 x 10.0 x 5.5	10.5	25.20	Fair	1. RE Wall Panels shall be properly aligned.
		RHS	1 x 10.0 x 5.5	10.5	25.20	Fair	
13	131+010	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition.**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
14	132+020	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	1. Stone Pitching shall be restored on both sides
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	2. Crash Barrier shall be repaired

S. No.	Chainage (km)		Span Arrangement (m)	Carriageway (m)	Deck Width (m)	Remarks	Measures to be taken
							(2rm) near approaches.
15	134+186	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
16	137+570	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
17	139+700	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	**Structure is in fair condition**
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
18	139+950	LHS	1 x 10.0 x 5.5	10.5	28.50	Fair	1. Stone Pitching shall be restored.
		RHS	1 x 10.0 x 5.5	10.5	28.50	Fair	
19	147+430	LHS	1 x 12.5 x 5.5	10.5	28.50	Fair	**Structure is in fair condition.**
		RHS	1 x 12.5 x 5.5	10.5	28.50	Fair	

A few pictures to ascertain the conditions of VUPs are presented as follows

VUP at Ch. 37+705

VUP at Ch. 38+705

VUP at Ch. 50+600

VUP at Ch. 55+905

VUP at Ch. 62+250

VUP at Ch. 65+870

VUP at Ch. 71+800

VUP at Ch. 73+240

VUP at Ch. 79+500

VUP at Ch. 87+360

VUP at Ch. 91+330

VUP at Ch. 106+450

VUP at Ch. 131+010

VUP at Ch. 132+020

VUP at Ch. 134+186

VUP at Ch. 137+570

VUP at Ch. 139+700

VUP at Ch. 139+950

VUP at Ch. 147+430

6.3.5 CULVERTS:

As per site investigation, 105 culverts are observed out of 151 culverts. The culverts are in fair condition however few culverts were found to be chocked and concessionaire is advised to clean them periodically. Salient features of Culverts are discussed in **Annexure 2.4**.

Following are observations in all the culverts:

- Quad Pitching damaged
- Rough Stone Apron Damaged
- Debris Silt observed in vent way of culverts
- Vegetation observed around the culvert

Following measures are required:

Pipe Culverts:-

- Removal of debris and silt in the vent
- Quadrant pitching shall be provided
- Flexible Apron Restoration
- Removal of vegetation around the culverts

Box Culverts:-

- Removal of debris and silt in the vent
- Rigid Apron Restoration
- Flexible Apron Restoration
- Curtain Wall to be Repaired

- Removal of vegetation around the culverts

A few pictures to ascertain the conditions of Culverts are presented as follows

Box Culvert at Ch. 26+557

Box Culvert at Ch. 27+625

Box Culvert at Ch. 32+015

Box Culvert at Ch. 34+110

Box Culvert at Ch. 42+750

Box Culvert at Ch. 50+308

Box Culvert at Ch. 54+570

Box Culvert at Ch. 66+838

Box Culvert at Ch. 67+883

Box Culvert at Ch. 73+460

Box Culvert at Ch. 78+932

Box Culvert at Ch. 80+268

Box Culvert at Ch. 93+500

Box Culvert at Ch. 97+100

Box Culvert at Ch. 101+488

Box Culvert at Ch. 102+800

Box Culvert at Ch. 114+985

Box Culvert at Ch. 126+400

Pipe Culvert at Ch. 34+720

Pipe Culvert at Ch. 35+550

Pipe Culvert at Ch. 36+920

Pipe Culvert at Ch. 38+150

Pipe Culvert at Ch. 40+650

Pipe Culvert at Ch. 54+750

Pipe Culvert at Ch. 56+600

Pipe Culvert at Ch. 60+708

Pipe Culvert at Ch. 68+658

Pipe Culvert at Ch. 87+050

Pipe Culvert at Ch. 91+400

Pipe Culvert at Ch. 98+687

Pipe Culvert at Ch. 122+434

Pipe Culvert at Ch. 130+500

Pipe Culvert at Ch. 138+650

Pipe Culvert at Ch. 146+350

6.3.6 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Structure Type	Sn	Chainage	Side	Span	CW Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition											Projected Overall Stability of Structure till the end of Concession period	Additional Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash Barrier/Hand Rail)	Wearing Coat	Approaches including approach slab	Adequacy of Water Way	Drainage Spouts		
	Flyover																		
FLY OVER	1	33.650	LHS	1x30	12.5														Incomplete Construction
			RHS	1x30	12.5														
	2	41.800	LHS																
			RHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
	3	129.700	LHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS																
	4	140.620	LHS	2x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
	5	141.260	LHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
	6	143.980	LHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x30	12.5		●	●	●	●	●	●	●	●	●	●	●	Stable	

MNB	1	25.956	LHS	2x5.0	45.000														Not Found
			RHS	2x5.0															
	2	35.720	LHS	2x5.0	33.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x5.0			●	●	●	●	●	●	●	●	●	●	●	Stable	
	3	36.840	LHS	2x5.0	33.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x5.0			●	●	●	●	●	●	●	●	●	●	●	Stable	
	4	40.501	LHS	1x30 (Skew 40)	2x14.25		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x30 (Skew 40)			●	●	●	●	●	●	●	●	●	●	●	Stable	
	5	44.908	LHS	2x5.0	41.000		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x5.0			●	●	●	●	●	●	●	●	●	●	●	Stable	
	6	46.805	LHS	2x25*	2x14.25		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x25*			●	●	●	●	●	●	●	●	●	●	●	Stable	
	7	56.800	LHS	2x5.0	33.500														Not Found
			RHS	2x5.0															
	8	59.500	LHS	2x5.0	33.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2x5.0			●	●	●	●	●	●	●	●	●	●	●	Stable	

	9	61.900	LHS	3x5.0	33.5		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	3x5.0			●	●	●	●	●	●	●	●	●	●	●	Stable	
	10	73.950	LHS	1x14.5	32.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x14.5			●	●	●	●	●	●	●	●	●	●	●	Stable	
	11	86+700	LHS	1 x 11 70deg	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1 x 11 70deg			●	●	●	●	●	●	●	●	●	●	●	Stable	
	12	86+750	LHS	1 x 8 (Skew-50)	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1 x 8 (Skew-50)			●	●	●	●	●	●	●	●	●	●	●	Stable	
	13	88.520	LHS	1x10.0 Skew-60	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x10.0 Skew-60			●	●	●	●	●	●	●	●	●	●	●	Stable	
	14	100.545	LHS	1x12.6 Skew-60	41.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1x12.6 Skew-60			●	●	●	●	●	●	●	●	●	●	●	Stable	
	15	109.682	LHS	1 x 8 (Skew-40)	27.500		●	●	●	●	●	●	●	●	●	●	●	Stable	

			RHS	1 x 8 (Skew-40)			●	●	●	●	●	●	●	●	●	●	●	Stable	
	16	111.490	LHS	4x15*	2x14.25		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	4x15*			●	●	●	●	●	●	●	●	●	●	●	Stable	
	17	117.190	LHS	1 x 8.2 (Skew-30)	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	1 x 8.2 (Skew-30)			●	●	●	●	●	●	●	●	●	●	●	Stable	
	18	136.100	LHS	2 x 5	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2 x 5			●	●	●	●	●	●	●	●	●	●	●	Stable	
	19	140.000	LHS	3x5.0	33.500														Not Found
			RHS	3x5.0															
	20	140.600	LHS	3 x 5	33.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	3 x 5			●	●	●	●	●	●	●	●	●	●	●	Stable	
	21	149.160	LHS	2 x 5	26.500		●	●	●	●	●	●	●	●	●	●	●	Stable	
			RHS	2 x 5			●	●	●	●	●	●	●	●	●	●	●	Stable	
ROB	1	36.340	LHS	1x31+1x40+1x15	2x14.25		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x31+1x40+1x15			●	●	●	●	●	●	●	●	●		●	Stable	

	2	83.955	LHS	3x36+2x23 (Skew 70 degree)	2x14.25		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	3x36+2x23 (Skew 70 degree)			●	●	●	●	●	●	●	●	●		●	Stable	
	3	120.169	LHS	1x40+2x15 (normal) (Skew 30 deg)	2x14.25		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x40+2x15 (normal) (Skew 30 deg)			●	●	●	●	●	●	●	●	●		●	Stable	
	4	145.825	LHS	1x40+2x15 (Skew 17 degree)	2x14.25		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x40+2x15 (Skew 17 degree)			●	●	●	●	●	●	●	●	●		●	Stable	
VUPS	1	25.550	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	2	27.100	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	3	29.200	LHS	1x10.0x5.5	25.2														Not Found

			RHS	1x10.0x5.5															
	4	31.050	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	5	37.705	LHS	1x10.0x5.5	32.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	6	38.705	LHS	1x10.0x5.5	32.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	7	42.970	LHS	1x10.0x5.5	28.5														Not Found
			RHS	1x10.0x5.5															
	8	50.600	LHS	1x10.0x5.5	25.2		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	9	55.905	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	10	62.250	LHS		12.5		●											Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	11	65.870	LHS	1x10.0x5.5	25.2		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	12	71.800	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	

	13	73.240	LHS	1x10.0x5.0	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.0			●	●	●	●	●	●	●	●	●		●	Stable	
	14	79.500	LHS	1x10.0x5.5	25.2		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	15	87.360	LHS	1x10x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	16	91.330	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	17	99.450	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	18	106.450	LHS	1x10.0x5.5	25.2		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	19	123.400	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	20	126.675	LHS	1x10.0x5.5	25.2														Not Found
			RHS	1x10.0x5.5															
	21	131.010	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	22	132.020	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	

			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	23	134.180	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	24	137.570	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	25	139.700	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	26	139.950	LHS	1x10.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x10.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	
	27	145.850	LHS	1x10.0x5.5	28.5														Not Found
			RHS	1x10.0x5.5															
	28	147.430	LHS	1x30.0x5.5	28.5		●	●	●	●	●	●	●	●	●		●	Stable	
			RHS	1x30.0x5.5			●	●	●	●	●	●	●	●	●		●	Stable	

AECOM Imagine it. Delivered.

TECHNICAL DUE DILIGENCE REPORT

Hazaribagh Tollway Limited

Report Number:

ACM-60657056-TDD-HREL-001-R1

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Hazaribagh Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the Cube **Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Hazaribagh Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Hazaribagh Tollway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset No. 5B,
Aerocity Hospitality District,
IGI Airport, New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **4**

Project Background 4
Project Salient Features 4
Project Principle Participants 5
Project Operation and Maintenance Cost 5
Limitation of Scope 8

1. INTRODUCTION **9**

1.1 Project Background 9
1.2 AECOM 12
1.3 Scope of Works 12
1.4 Site Visit and Key Points covered during Site Visit 13
1.5 Data Shared by the Company 13

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **15**

2.1 General 15
2.2 Estimation of Design Traffic 16
2.3 Test Pit 16
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 16
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 16
2.6 Roughness Survey using Network Survey Vehicle (NSV) 16
2.7 Pavement Condition Mapping 16
2.8 Determination of Pavement Major Maintenance 17
2.9 Base Year Pavement Rehabilitation Requirement 17
2.10 Future Maintenance Requirements 17

3. CAPEX REQUIREMENT **19**

3.1 CAPEX needs 19
3.3 Unit Rate Analysis 22
3.4 Cost Estimate 23

4. MAJOR MAINTENANCE COST **24**

4.1 Major Maintenance Cycle 24
4.2 Major Maintenance Quantity 24
4.3 Unit Rate Analysis 25
4.4 Cost Estimate 26

5. OPEATION AND MAINTANANCE COST - OPEX **28**

5.1 O & M Requirement as per CA 28
5.2 O & M Strategy 31
5.3 Routine and Preventive Maintenance 32
5.4 Preventive Maintenance 32
5.5 6.4 Highway Lighting 32
5.6 ATMS and TMS Cost 33
5.7 Incident Management 33
5.8 Manpower Cost 33
5.9 Office Expenses 34

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **36**

6.1 Reconnaissance Survey 36
6.2 Road Inventory and Condition Survey 36
6.3 Inventory and Condition Survey of Structures 48

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
HREL	Hazaribagh Ranchi Expressway Limited
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological

MIS	Management Information System
MJB	Major Bridge
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Hazaribagh Tollway Limited (“HTL”) is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India (“SEBI”) as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways (hereinafter “the Client”) has appointed M/s AECOM India Private Limited (hereinafter referred as “Technical Consultant”) to carry out Technical Due Diligence of operational asset of Four Laning of Hazaribagh Ranchi Section from Km 41+500 to Km 115+290 of NH 26 in the State of Jharkhand is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI) which is being operated by Hazaribagh Ranchi Expressway Limited (HREL).

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client. This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Hazaribagh-Ranchi including Ramgarh bypass Section from KM 41+500 to Km 115+290 of NH 33 in the State of Jharkhand
Project Length	73.790 km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Hazaribagh Tollway Limited
Appointed Date	Oct 2020
O & M Handover Date	March 2028
Concession Period	30 Years
End of Concession Period	Mar 2050
Likely End of Concession Period	Mar 2050
Six Lanning under EPC by NHAI	To be completed by FY 2037/38*
Number of Toll Plaza	1 nos, plaza having 12 lanes including extra width

* - as per information provided by the Company

Project Principle Participants

Major project participants and their roles are as stated in the following table:

S.N.	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Hazaribagh Tollway Limited
3	Independent Engineer	
4	Maintenance Contractor	1) Toll Plaza (Markolines Traffic Controls Pvt Ltd.), 2) Incident Management (Markolines) 3) G4S India for Security
5	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 18 months.

- Construction of New Service Road & Structures
- Widening of Cross Drainage Works
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 87.80 crore including GST as on FY 2023.

b) Major Maintenance (MM) Cost

The project road is being maintained by the existing Annuity Concessionaire till Mar 2028 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2028. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1	2032/33	Main Carriageway - 40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length. Service Road - 30 mm BC in 50% of length, Microsurfacing in 50% of length.	141.45
2	2036/37-38/39	6 Lanning under EPC	
3	2045/46	Main Carriageway - 30 mm BC in entire length in 6L. Service Road - 30 mm BC in 50% of length, Microsurfacing in 50% of length.	160.69
4	2049/50	Main Carriageway - 30 mm BC in entire length in 6L. Service Road - 30 mm BC in 50% of length, Microsurfacing in 50% of length.	201.23

The above cost of MM is based on Cube Input for rate of bitumen and escalation factor. The bitumen rate is considered flat from FY 2024 onwards till end of concession period and escalation is applied only for other component of MM works i.e. except bitumen cost.

As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways shall be after completion of revised Concession Period i.e. after FY 2037/38.

c) Operation and Maintenance (OpEX)

The project road is currently maintained by Annuity Concessionaire and O & M handover will be on Mar 2028. The Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway from Mar 2028 to end of Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2021/21 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	15,902,878
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	6,477,819
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	8,662,148
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	4,383,328
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	2,711,386
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	3,161,455
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	8,158,056
11	Community Development	Includes CSR related expenses.	648,757
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	2,744,318
15	IE Fees	Includes IE fees.	2,744,318
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	

Sl. No.	Description	Remarks	Amount (in INR)
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	
		O & M Cost for Year 2022-23	74,336,843

A total of Rs. 7.43 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs

1. INTRODUCTION

1.1 Project Background

Hazaribagh Tollway Limited (hereinafter referred to as HTL or the Concessionaire), is a company promoted by Cube Mobility Investments Pte. Ltd. (herein after refer as Cube Highways or the Company) to undertake Tolling, Operation, Maintenance & Transfer (TOT Model) of Hazaribagh – Ranchi Section from Km 41+500 to Km 115+290 of NH 33 in the State of Jharkhand is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI).

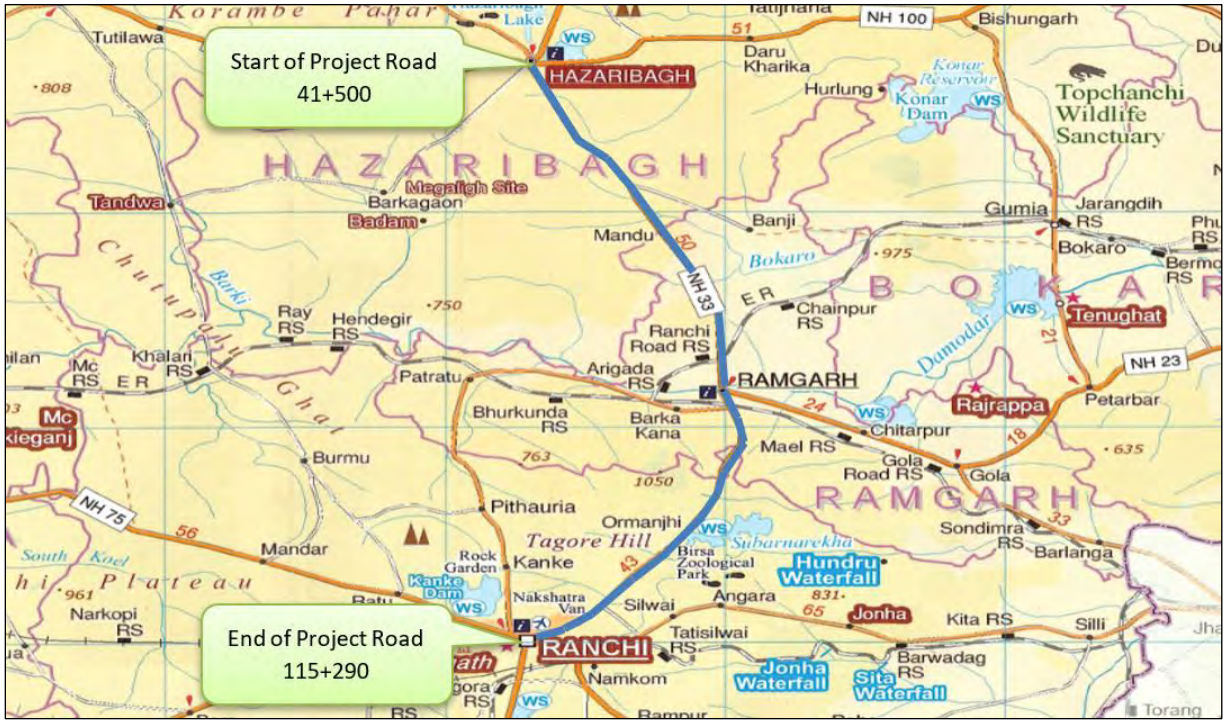
In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 33 start from Km 41+500 at Hazaribagh and ends at Km 115+290 at Ranchi. NH 33, one of the major arterial roads of the country originates from Barhi in Hazaribagh district in Jharkhand and ends at Baharagora in East Singhbhum, which share border with Bengal and Odisha. The total length of highway from Hazaribagh to Ranchi is 73.790 km. Major cities along NH 33 are Hazaribagh and Ranchi. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	73.79 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement - MCW & Service Road Rigid Pavement -Toll Plaza
Shoulder	1 m earthen for MCW at Rural Area
Service Road / Slip Road	3.01 km one side length having width of 5.5 m
Major / Minor Junction	1 Major & 14 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 4.870 Km
Median Opening	24 Nos
Toll Plaza	1 Nos – 12 lanes (6 + 6 lanes on each side)
Truck Lay-bys	6 Nos
Bus Bays with shelter	22 Bus Shelter
Highway Lighting	289 Nos. Double Arm & 115 Nos. Single Arm

Description	Project Features
High Mast	5 nos
Highway Patrol	1 nos (To be deployed after O&M handover)
Ambulance	1 nos (To be deployed after O&M handover)
Crane	1 nos (To be deployed after O&M handover)

b) Structure

Description	Project Features
Major Bridge	1 No
Minor Bridge	9 Nos
Flyovers	0
Road Over Bridge (ROB)	3 No
Road Under Bridge (RUB)	1 No
Vehicular Under Pass (VUP)	6 No
Pedestrian/Cattle Under Pass	2 No
Box Culverts	40 Nos
Pipe Culverts	88 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.
b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work

- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

Project is being maintained by Annuity Concessionaire. Data not available.

2.3 Test Pit

Project is being maintained by Annuity Concessionaire. Data not available.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

Project is being maintained by Annuity Concessionaire. Data not available.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

Project is being maintained by Annuity Concessionaire. Data not available.

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Project is being maintained by Annuity Concessionaire. Data not available.

2.7 Pavement Condition Mapping

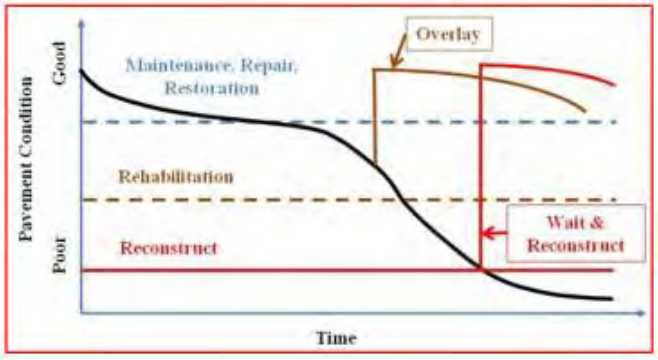
Based on the pavement investigation survey results (NSV Survey and FWD Survey and Visual Survey), the section along the Project Stretch were classified as Good, Fair and Poor with appropriate color as below:

Condition	Color adopted
Good	
Fair	
Poor	

Project is being maintained by Annuity Concessionaire. Data not available.

2.8 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.9 Base Year Pavement Rehabilitation Requirement

Not applicable as project road in under Annuity.

2.10 Future Maintenance Requirements

The project road is being maintained by the existing Annuity Concessionaire till Mar 2028 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2028. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Six Lanning work is going beyond end of Concession Period therefore effect of six Laning is considered while forecasting MM cycles.

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2032/33	Functional Overlay	40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length	30 mm BC in 50% of length, Microsurfacing in 50% of length
2	2036/37-38/39	6L	Under EPC	
3	2045/46	Functional Overlay	30 mm BC in entire length in 6L	30 mm BC in 50% of length, Microsurfacing in 50% of length
4	2049/50	Functional Overlay	30 mm BC in entire length in 6L	30 mm BC in 50% of length, Microsurfacing in 50% of length

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 14210 m having width of varying 5.5 to 7.5 m.
2. Widening of existing culvert – 5 Nos
3. RCC Drain – 14205 m along service road
4. Road Furnitures – Transverse Marking 14.2 km, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual, PGR-11.4 Km
5. Toll Plaza
6. Landscaping and tree plantation
7. Way Side Amenities: to be constructed by NHAI
8. Incident Management – Highway Patrol, Ambulance, Crane

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from O & M Handover Date
4	Repair and Rehabilitation of Structure	12 months from O & M Handover Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date

Sn	Description of Work	Date of Completion
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from O & M Handover Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

O & M Handover Date: Mar 2028.

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in Schedule C, Engineering and Safety Improvements along the Project Highways shall confirm to IRC: SP: 84 -2014, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. Construction of new / widening of Service road /Slip road
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. Reconstruction of existing Service road /Slip road
   No existing service roads in this package.
3. Construction of new / widening of culverts / bridges / Grade separated structures
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. Repair / Rehabilitation of pavement (overlay)
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.
5. Repair / Rehabilitation of structures
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
6. Junction improvement

Not appliable

7. Construction of new drain
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. Road furniture
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Signposts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
   i) Road marking – quantity considered along entire length of project road
   j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.
9. Construction of new Toll plaza
   Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is not having PQC on tapper portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.
10. Landscaping and tree plantation
    The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.
11. Truck lay byes / toilet blocks
    Not applicable
12. Bus bays / bus shelters
    Not applicable
13. Highway Patrol vehicles, Ambulance, Cranes
    One number at each toll location has been considered.
14. ATMS / TMS
    Not Applicable.
15. Rainwater harvesting systems
    Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.
16. Slope protection
    As per site investigation, no special slope protection is required other than regular maintenance

which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ FY 2022	IOC Baroni		
Bitumen	Base Price	Discount	Ex MI price
VG30	52,952	2,650	50,302
VG40	56,432	2,650	53,782

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	340
2	Granular Subbase	Cum	2081
3	Wet mix macadam	Cum	2514
4	Dense Bituminous Macadam VG -40	Cum	8227
5	Bituminous Concrete – VG 40	Cum	9704
6	Pavement Quality Concrete (PQC)	Cum	6274
6	RCC M 20 for Drain	Cum	5,972

Sn	Items Description	Unit	Rates (Rs.)
7	Reinforcement Steel	MT	86502
~~14~~	~~Metal "W" Beam crash barrier~~	~~Rm~~	~~2,500~~

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of FY 2022/23

S.no	Description	Cost in Rs
1	Cost of VUP Approaches	55,372,162
2	Cost of Service/Slip road	326,337,669
3	Cost of Road Furniture	40,387,800
4	Cost of Drain and protection works	128,813,977
	Retaining Wall	56,747,393
5	Cost of VUP including RE Wall and Earthwork	25,008,764
	RE Wall	110,798,382
6	Cost of Structure (BOX Culvert and Pipe culvert)	14,915,445
7	Cost of Toll plaza Improvement	71,715,905
8	Cost of Hybrid ETC	
9	Safety Enhancement	25,591,500
	Total	783,973,091
	Add 12% for GST	94,076,771
	Total including GST	878,049,862

Total CAPEX – Rs. 87.80 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2032/33	Functional Overlay	40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length	30 mm BC in 50% of length, Microsurfacing in 50% of length
2	2036/37-38/39	6L	Under EPC	
3	2045/46	Functional Overlay	30 mm BC in entire length in 6L	30 mm BC in 50% of length, Microsurfacing in 50% of length
4	2049/50	Functional Overlay	30 mm BC in entire length in 6L	30 mm BC in 50% of length, Microsurfacing in 50% of length

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

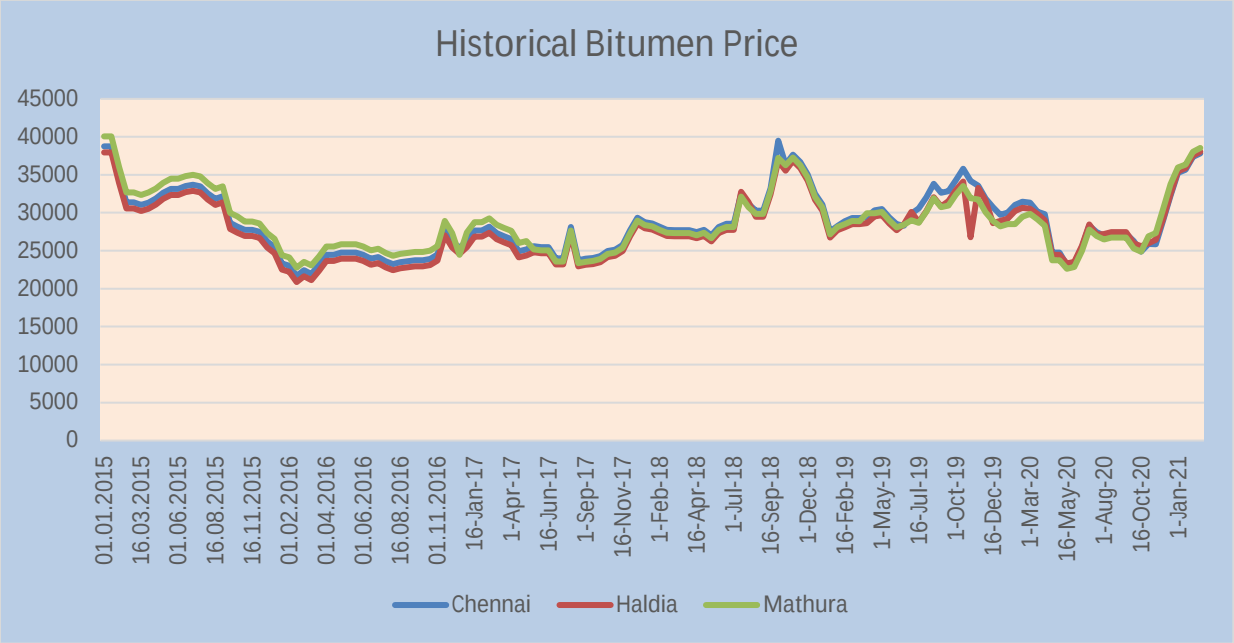
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year FY 2024 onwards is considered as below:

Bitumen Price @ FY 2024 on wads	IOC Baroni		
Bitumen	Base Price		Ex MI price
VG30	31,579	2,650	28,929
VG40	35,059	2,650	32,409

,

Basis of projection of Bitumen Price do not vetted by AECOM and any fluctuation on MM Cost due to changes in bitumen price to be covered by the Company.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY- 22	2.83%	1.000
FY- 23	4.66%	1.047
FY- 24	5.65%	1.106
FY- 25	5.37%	1.165
FY- 26	5.52%	1.229
FY- 27	5.25%	1.294
FY- 28	4.86%	1.357
FY- 29	4.44%	1.417
FY- 30	4.24%	1.477
FY- 31	4.13%	1.538
FY- 32	4.08%	1.601
FY- 33	4.01%	1.665
FY- 34	4.00%	1.732
FY- 35	4.03%	1.801
FY- 36	4.01%	1.874

Year	Growth Rate	Escalation Factor
FY- 37	3.98%	1.948
FY- 38	3.98%	2.026
FY- 39	4.00%	2.107
FY- 40	3.99%	2.191
FY- 41	3.99%	2.278
FY- 42	3.99%	2.369
FY- 43	3.99%	2.464
FY- 44	3.99%	2.562
FY- 45	3.99%	2.664
FY- 46	3.99%	2.771
FY- 47	3.99%	2.881
FY- 48	3.99%	2.996
FY- 49	3.99%	3.116
FY- 50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of FY 2023 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – VG 40	Cum	8,725
2	Bituminous Concrete – VG 40	Cum	9,462
3	Microsurfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in Page No 59 of this report.
Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

S.N.	Activity	Unit	Quantity			Unit Rate 2022	Amount		
			2032/33	2045/46	2049/50		2032/33	2045/46	2049/50
	Main Carriageway - Flexible Pavement								
1	Tack Coat	Sqm	1,695,920	1,866,155	1,866,155	13	21,436,428	23,588,205	23,588,205
2	Bituminous Concrete - VG 40 / CRMB	Cum	54,179	55,985	55,985	9462	512,636,378	529,718,470	529,718,470
3	Dense Bituminous Macadam - VG 40	Cum	17,072			8725	148,952,106	-	-
4	Milling of existing 40 mm BC	Sqm	341,438			77	26,290,688	-	-
	Main Carriageway - Rigid						-	-	-
1	Joint sealant replacement every 5th Year (50 %)	m	1,961	1,961	1,961	220	431,338	431,338	431,338
	Service Road						-	-	-
1	Tack Coat	Sqm	75,316	75,316	75,316	13	951,994	951,994	951,994
2	BC - VG 30	Cum	2,259	2,259	2,259	9020	20,381,047	20,381,047	20,381,047
3	Microsurfacing	Sqm	75,316	75,316	75,316	176	13,255,616	13,255,616	13,255,616
	Structure(Including Flyover,Elevated,VUP,PUP and								
1	Tack Coat	Sqm	11463	11463	11463	13	144,894	144,894	144,894
2	Wearing Course	Cum	459	344	344	9462	4,338,495	3,253,871	3,253,871
3	Milling of existing Wearing Coat	Sqm	11463	11463	11463	77	882,661	882,661	882,661
4	Painting of Crash Barrier	Sqm	8311	8311	8311	121	1,005,670	1,005,670	1,005,670
	Structures Repair/ rectification								
1	Raising of Road Kerb	m	146,194		146,194	439	64,178,982	-	64,178,982
2	Road Studs	Nos	44,023	44,023	44,023	220	9,685,060	9,685,060	9,685,060
3	Solar Studs	Nos	2,220	2,220	2,220	1647	3,656,340	3,656,340	3,656,340
4	Painting of Road Kerb	Sqm	36,548	36,548	36,548	121	4,422,356	4,422,356	4,422,356
5	Road Marking - MCW	Sqm	54687	54687	54687	439	24,007,413	24,007,413	24,007,413
6	Shoulder Filling (40 to 50 mm)	Sqm	147480	147480	147480	22	3,244,560	3,244,560	3,244,560
7	Median Filling	Cum	3655		3655	439	1,604,475	-	1,604,475
8	PMC Cost for Overlay @ 10 lakh per month	Month					16,000,000	16,000,000	16,000,000
9	Major Maintenance Cost Per Year						877,506,499	654,629,493	720,412,950
10	Major Maintenance Cost Per Year with GST						982,807,279	733,185,033	806,862,503
					Amount in Crore		98.28	73.32	80.69
	Escalation Factor						1.665	2.881	3.240
	Esclated Amount keping Bitumen Component w/o Escalation						141.45	160.69	201.23

5. OPEATION AND MAINTANANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall always procure that during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures considering 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.

b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:

   i. Where the other road crosses an underpass, the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.

   ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.

c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.

d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.

e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimized staff requirement at Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 16,948 / km / month excluding GST.

5.4 Preventive Maintenance

The cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 10,195 / km / month excluding GST.

5.5 6.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 8 Rs / Kwh based on monthly electricity bill.
c) Adopted till O & M Handing Over is Rs. 6568446 per Year.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	11.34	137,216	1,556,440
2	Highway Lighting Electricity Charge	Kwh	483,771	8	3,662,716
3	Operation and Maintenance of DG Set	Nos	2	174,873	349,745
4	Solar Blinker	Nos	76	3,293	250,282
5	Office Building Electricity Charge	LS	12	54,886	658,636
	Total				64,77,819

5.6 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is Rs. 1.47 crore per year and additional cost of Rs. 29.59 crore for replacement of equipment at every 7 (seven) years for FY 28.

5.7 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 2 nos of route patrol vehicle as per Article 17
c) 2 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 2.71 crore per year including GST for FY 2029.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.
   As per Company, overloading shall not be collected from this asset therefore only four Toll Collector is considered for 8 lane plazas from FY 2023 onwards. at this stage.

The cost of manpower is estimated as Rs. 3.99 core for FY 2023 an Rs. 3.19 crore per year from FY 2024 onwards.

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses based on data provided by the Company. The cost estimated is Rs. 1.79 crore per year for FY 22.

Year wise O & M Cost (OPEX) is presented in next page.

Year wise O & M Cost Opex:

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2022-23			6,477,819	13,045,476		1,778,318	31,925,866	3,161,455	17,947,909	74,336,843
2	2023-24			6,477,819	15,675,473		1,778,318	31,925,866	3,161,455	17,947,909	76,966,840
3	2024-25			6,477,819	17,428,804		1,778,318	31,925,866	3,161,455	17,947,909	78,720,171
4	2025-26			6,477,819	19,182,136		1,778,318	31,925,866	3,161,455	17,947,909	80,473,502
5	2026-27			6,477,819	19,182,136		1,778,318	31,925,866	3,161,455	17,947,909	80,473,502
6	2027-28			6,477,819	82,632,104		1,778,318	31,925,866	3,161,455	17,947,909	143,923,471
7	2028-29	7,129,630	16,807,971	7,376,636	11,292,145	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	126,662,970
8	2029-30	10,139,442	16,807,971	7,376,636	13,045,476	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	131,426,113
9	2030-31	11,847,473	16,807,971	7,376,636	15,675,473	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	135,764,141
10	2031-32	13,118,009	16,807,971	7,376,636	17,428,804	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	138,788,009
11	2032-33	4,967,640	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	132,390,971
12	2033-34	7,129,630	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	134,552,961
13	2034-35	10,139,442	16,807,971	7,376,636	82,632,104	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	201,012,741
14	2035-36	11,847,473	16,807,971	7,376,636	11,292,145	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	131,380,813
15	2036-37	13,118,009	16,807,971	7,376,636	13,045,476	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	134,404,681
16	2037-38	14,385,873	16,807,971	7,376,636	15,675,473	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	138,302,541
17	2038-39	15,147,871	16,807,971	7,376,636	17,428,804	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	140,817,870
18	2039-40	4,967,640	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	132,390,971
19	2040-41	7,129,630	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	134,552,961
20	2041-42	10,139,442	16,807,971	7,376,636	82,632,104	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	201,012,741
21	2042-43	11,847,473	16,807,971	7,376,636	11,292,145	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	131,380,813
22	2043-44	13,118,009	16,807,971	7,376,636	13,045,476	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	134,404,681
23	2044-45	14,385,873	16,807,971	7,376,636	15,675,473	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	138,302,541
24	2045-46	15,147,871	16,807,971	7,376,636	17,428,804	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	140,817,870
25	2046-47	4,967,640	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	132,390,971
26	2047-48	7,129,630	16,807,971	7,376,636	19,182,136	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	134,552,961
27	2048-49	10,139,442	16,807,971	7,376,636	82,632,104	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	201,012,741
28	2049-50	11,847,473	16,807,971	7,376,636	11,292,145	27,120,755	1,778,318	31,925,866	3,161,455	20,070,196	131,380,813
	Total	229,790,616	369,775,355	201,152,911	713,753,093	596,656,605	49,792,904	893,924,235	88,520,727	549,231,761	3,692,598,208
	Total Cost in Crore	22.98	36.98	20.12	71.38	59.67	4.98	89.39	8.85	54.92	369.26

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Hazaribagh - Ranchi section of NH 33. Project road starts from Km 41+500 at Hazaribagh to Km 115+290 at Ranchi in the state of Jharkhand. The total length of the project road is 73.790 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Hazaribagh to Ranchi Section of NH – 33 on TOT Basis in the State of Jharkhand	41+500	115+290	73.790	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor

Various key features along the project road such as slope protections, median openings,

Start Point of Project Road at Km 41+500

End Point of Project Road at Km 115+290

- Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 41+500 at Hazaribagh of NH- 33	Km 41+50 at Hazaribagh of NH-33
2	Project Road End	Km 115+290 at Ranchi of NH-33	Km 115+290 at Ranchi of NH- 33
3	Project Length	73.790km	73.790 km
6	Carriageway	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	Shoulders	Varying from 1 to 2 m.	Varying from 1 to 2 m.
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	Service Roads	LHS: 6.143 km RHS: 6.281 km	LHS: 6.143 km RHS: 6.281 km
10	Major Bridge	1 No.	1 No.
11	Minor Bridge	9 Nos.	9 Nos.
12	Pipe, Box & Slab Culverts	128 Nos.	128 Nos.
13	Major/Minor Junctions	0 Major & 73 Minor	0 Major & 73 Minor
14	Underpass	6 VUP & 2 PUP	6 VUP & 2 PUP
15	Grade Separator	0 Flyover	0 Flyover
15	ROB/RUB	3 No/ 1 No	3 No/ 1 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	1 Nos.	6 Nos
18	Bus Shelter	22 Nos	22 Nos

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td>
</td></tr>
<tr><td>Typical Urban Section</td><td>Toll Plaza</td></tr>
</table>

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	41+500	100+400	BT	BT	58.900
2	100+400	100+930	CC	CC	0.530
3	100+930	115+290	BT	BT	14.360

6.2.3 Service Roads

As per Schedule A of CA 6.143 Km LHS and 6.281 km RHS of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 6.01 Km LHS & 6.281 Km RHS length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road of 7.5 m width has been proposed for the length of 6.595Km on either side and 5.5 m on 0.510 km either side. (Total 2x7.105=14.210 km)

Service Road along Project Road

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 2 m wide median	4.5 m wide Median with Shrubs

54 nos. of authorized and 8 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening without Solar Blinker	Unauthorized Median Opening

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the

Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total Shoulder drain 14.248 km LHS and 13.054 km RHS is found on site. Median drain has observed in 0 Km of length. New Drain at 7.105 m either side as per Schedule B.

Median Drain at Project Road	Open Line at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 2 major and 74 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas

Major Junction	Minor Junction

6.2.7 Safety Barriers

W-Beam Metal Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.
Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
W-Beam Metal Crash Barrier	LHS	11.22
	RHS	10.48
Pedestrian Guard Rail	LHS	3.610
	RHS	5.040
Safety Barrier/Concrete Barrier	LHS	1.700
	RHS	1.300

MBCB and PGR present on the Project Road

6.2.8 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 100+600 near Pungad with the configuration 2 x 6. The existing toll plaza

have complied requirements of NHAI latest circular, integration of Weigh-in-motion with Static Weight Bridge. PQC has not been provided in taper portion.

Concessionaire has mobilized Toll Collection team with new system installed at Toll Plaza.

Pungad Toll Plaza at Km 100+600

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at built-up area, approach of grade separated structures for total 11.34 Kms. All lights were provided with LED bulbs for better quality and low operation cost.

High Mast and Highway Light along project Highway

6.2.10 Bus Bays and Bus Shelter

There are 22 Bus Bays and 16 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter along Project Highway

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	47+500	LHS	Steel	Bus Bay
2	51+220	LHS	Steel	Bus Bay
3	59+320	RHS	Steel	Bus Bay
4	63+270	LHS	Steel	Bus Shelter Only
5	70+750	RHS	Steel	Bus Bay
6	74+510	LHS	Steel	Bus Shelter Only
7	82+000	LHS	Steel	Bus Bay
8	87+425	LHS	Steel	Bus Bay
9	92+120	LHS	Steel	Bus Bay
10	93+050	RHS	Steel	Bus Shelter Only
11	93+400	RHS	Steel	Bus Bay
12	94+820	LHS	Steel	Bus Shelter Only
13	94+930	LHS	Steel	Bus Bay
14	100+270	RHS	Steel	Bus Bay
15	101+900	RHS	Steel	Bus Bay
16	102+075	LHS	Steel	Bus Bay
17	105+040	LHS	Steel	Bus Bay
18	105+840	LHS	Steel	Bus Bay
19	108+375	LHS	Steel	Bus Shelter Only
20	110+670	RHS	Steel	Bus Bay

S.N.	Chainage	Side	Shelter Type	Remarks
21	110+970	LHS	Steel	Bus Bay
22	114+350	LHS	Steel	Bus Shelter Only

6.2.11 Truck Lay Byes

Six numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	60+270	Both	Available	Available	Available
2	73+030	Both	Available	Available	Available
3	104+040	Both	Available	Available	Available

Truck Lay Bye

6.2.12 Signage and Marking

Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.

Road marking along the carriageway

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the Project Road	Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.
Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they need maintenance to extend their design life.
As per site inspection it has been observed that

- 1 no of Major Bridge of total length of 246m having span arrangement of 12 x 20.5m is in good condition
- 9 nos. of Minor bridges having total length varies from 18 m to 40 m are generally found in good condition.
- 8 nos. of Underpass having minimum span arrangement of 1 x 6 are found in good condition.
- 3 nos. of Railway over Bridge are found in good condition
- 1 nos. of Single Span Railway under Bridge total of total length of 47.7 m is in good condition
- No Flyover is found
- 128 (pipe/slab/box) nos. of culverts found at site.

6.3.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.85+440

It consists of bridge on both (LHS and RHS) carriageway. Both the bridge has span arrangement of 12X20.5m. The super structure comprises of RCC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. Minor repairing of the wearing coat is required, and the condition of the expansion joint is fair. Other condition of the bridge is good. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of the carriageway

Span Arrangement

Major Bridge at Ch. 85+440

Minor Bridges

a) Minor Bridge

Salient features along with condition of 17 Minor bridges are discussed.

b) Minor Bridge – CH.57+780

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 3x13.15 m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat and expansion joint is in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Poor Maintenance of Ventway

Minor Bridge at Ch. 57+780

c) Minor Bridge – CH.61+720

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 2x16.8m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 2x17.15m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

Wearing coat and expansion joint are in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 61+720

d) Minor Bridge – CH.71+020

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 4x10m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 2x18.9m. The super structure comprises of RCC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment and pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat is in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 71+020

e) Minor Bridge – CH.84+450

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 3x6m. The super structure comprises of RCC Box. Wearing coat and Slope pitching are in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 84+450

f) Minor Bridge – CH.103+420

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 2x12.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 2x13.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

Wearing coat and expansion joint is in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 103+420

g) Minor Bridge – CH.107+580

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 3x6.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 1x18.9m. The super structure comprises of RCC Girder. Elastomeric bearings are used for resting of Superstructure on RCC Wall type abutment.

Wearing coat and expansion joint are in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span arrangement

Expansion joint in poor condition

Minor Bridge at Ch. 107+580

h) Minor Bridge – CH.109+200

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 2x12 m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 2x13.15m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on Brick Masonry Wall type abutment and pier.

Wearing coat, expansion joint and slope pitching are in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 109+200

i) Minor Bridge – CH.112+460

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 2x19m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

RHS bridge has Span arrangement of 2x18.9 m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment and circular pier.
Expansion joint is in poor condition. Cleaning of the drainage spout is required. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriageway

Span arrangement

Minor Bridge at Ch. 112+460

j) Minor Bridge – CH.115+000

It consists of bridge on LHS and RHS carriageway. LHS bridge has Span arrangement of 3x8.7m. The super structure comprises of RCC Box.
RHS bridge has Span arrangement of 3x8.7m. The super structure comprises of RCC Slab. Superstructure is resting on RCC Wall type abutment and pier.
Wearing coat and Slope Pitching are in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span arrangement LHS

Span Arrangement RHS

Minor Bridge at Ch. 115+000

Under-Passes (UPs)

There is a total of 08 UPs has been provided. All UPs have minimum span of 1 x 6 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages. Detailed condition assessment of PUP is presented A few pictures to ascertain the conditions of UPs are presented as follows:

Service road

Span Arrangement

UP at Ch. 55+350

Service road

Span Arrangement

PUP at Ch.64+877

Super structure in fair condition

Span Arrangement

PUP at Ch. 68+250

Super structure in fair condition

Span Arrangement

UP at Ch. 74+240

Slope pitching is in good condition

Span Arrangement

UP at Ch. 76+137

Slope pitching is in good condition

Span Arrangement

UP at Ch. 78+614

Railway over Bridge (ROBs)

ROB at Ch. 67+570

It consists of bridge on LHS and RHS carriageway over railway tracks. Both the ROB have a span arrangement of 1x 3.99m. The super structure comprises of RCC Box. It requires regular repair works such painting and repairing of RCC railing. Wearing coat and other conditions of the bridge are good.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Superstructure is in good condition

ROB at Ch. 67+570

ROB at Ch. 80+492

It consists of bridge on LHS and RHS carriageway over railway tracks. Both the ROB have a span arrangement of 1x 19.54m. The super structure comprises of Steel Girder. Elastomeric bearings are used for resting of superstructure on RCC wall type abutment. Wearing coat and other conditions of the bridge are good. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Superstructure is in good condition

Superstructure is in good condition

ROB at Ch. 80+492

ROB at Ch. 90+030

It consists of bridge on LHS and RHS carriageway over railway tracks. Both the ROB have a span arrangement of 1x20.8 +2x10.61 m. The super structure comprises of RCC Girder and Steel Girder. Elastomeric bearings are used for resting of superstructure on RCC wall type abutment and pier.
Slope pitching, wearing coat and other conditions of the bridge are good. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Superstructure is in good condition

Slope potching is in good condition

ROB at Ch. 90+030

RUB at Ch. 58+870

It consists of Rail under Bridge above the main carriageway. RUB have a span arrangement of 1x 45.7m. The super structure comprises of steel sections. Superstructure is resting on RCC wall type abutment. The General conditions of the bridge are good.
A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Culverts:
There are 128 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	85+440	LHS	12 x 20.5	11.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	12 x 20.5	11.0			●	●	●	●	●	●	●	●	●		●	Stable	
2	57+780	LHS	3 x 13.15	8.5	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	3 x 13.15	11			●	●	●		●	●	●	●	●			Stable	
3		LHS	2x16.8	8.5	MNB	Y	●	●	●		●	●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
	61+720	RHS	2x17.15	11			●	●	●		●	●	●	●	●			Stable	
4	71+020	LHS	4 X 10	8.5	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	2 X 18.9	12.0			●	●	●		●	●	●	●	●			Stable	
5	84+450	LHS	3 x 6	2 x 12.0	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	3 x 6	2 x 12.0			●	●	●		●	●	●	●	●			Stable	
6	103+420	LHS	2 x 12.5	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	2 x 13.15	12			●	●	●		●	●	●	●	●			Stable	
7	107+580	LHS	3 x 6.5	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1 x 18.9	12			●	●	●		●	●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
8	109+200	LHS	2 x 12	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	2 x 13.15	12			●	●	●		●	●	●	●	●			Stable	
9	112+460	LHS	2 x 19	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	2 x 18.9	12			●	●	●		●	●	●	●	●			Stable	
10	115+000	LHS	3 x 8.7	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	3 x 8.7	12			●	●	●		●	●	●	●	●			Stable	
11	55+350	LHS	1x 6	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x 6	2x11			●	●	●		●	●	●	●	●			Stable	
12	74+240	LHS	1x 6	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x 6	2x11			●	●	●		●	●	●	●	●			Stable	
13	76+137	LHS	1x 6	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x 6	2x11			●	●	●		●	●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
14	78+614	LHS	1x 6	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x 6	2x11			●	●	●		●	●	●	●	●			Stable	
15	82+080	LHS	1x 6	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x 6	2x11			●	●	●		●	●	●	●	●			Stable	
16	89+644	LHS	2 x 11	2x11	UP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	2 x 11	2x11			●	●	●		●	●	●	●	●			Stable	
17	64+877	LHS	1x3.5x2.5	27	PUP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x3.5x2.5	27			●	●	●		●	●	●	●	●			Stable	
18	68+250	LHS	1x3.5x2.5	27	PUP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1x3.5x2.5	27			●	●	●		●	●	●	●	●			Stable	
19	67+570	LHS	1x 3.99	2 x 11	ROB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x 3.99	2 x 11			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
20	80+492	LHS	1x19.54	2 x 11	ROB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x19.54	2 x 11			●	●	●	●	●	●	●	●	●		●	Stable	
21	90+030	LHS	1x20.8 +2x10.61	2 x 11	ROB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x20.8 + 2x10.61	2 x 11			●	●	●	●	●	●	●	●	●		●	Stable	
22	58+870	-	1x45.7		RUB		●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Jhansi Lalitpur Tollway Limited

Report Number:

ACM-60657056-TDD-JLTL-001-R2

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Jhansi-Lalitpur Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Jhansi Lalitpur Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
RP	MD	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Jhansi Lalitpur Tollway Limited

5th Floor, OSE Commercial Block, Asset 5B,
Aerocity Hospitality District,
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **2**

Project Background 2
Project Salient Features 2
Project Principal Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 6

1. INTRODUCTION **8**

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 11

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Estimation of Design Traffic 14
2.3 Test Pit 14
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 14
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 14
2.6 Roughness Survey using Network Survey Vehicle (NSV) 14
2.7 Determination of Pavement Major Maintenance 15
2.8 Base Year Pavement Rehabilitation Requirement 15
2.9 Future Maintenance Requirements 15

3. CAPEX REQUIREMENT **17**

3.1 CAPEX needs 17
3.3 Unit Rate Analysis 20
3.4 Cost Estimate 21

4. MAJOR MAINTENANCE COST **22**

4.1 Major Maintenance Cycle 22
4.2 Major Maintenance Quantity 22
4.3 Unit Rate Analysis 23
4.4 Cost Estimate 24

5. OPEATION AND MAINTANANCE COST - OPEX **26**

5.1 O & M Requirement as per CA 26
5.2 O & M Strategy 29
5.3 Routine and Preventive Maintenance 29
5.4 Preventive Maintenance 29
5.5 Highway Lighting 30
5.6 ATMS and TMS Cost 30
5.7 Incident Management 30
5.8 Manpower Cost 31
5.9 Office Expenses 31

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **33**

6.1 Reconnaissance Survey 33
6.2 Road Inventory and Condition Survey 33
6.3 Inventory and Condition Survey of Structures 44

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
JLTL	Jhansi Lalitpur Tollways Limited
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System

MJB	Major Bridge
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Jhansi-Lalitpur Tollway Limited ("JLTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and JLTL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Jhansi – Lalitpur Section from Km 0+000 to Km 49+700 of NH 26 in the State of Uttar Pradesh awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India ("NHAI"). The construction of project road was completed under Annuity (BOT) basis and existing Concessionaire is maintaining highway till Mar 2027 which is being operated by "M/s Jhansi Lalitpur Tollway Limited". The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer Jhansi – Lalitpur Section from Km 0+000 to Km 49+700 of NH 26 in the State of Uttar Pradesh
Project Length	49.70 km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Jhansi Lalitpur Tollway Limited
Signing of Agreement	27 Dec 2019
Appointed Date	20 Oct 2020
O & M Handover Date	Mar 2027
Concession Period	30 years
End of Concession Period	19 Oct 2020
Likely End of Concession Period	Mar 2045*
Six Lanning under EPC by NHAI	NA
Number of Toll Plaza	1 nos, plaza having 8 lanes including extra width

* - as per information provided by the Company

Project Principal Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Jhansi Lalitpur Tollway Limited
3	Annuity Concessionaire	Gayatri Projects Limited
4	Independent Engineer	
5	Maintenance Contractor	Egis Road Operation India Private Limited G4S India for Security
6	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 18 months.

- Construction of New Service Road & Structures
- Widening of Cross Drainage Works
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

- The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 23.83 crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2031-32	40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length of Main Carriageway 30 mm BC in 50% of length, Micro surfacing in 50% of length of Service Road	85.69
2.	2038-39	30 mm BC in entire length for Main Carriageway 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	56.00
3.	2044/45	30 mm BC in entire length for Main Carriageway 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	80.16

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs except bitumen cost.

As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways shall be after completion of revised Concession Period i.e. after FY 2045.

c) Operation and Maintenance (OpEX)

The project road is currently maintained by Annuity Concessionaire and O & M handover will be on Mar 2027. The Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway from Mar 2027 to end of Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	12,632,254
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	-
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	11,820,000
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	6,508,136
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	3,389,127
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	2,901,735
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	3,161,455

Sl. No.	Description	Remarks	Amount (in INR)
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	6,808,487
11	Community Development	Includes CSR related expenses.	368,000
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	2,195,455
15	IE Fees	Includes IE fees.	2,766,273
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	-
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	
		O & M Cost for Year 2022-23	71,293,299

A total of Rs. 7.13 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and

authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

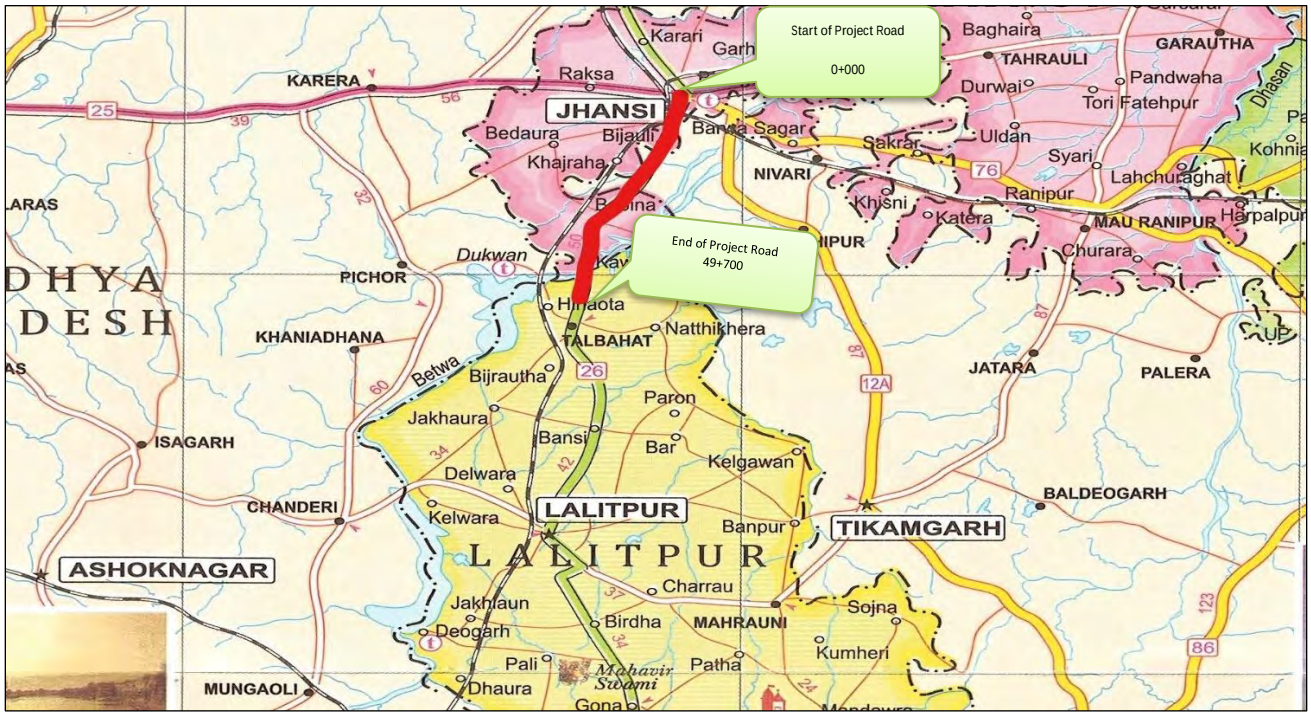
1.1 Project Background

Jhansi Lalitpur Tollway Limited (hereinafter referred to as JLTL or the Concessionaire), is a company to undertake Tolling, Operation, Maintenance & Transfer (TOT Model) of Jhansi – Lalitpur Section from Km 0+000 to Km 49+700 of NH 26 in the State of Uttar Pradesh is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The construction of project road was completed under Annuity (BOT) basis and existing Concessionaire is maintaining highway till Mar 2027.

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.
This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The Project Stretch is section of NH 26 in the State of Uttar Pradesh, starts from km 0+000 (at T Junction, near Jhansi) on NH 26 and ends km 49+700 (near Khandi Village) and it is a part of North- South corridor. The 49.700 km long Project Stretch has 4-lane configuration and is currently tolled at one location – Babina toll plaza at km 32.100 for complete length. The total Length of Highway is 49.7 Km. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	49.70 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement - MCW & Service Road Rigid Pavement -Toll Plaza
Shoulder	1 m earthen for MCW at Rural Area
Service Road / Slip Road	3.01 km one side length having width of 5.5 m
Major / Minor Junction	1 Major & 14 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 4.870 Km
Median Opening	24 Nos
Toll Plaza	1 Nos – 8 lanes (4 + 4 lanes on each side)
Truck Lay-bys	1 Nos
Bus Bays with shelter	3 Bus Shelter
Highway Lighting	22 Nos. Double Arm
High Mast	5 nos
Highway Patrol	1 nos (To be deployed after O&M handover)
Ambulance	1 nos (To be deployed after O&M handover)
Crane	1 nos (To be deployed after O&M handover)

b) Structure

Description	Project Features
Major Bridge	5 No
Minor Bridge	4 Nos
Flyovers	1 No
ROB and RUB	1 No
VUP	12VUP & 4 PUP
Culverts	79 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.
b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from cube highways and accordingly report is updated as March 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date

- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Ravelling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.3 Test Pit

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

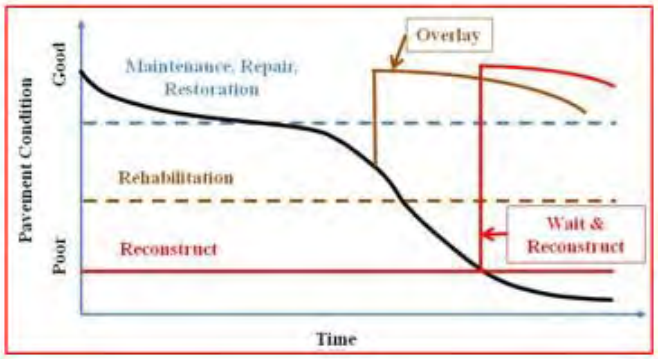
Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Not applicable as project road in under Annuity.

2.9 Future Maintenance Requirements

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Six Lanning work is

going beyond end of Concession Period therefore effect of six laning is considered while forecasting MM cycles.

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	**2031-32**	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2	**2038-39**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %
3	**2044-45**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 4870 m having width of 5.50 m
2. Widening of existing culvert for Slip Road – 5 Nos
3. Widening of Pipe Culvert for Service Road– 1 Nos
4. RCC Drain – 4870 m along service road
5. Road Furnitures – Transverse Marking 4.87 km, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
6. Toll Plaza
7. Landscaping and tree plantation
8. Way Side Amenities: to be constructed by NHAI
9. Incident Management – Highway Patrol, Ambulance, Crane
10. ATMS
11. Rainwater Harvesting
12. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from O & M Handover Date
4	Repair and Rehabilitation of Structure	12 months from O & M Handover Date
5	Junction Improvement	12 Months from Appointed Date

Sn	Description of Work	Date of Completion
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from O & M Handover Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

O & M Handover Date: Mar 2027.

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in Schedule C, Engineering and Safety Improvements along the Project Highways shall confirm to IRC: SP: 84 -2014, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. Construction of new / widening of Service road /Slip road

Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.

2. Reconstruction of existing Service road /Slip road

No existing service roads in this package.

3. Construction of new / widening of culverts / bridges / Grade separated structures

As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.

4. Repair / Rehabilitation of pavement (overlay)

Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.

5. Repair / Rehabilitation of structures

In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair /

rehabilitation.

6. Junction improvement

Not appliable

7. Construction of new drain

In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.

8. Road furniture

a) Street Lighting – Not applicable
b) High mast lighting – Not applicable
c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
i) Road marking – quantity considered along entire length of project road
j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. Construction of new Toll plaza

Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is not having PQC on tapper portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.

10. Landscaping and tree plantation

The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.

11. Truck lay byes / toilet blocks

Not applicable

12. Bus bays / bus shelters

Not applicable

13. Highway Patrol vehicles, Ambulance, Cranes

One number at each toll location has been considered.

14. ATMS / TMS

Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.

15. Rainwater harvesting systems

Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.

16. Slope protection

As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 16 March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	52452	2650	49802
VG40	55932	2650	53282

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	326
2	Granular Subbase	Cum	1,660
3	Wet mix macadam	Cum	2,360
4	Dense Bituminous Macadam VG -30	Cum	9,387
5	Bituminous Concrete – VG 30	Cum	9,995
6	Pavement Quality Concrete (PQC)	Cum	6,496
12	RCC M 20 for Drain	Cum	5,322
13	Reinforcement Steel	MT	73,212
14	Metal "W" Beam crash barrier	Rm	2,500

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs
1	Cost of Service/Slip road	77,293,626
2	Cost of Road Furniture	0
3	Cost of Drain	11,653,572
4	Cost of Miscellaneous works	93,239,987
5	Cost of Minor Structure (BOX Culvert and Pipe culvert)	14,328,136
6	Cost of Toll plaza Improvement	16,302,966
7	Cost of ATMS	0
8	Cost of Hybrid ETC	0
	Total	212,818,287
	Add 12% for GST	25,538,194
	Total including GST	238,356,481

Total CAPEX – Rs. 23.83 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2031-32	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2	2038-39	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %
3	2044-45	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

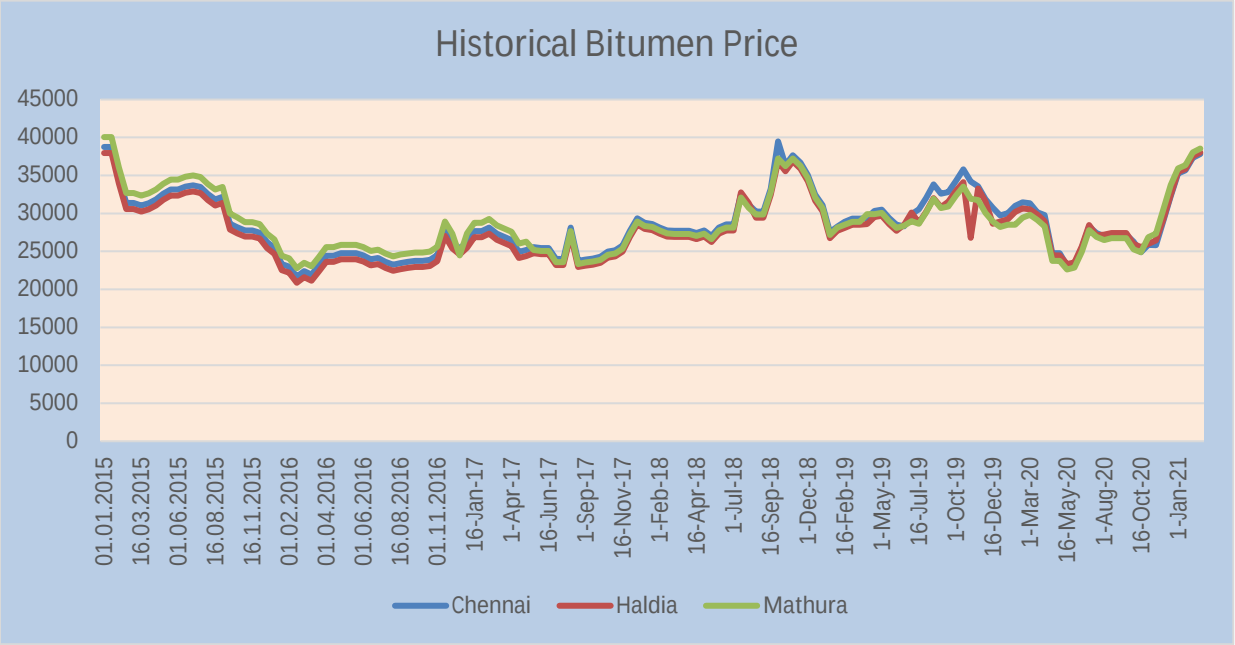
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro-surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 2024 onwards	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	31,573	2650	28,923
VG40	35,053	2650	32,403

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874

Year	Growth Rate	Escalation Factor
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – VG 40	Cum	7,710
2	Bituminous Concrete – VG 40	Cum	8,667
3	Micro-surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	93
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in this report.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

S.N.	Activity	Unit	Quantity				Unit Rate 2022#	Amount			
			2031-32	2038-39	2044-45	2050-51		2031-32	2038-39	2044-45	2050-51
	Main Carriageway - Flexible Pavement										
1	Tack Coat	Sqm	1,025,913	853,248	853,248		13	12,854,695	10,691,202	10,691,202	-
2	Bituminous Concrete - VG 40	Cum	38,247	25,597	25,597		8667	331,482,068	221,849,810	221,849,810	-
3	Dense Bituminous Macadam - VG 40	Cum	11,117				7710	85,713,564	-	-	-
4	Wet Mix Macadam	Cum						-	-	-	-
5	Providing Insitu RAP	Cum					6038	-	-	-	-
6	Dismantling of Bituminous Layer	Cum					351	-	-	-	-
7	Dismantling of WMM (Manual)	Cum					790	-	-	-	-
8	Milling	Sqm	222,349				77	17,120,854	-	-	-
9	Microsurfacing	Sqm					176	-	-	-	-
10	Crack Sealing	Sqm						-	-	-	-
	Main Carriageway - Rigid							-	-	-	-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015)	Sqm					132	-	-	-	-
2	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum					6496	-	-	-	-
3	Joint sealant replacement every 5th Year (5 %)	m	8,916	8,916	8,916		220	1,961,562	1,961,562	1,961,562	-
4	Pot Hole Filling (1 %)	Sqm					549	-	-	-	-
5	Cross stitching of PQC slab (0.5 %)	Rm					549	-	-	-	-
6	Dismantling	Cum			-		3568	-	-	-	-
	Service Road							-	-	-	-
1	GSB	Cum						-	-	-	-
2	WMM	Cum						-	-	-	-
3	Prime Coat	Sqm						-	-	-	-
4	Tack Coat	Sqm	13,393	13,393	13,393		13	167,808	167,808	167,808	-
5	DBM - VG 30	Cum						-	-	-	-
6	BC - VG 30	Cum	402	402	402		8120	3,262,610	3,262,610	3,262,610	-
7	Microsurfacing	Sqm	13,393	13,393	13,393		176	2,357,080	2,357,080	2,357,080	-
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)										
1	Tack Coat	Sqm	34064	34064	34064		13	426,819	426,819	426,819	-
2	Wearing Coat	Cum	1363	1022	1022		8667	11,809,045	8,856,784	8,856,784	-
3	Dense Bituminous Macadam VG-40	Cum					7710	-	-	-	-
4	Milling of existing Wearing Coat	Sqm	34064	34064	34064		77	2,622,909	2,622,909	2,622,909	-
5	Painting of Crash Barrier	sqm	16085	16085	16085		93	1,495,886	1,495,886	1,495,886	-
6	Microsurfacing	Sqm					170	-	-	-	-
	Structures Repair/ rectification										
1	Expansion Joints Replacement	Rm									
2	Strip Seal	Rm					2876	-	-	-	-
3	Filler Joints	Rm						-	-	-	-
4	Elastromeric Bearing replacement	Cub Cm.					1	-	-	-	-
5	POT PTFE Bearing	Nos					71352	-	-	-	-
6	Lifting Arrangement for Bearling Replacement	Nos					4940	-	-	-	-
7	Drainaige Sprouts	Nos					2744	-	-	-	-
8	Repair of Damaged Concrete Crash Barrier	Rm					318	-	-	-	-
9	Stone pitching -300 mm	Cum					740	-	-	-	-
10	Filter Media below pitching -300 mm	Cum					930	-	-	-	-
	Other Works										
1	Raising of Road Kerb	m	94,105		94,105		439	41,312,095	-	41,312,095	-
2	Replacement of Road Studs							-	-	-	-
	Road Studs	Nos	12,637	12,637	12,637		220	2,780,140	2,780,140	2,780,140	-
	Solar Studs	Nos	1,576	1,576	1,576		1647	2,595,672	2,595,672	2,595,672	-
3	Painting of Road Kerb	Sqm	23,526	23,526	23,526		93	2,187,941	2,187,941	2,187,941	-
4	Road Marking - MCW	Sqm	36833	36833	36833		439	16,169,785	16,169,785	16,169,785	-
5	Shoulder Filling (40 to 50 mm)	Sqm	98600	98600	98600		22	2,169,200	2,169,200	2,169,200	-
6	Median Filling	Cum	2353		2353		439	1,032,802	-	1,032,802	-
7	Cost for fixing Other CA Issue at Handback Time - 5 % of above cost	LS									-
8	PMC Cost for Overlay @ 10 lakh per month	Month	8	8	8		2000000	16,000,000	16,000,000	16,000,000	-
	Major Maintenance Cost Per Year							555,522,534	295,595,208	337,940,105	-
	Major Maintenance Cost Per Year with GST							622,185,238	331,066,633	378,492,918	-
								62.22	33.11	37.85	-
	Escalation Factor							1.601	2.107	2.664	
	Esclated Amount keping Bitumen Component w/o Escalation							85.69	56.00	80.16	

5. OPEATION AND MAINTANANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organising itself, adopting measures and standards, executing procedures such as inspection

procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;

b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:

i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.

ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.

iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.

iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.

v) Risk of disturbance or damage or destruction to property of third party is minimised.

vi) Members of the public are treated with due courtesy and consideration.

vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.

viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.

ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.

x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.

xi) The Scope for Operation and Maintenance includes but not limited to following:

- Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
- Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
- Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance
- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning

- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.

b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:

i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.

ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.

c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.

d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.

e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimsed staff requirement at Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance

2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 15,863 / km / month excluding GST.

5.4 Preventive Maintenance

the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 9,502 / km / month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180 watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 16.10 Rs / Kwh based on monthly electricity bill.
c) Adopted till O & M Handing Over is Rs. 11,820,000 per Year.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	1.90	104,284	198,140
2	Highway Lighting Electricity Charge	Kwh	338,428	16.10317	5,449,764
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos		3,293	-
5	Office Building Electricity Charge	LS			1,200,000
	Total				71,28,373

5.6 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is Rs. 1.12 crore per year and additional cost of Rs. 25.10 crore for replacement of equipment at every 7 (seven) years for TMS and HTMS/ATMS.

5.7 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 2 nos of route patrol vehicle as per Article 17

c) 2 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 1.46 crore per year including GST for FY 2022-23

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.

As per Company, overloading shall not be collected from this asset therefore only four Toll Collector is considered for 8 lane plaza from FY 2023 onwards. at this stage.

The cost of manpower is estimated as Rs. 2.89 crore (per year).

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses based on data provided by the Company. The cost estimated is Rs. 1.56 crore per year.

Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
2	2022-23			11,820,000	9,897,263		1,778,318	28,965,123	3,161,455	15,671,142	71,293,299
3	2023-24			11,820,000	11,930,738		1,778,318	28,965,123	3,161,455	15,671,142	73,326,775
4	2024-25			11,820,000	13,286,389		1,778,318	28,965,123	3,161,455	15,671,142	74,682,426
5	2025-26			11,820,000	14,642,040		1,778,318	28,965,123	3,161,455	15,671,142	76,038,077
6	2026-27			11,820,000	14,642,040		1,778,318	28,965,123	3,161,455	15,671,142	76,038,077
7	2027-28	3,669,295	11,587,391	12,729,243	69,248,233	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	162,928,421
8	2028-29	4,919,675	11,587,391	12,729,243	8,541,612	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	103,472,180
9	2029-30	6,357,318	11,587,391	12,729,243	9,897,263	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	106,265,474
10	2030-31	7,389,779	11,587,391	12,729,243	11,930,738	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	109,331,410
11	2031-32	3,669,295	11,587,391	12,729,243	13,286,389	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	106,966,577
12	2032-33	4,919,675	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	109,572,608
13	2033-34	6,357,318	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	111,010,251
14	2034-35	7,389,779	11,587,391	12,729,243	69,248,233	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	166,648,905
15	2035-36	8,146,584	11,587,391	12,729,243	8,541,612	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	106,699,088
16	2036-37	8,902,898	11,587,391	12,729,243	9,897,263	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	108,811,053
17	2037-38	3,669,295	11,587,391	12,729,243	11,930,738	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	105,610,926
18	2038-39	4,919,675	11,587,391	12,729,243	13,286,389	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	108,216,957
19	2039-40	6,357,318	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	111,010,251
20	2040-41	7,389,779	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	112,042,711
21	2041-42	8,146,584	11,587,391	12,729,243	69,248,233	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	167,405,710
22	2042-43	8,902,898	11,587,391	12,729,243	8,541,612	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	107,455,402
23	2043-44	3,669,295	11,587,391	12,729,243	9,897,263	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	103,577,450
24	2044-45	4,919,675	11,587,391	12,729,243	11,930,738	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	106,861,307
25	2045-46	6,357,318	11,587,391	12,729,243	13,286,389	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	109,654,600
26	2047-48	7,389,779	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	112,042,711
27	2048-49	8,146,584	11,587,391	12,729,243	14,642,040	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	112,799,516
28	2049-50	8,902,898	11,587,391	12,729,243	6,508,136	14,604,523	1,778,318	28,965,123	3,161,455	17,184,841	105,421,926
	Total	140,492,714	254,922,592	350,963,350	506,013,162	321,299,513	49,792,904	817,248,660	88,520,727	472,276,117	3,001,529,738
	Total Cost in Crore	14.05	25.49	35.10	50.60	32.13	4.98	81.73	8.85	47.23	300.15

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Jhansi - Lalitpur section of NH 26. Project road starts from Km 0+000 at Jhansi to Km 49+700 at Khandi Village in the state of Uttar Pradesh. The total length of the project road is 49+700 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Jhansi to Lalitpur Section of NH – 26 on TOT Basis in the State of Uttar Pradesh	0+000	49+700	49.70	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor

Various key features along the project road such as slope protections, median openings,

Start Point of Project Road at Km 0+000

End Point of Project Road at Km 49+700

- Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 0+000 at Jhansi of NH-26	Km 0+000 at Jhansi of NH-26
2	Project Road End	Km 49+700 at Khandi Village of NH-26	Km 49+700 at Khandi Village of NH-26
3	Project Length	49.7 km	49.7 km
6	Carriageway	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	Shoulders	1 m earthen for MCW	1 m earthen for MCW
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	Service Roads	LHS: 2.06 km RHS: 2.81 km	LHS: 2.06 km RHS: 2.81 km
10	Major Bridge	5 No.	5 No.
11	Minor Bridge	4 Nos.	4 Nos.
12	Pipe, Box & Slab Culverts	79 Nos.	79 Nos.
13	Major/Minor Junctions	1 Major & 14 Minor	1 Major & 14 Minor
14	Underpass	12 VUP & 4 PUP	12 VUP & 4 PUP
15	Grade Separator	1Flyover	1Flyover
15	ROB/RUB	1 No	1 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	1 Nos.	1 Nos.
18	Bus Shelter	2 Nos.	3 Nos.

6.2.1 Cross Sectional Elements

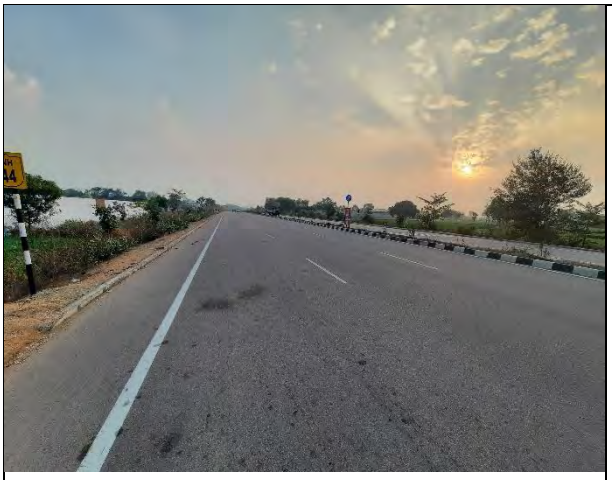
Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td>
</td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	0+000	31+100	BT	BT	31.1
2	31+100	31+160	CC	CC	0.06
3	31+160	49+700	BT	BT	18.54



Flexible Pavement

Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA no service road has been constructed. As per Schedule B new service road of 5.5 m width has been proposed for the length of 4870 m.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 1.5 m wide median without MBCB and Antiglare	4.5 m wide Median with Shrubs

24 nos. of authorized and 11 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening without Solar Blinker	Unauthorized Median Opening

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. As per Schedule B lined drains are to be provided at the sides of the Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total 4.870 Km of covered line side drain is to be provided as per Schedule B. Median drain has observed in 1.81 Km of length.

Median Drain at Project Road	Median Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 1 major and 14 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas

Major Junction at KM 0+000	Minor Junction

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	27.300
	Median	Nil
Pedestrian Guard Rail	Carriageway Edge	Nil
Concrete Barrier	Carriageway Edge & Median	4.468

MBCB and RCC Crash Barrier present on the project road

6.2.8 Toll Plaza and Other Facilities

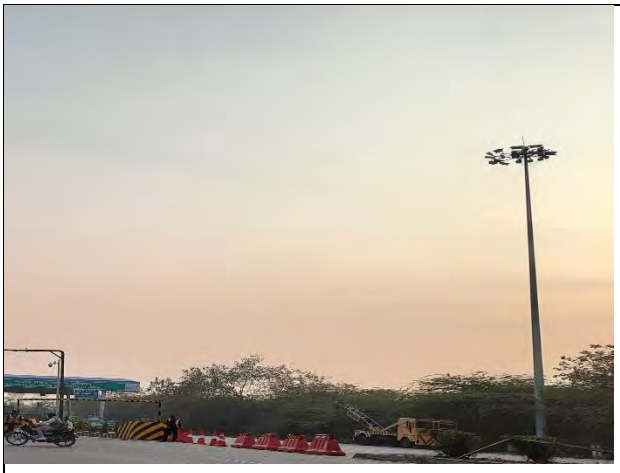
There is one existing toll plaza at KM 31+100 near Babina with the configuration 2 x (3+1). This has 8 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Since new toll plaza is to be constructed as per IRC SP – 84: 2014, existing toll plaza is to be dismantled completely and new toll plaza with complete facility is to be provided.

Concessionaire has mobilized Toll Collection team with new system at Toll Plaza.

Babina Toll Plaza at Km 31+100

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at built-up area, approach of grade separated structures. All lights were provided with LED bulbs for better quality and low operation cost.



High Mast and Highway Light along project Highway

6.2.10 Bus Bays and Bus Shelter

There are 4 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter along Project Highway

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	0+280	RHS	Steel shelter RCC seats	BT
2	0+380	LHS	Steel shelter RCC seats	BT
3	40+350	BHS	Steel shelter RCC seats	BT

6.2.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	37+840	RHS	NA	NA	NA

Truck Lay Bye

6.2.12 Signage and Marking

Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.

Road marking along the carriageway

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road

Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they need maintenance to extend their design life.

As per site inspection it has been observed that

- 5 no of Major Bridge having Span Arrangement varies from 13 m to 33m and total length varies from 65 m to 840 are found in good condition.
- 4 nos. of Minor bridges having total length varies from 10 m to 45 m are generally found in good condition.
- 12 nos. of vehicular underpasses and 4 Nos of PUP are found in good condition.
- 1 nos. of Railway over Bridge having span arrangement of 1x23+1x20+1x32+1x 18+1x24 on Both Sides are in good condition.
- 1 no of Flyover having span arrangement of 1x12+1x45+1x11.5(Sk)x6 on BHS are found in good condition.
- 79(pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.03+560

It consists of bridge on both the carriageways. It has span arrangement of 5x13m. The super structure comprises of RCC Slab. The Foundation adopted is Open foundation. The general condition of the bridge is good. It requires regular repair works such painting and repairing of railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint and wearing coat is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of the Carriageway

Span Arrangement

Major Bridge at Ch. 03+560

b) Major bridge – CH.06+700

It consists of two structures one on LHS and another structure on RHS. Both the bridge structure has a span arrangement of 3x33m. The super structure comprises of PSC Girder. Foundation of bridge is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Solid wall Pier. The general condition of the bridge is in good condition and it requires regular repair works such as stone pitching and periodic maintenance of expansion joints etc.

A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Superstructure is in fair condition

Major Bridge at Ch. 06+700

c) Major bridge – CH.15+000

It consists of two structures one on LHS and another structure on RHS. Both the bridge structure has a span arrangement of 6x32+1x60+1x16m. The super structure is BOX Girder & PSC Girder type. Foundation of bridge is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Solid wall Pier. Wearing coat of bridge carriageway needs to be repaired as cracks are being developed there. Expansion joint needs to be repaired immediately. Structurally the bridge is in good condition and it requires regular repair works such as painting, Rehabilitation of stone pitching and periodic maintenance of expansion joints etc. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Poor Expansion Joint

Fair Pitching

Major Bridge at Ch. 15+000

d) Major Bridge – CH.20+660

It is a major bridge which consists of two structures. The LHS bridge structure has a span arrangement of 4x32m while the RHS bridge structure has a span arrangement of 4x33m.

Both the bridge has super structure comprises of Box Girder and the Foundation is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & solid wall Pier

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, Cleaning of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures showing conditions of Major Bridge are presented as follows:

Span Arrangement

Superstructure is in fair condition

Minor Bridge at Ch. 20+660

e) Major Bridge – CH.42+000

It is a major bridge which consists of two structures. The bridge on LHS has a span arrangement of 31x20m and the super structure comprises of Arch type Girder. Foundation of the bridge is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on Brick Masonry Wall type abutment & Pier. While the bridge on RHS has a span arrangement of 31x20m and the super structure comprises of PSC Girder. Foundation of the bridge is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Solid wall Pier. Minor rehabilitation of Slope Pitching is required and repairing of expansion joint is to be done immediately.

RHS bridge is in good exposure conditions While the LHS bridge requires regular repair works such as painting and fixing of parapet, slope pitching and periodic maintenance of expansion joints etc.

A few pictures showing conditions of Major Bridge are presented as follows:

RHS Span Arrangement

LHS Span Arrangement

Poor Pitching (RHS)

View of carriageway (LHS)

Minor Bridges

Minor Bridge – CH.17+520

It consists of two structures one on LHS and another structure on RHS. Both the bridge structure has a span arrangement of 1x15m. The super structure comprises of PSC Girder. Foundation of bridge is Open Foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. There are minor repairs in abutment RCC wall. Strip seal type expansion joint to be replaced.

Beside this other general condition of the bridge is in good condition and regular repair works such as painting, stone pitching repair and periodic maintenance of expansion joints etc. is required at regular interval. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Expansion Joint

Span Arrangement

Minor Bridge at Ch. 17+520

Minor Bridge – CH.19+050

It consists of two structures one on LHS and another structure on RHS. Both the bridge structure has a span arrangement of 2x20m. The super structure comprises of PSC Girder. Foundation of bridge is Open Foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & solid wall Pier. Slope pitching is in poor condition and needs to be repaired immediately, wearing coat of bridge carriageway needs to be repaired, Other general condition of the bridge is in good condition and regular repair works such as painting, pitching repair and periodic maintenance of expansion joints etc. are required in regular interval. A few pictures showing the conditions of Minor Bridge are presented as follows:

Span arrangement

View of carriageway

Minor Bridge at Ch. 19+050

Minor Bridge – CH.22+680

It consists of two structures one on LHS and another structure on RHS. Both the bridge structure has a span arrangement of 1x45m. The super structure comprises of Box Girder. Foundation of bridge is Open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment. It requires regular repair works such repairing of railing, repairing of stone pitching etc. As periodic maintenance, replacement of joint and wearing coat is also required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of carriageway

Span Arrangement

Minor Bridge at Ch. 22+680

Under-Passes (UPs)

There are total of 04 PUPs in the entire project road. All UPs are single span of 1 x 6 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B. UPs are generally in good condition with some minor damages. A few pictures to ascertain the conditions of PUPs are presented as follows:

Super structure in fair condition

Span Arrangement

UP at Ch. 21+720

Super structure in fair condition

Span Arrangement

UP at Ch.24+710

Super structure in fair condition

Span Arrangement

UP at Ch. 45+810

Railway over Bridge (ROBs)

ROB at Ch. 10+500

It consists two bridge structure over railway tracks. The LHS bridge has a span arrangement of 1x23+1x20+1x32+1x18+1x24m. The super structure comprises of PSC Girder and Steel Beam Girder. The Foundation is open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and solid wall type pier. At the vicinity of steel girder and PSC girder, some maintenance work is to be done.

Regular repair works such painting and repairing of crash barrier, cleaning of drainage spout, epoxy grouting and periodic maintenance of expansion joints and bearings etc. should be done in regular interval.

The RHS bridge has a span arrangement of 1x23+1x20+1x32+1x18+1x24m. The super structure comprises of PSC Girder and Steel Beam Girder. The Foundation is open Foundation. POT – PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and solid wall type pier. Exposed reinforcement on the slab adjacent to abutment wall require immediate rectification. Other conditions of the bridge is good and only requires regular repair works. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Slabreinforcement exposed

Superstructure

ROB at Ch. 10+500

Grade Separators (Flyover)

Grade Separator at Ch. 182+050

It consists of flyover on both carriageways. It has a span arrangement of 1x36.0m. The super structure comprises of Steel Girder and RCC Box Girder. The Foundation is not visible. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment. The general condition of the bridge is good. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after 15 years from date of construction. A few pictures showing conditions of Grade Separator are presented as follows:

View of Carriageway

Span Arrangement

Drainage spout

Superstructure is in fair condition

Flyover at Ch. 182+050

Culverts:

There are 79 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	03+560	LHS	5x13	12.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	5x13	12.0			●	●	●	●	●	●	●	●	●		●	Stable	
2	06+700	LHS	3x33	10.0	MJB	Y	●	●	●	●	●	●	●	●	●			Stable	
		RHS	3x33	10.0			●	●	●	●	●	●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
3	15+000	LHS	6x32+1x60+1x16	10.0	MJB	Y	●	●	●	●	●	●	●	●	●			Stable	
		RHS	6x32+1x60+1x16	10.0			●	●	●	●	●	●	●	●	●			Stable	
4	20+660	LHS	4x32	10.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	4x33	10.0			●	●	●	●	●	●	●	●	●		●	Stable	
5	42+000	LHS	31x20	10.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	31x20	12.0			●	●	●	●	●	●	●	●	●		●	Stable	
6	17+520	LHS	1x15	10.5	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x15	10.5			●	●	●		●	●	●	●	●		●	Stable	
7	19+050	LHS	2X20	10.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2X20	10.5			●	●	●	●	●	●	●	●	●		●	Stable	
8	22+680	LHS	1X45	10.5	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1X45	10.5			●	●	●	●	●	●	●	●	●		●	Stable	
		LHS	1X10	12	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
9	41+160	RHS	1X10	12			●	●	●		●	●	●	●	●		●	Stable	
10	1+270	LHS	1x10.5	24	VUP	NA	●	●	●			●	●	●	●			Stable	
		RHS	1x10.5	24			●	●	●			●	●	●	●			Stable	
11	5+240	LHS	1X10	24	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1X10	24			●	●	●			●	●	●	●		●	Stable	
12	8+280	LHS	1X10	24	VUP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1X10	24			●	●	●			●	●	●	●		●	Stable	
13	9+040	LHS	1X17(SK)	24	VUP	NA	●	●	●			●	●	●	●			Stable	
		RHS	1X17(SK)	24			●	●	●			●	●	●	●			Stable	
14	10+280	LHS	1X16(SK)	40	VUP	NA	●	●	●			●	●	●	●			Stable	
		RHS	1X16(SK)	40			●	●	●			●	●	●	●			Stable	
15	12+740	LHS	1X14.5(Sk)	34	VUP	NA	●	●	●			●	●	●	●			Stable	
		RHS	1X14.5(Sk)	34			●	●	●			●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
16	16+000	LHS	1X10	24	VUP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1X10	24			●	●	●		●	●	●	●	●			Stable	
17	23+340	LHS	1X11.5(Sk)	27.5	VUP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1X11.5(Sk)	27.5			●	●	●		●	●	●	●	●			Stable	
18	28+780	LHS	1X15(Sk)	36	VUP	NA	●	●	●		●	●	●	●	●			Stable	
		RHS	1X15(Sk)	36			●	●	●		●	●	●	●	●			Stable	
19	30+420	LHS	1x15(Sk)	36	VUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x15(Sk)	36			●	●	●		●	●	●	●	●		●	Stable	
20	36+300	LHS	2x10(Sk) + 1 x 13.5	39	VUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10(Sk) + 1 x 13.5	39			●	●	●		●	●	●	●	●		●	Stable	
21	38+960	LHS	1X11.5(Sk)	28	VUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1X11.5(Sk)	28			●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
22	18+840	LHS	1x6	24	PUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x6	24			●	●	●		●	●	●	●	●		●	Stable	
23	21+720	LHS	1x6	24	PUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x6	24			●	●	●		●	●	●	●	●		●	Stable	
24	24+710	LHS	1x6	24	PUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x6	24			●	●	●		●	●	●	●	●		●	Stable	
25	45+810	LHS	1x6	24	PUP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x6	24			●	●	●		●	●	●	●	●		●	Stable	
26	13+800	LHS	1x12+1x45+1x 11.5(Sk)x6	12	FO		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x12+1x45+1x 11.5(Sk)x6	12			●	●	●	●	●	●	●	●	●		●	Stable	
27	10+500	LHS	1x23+1x20+1x 32+1x18+1x24	10.5	ROB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x23+1x20+1x 32+1x18+1x24	10.5			●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Jaipur Mahua Tollway Limited

Report Number:

ACM-60657056-TDD-JVTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Jaipur Mahua Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Jaipur Mahua Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
MD	PS	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Jaipur Mahua Tollway Limited

5th Floor, OSE Commercial Block
Hotel Aloft, Asset No. 5B
Aerocity Hospitality District
IGI Airport, New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

LIST OF ABBREVIATION II

1. EXECUTIVE SUMMARY 3

1.1 Basis of Preparation 3
1.2 Overview of the Project 5
1.3 Key Findings 6
1.4 Asset Condition 9
1.5 Toll Plaza and TMS 11
1.6 Change of Scope (COS) 12
1.7 Balance Work 12
1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement 12
1.9 Insurance 14
1.10 Introduction of Asset 15
1.11 Review of Pavement 17
1.12 Major Maintenance 21
1.13 Operation & Maintenance Works 23
1.14 Major Maintenance Cost 26
1.15 List of Document Reviewed 26

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS 28

2.1 Background 28
2.2 Pavement Design 28
2.3 Survey and Investigations 29
2.4 Determination of Pavement Major Maintenance 40

3 CAPEX REQUIREMENT 43

3.1 Initial Repair & Rehabilitation Work 44

4 MAJOR MAINTENANCE COST 45

4.1 Major Maintenance Cycle 45
4.2 Major Maintenance Quantity 46
4.3 Unit Rate Analysis 46
4.4 Cost Estimate 48

5 OPERATION AND MAINTENANCE COST 51

5.1 Introduction 51
5.2 Forecast Methodology 52
5.3 Requirement of CA (Schedule L and Concession Agreement) 52
5.4 Routine and Preventive Maintenance 52
5.5 Highway Lighting 53
5.6 TMS Cost and ATMS 53
5.7 Corridor Management 54
5.8 Manpower Cost 54
5.9 Office Expenses 54

6 PROJECT ROAD ANALYSIS 56

6.1 Reconnaissance Survey 56
6.2 Road Inventory and Condition Survey 56
6.3 Toll Plaza and Associated Facilities 72
6.4 Inventory and Condition Survey of Structures 81

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract	FWD	Falling Weight Deflectometer
ATMS	Advanced Traffic Management System	GAD	General Arrangement Drawing
BC	Bituminous Concrete	GSB	Granular Sub-base
BHS	Both Hand Side	GST	Goods and Services Tax
BI	Bump Integrator	HSYD	High Yielding Strength Deformed
BOQ	Bill of Quantity	INR	Indian Rupees
BT	Bituminous Top	IRC	Indian Road Congress
CA	Concession Agreement	ITM	Integrated Traffic Management
CAPEX	Capital Expenditures	JMTL	Jaipur-Mahua Tollway Limited
CC	Control Centre	KVA	Kilo-Volt-Ampere
CCTV	Closed Circuit Television Systems	LCV	Light Commercial Vehicle
CMSA	Cumulative Million Standard Axles	LED	Light Emitting Diode
COS	Change of Scope	LHS	Left Hand Side
COD	Commercial Operation Date	LIU	Light Interface Units
CUP	Cattle Underpass	LVUP	Light Vehicular Underpass
DBM	Dense Bituminous Macadam	MAV	Multi Axle Vehicle
DG	Diesel Generator	MCA	Model Concession Agreement
DLC	Dry Lean Concrete	MCW	Main Carriageway
ECB	Emergency Call Box	MDS	Metrological Data System
EPC	Engineering, Procurement, and Construction	MET	Metrological
ESAL	Equivalent Standard Axle Load	MIS	Management Information System
ETC	Electronic Toll Collection	MJB	Major Bridge
EW	East West	MNB	Minor Bridge
FO	Flyover	MoRTH	Ministry of Road Transport and Highways
FOB	Foot Over Bridge	MSA	Million Standard Axles

MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Jaipur – Mahua Tollway Private Limited ("JMTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Mahua – Jaipur Section of NH – 11 (New NH No 21) on BOT Basis in the State of Rajasthan (herein after refer as "the Project") which is being operated by "M/s Jaipur – Mahua Tollway Private Limited" (hereinafter refer as "the Concessionaire or Company or JMTL").

1.1.2 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.

In this report, AECOM provides an overview of the asset from technical perspective based on various surveys and investigations carried out on the project road, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.
Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.1.3 Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

a) Project Document

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- O and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepared by IE
- Test Report
- Traffic Data

b) Test Report

- Axle Load Survey Data with VDF
- NSV Survey Data
- FWD Test Report with analysis
- Test Pit and Core Test Report

Apart from data room, information / data provided thorough email has also reviewed and included in this report.

1.1.4 Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.2 Overview of the Project

Agreement was signed between National Highways Authority of India (NHAI) and M/s Jaipur – Mahua Tollway Private Limited, a Company promoted and incorporated by M/s IJM Corporation Berhad of Malaysia on 23 Sep 2005 for Improvement, Operation and Maintenance, Rehabilitation and Strengthening of the existing 2-lane and widening it to 4-lane divided highway of Mahua – Jaipur Section of NH 11 (New NH No 21) under BOT (hereinafter called "the Project"). The project road has been acquired by Cube Highways in Year 2016 and operating project road in the name of M/s Jaipur – Mahua Tollway Private Limited.

Project Corridor	Four Laning of Mahua - Jaipur Section of NH – 11 (New NH No 21) on BOT Basis in the State of Rajasthan
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways
Concessionaire	Jaipur-Mahua Tollway Private Ltd.
Independent Engineer (During O & M)	M/s SA Infrastructure Consultants Pvt. Ltd.
EPC Contractor	M/s IJM (India) Infrastructure Pvt Ltd
Project Road Length	109.088 km
Project Cost	483 Crore (as per IE MPR Sep 2019)
Grant	99 crores
Date of Concession Agreement	23 Sep 2005
Appointed Date	20 Mar 2006
Concession Period	25 years including Construction Period
Construction Period	36 months
Schedule Date of COD	20 Mar 2009
PCOD (Chainage as per IE Letter)	MS-1 (54.729 km from 119+567 to 174+296) – 30 Mar 2008
	MS-2 (54.359 km from 174+741 to 229+100) – 26 Sep 2009
Date of Final Completion Certificate	09 Mar 2015
O & M Contractor	1) Toll Operations (Markolines Traffic Controls Pvt Ltd.), 2) Dhara Singh for Routine Maintenance Km 120 to Km 145 3) Vikash Construction Km 145 to Km 168 4) Chetan Construction Company from Km 168 to Km 204 5) Krishna Kumar Company from Km 204 to Km 229 6) Shri Khemji Security and US India Horizon for Security

Number of Toll Plaza and Lanes	2 nos each plaza having 8 lanes including extra width
End of Concession Period as per CA	20 Mar 2031

Source: IE MPR Sep 2019, O & M Contracts, Concession Agreement

1.3 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (COD)	PCOD 1 was issued on 30 Mar 2008 from Km 119+567 to Km 174+296 (MS 1) for a length of 54.729 km before Schedule Completion Period and from Km 174+296 to end of Project (MS 2) PCOD 2 was issued on 26 Sep 2009 six months later from Schedule Completion. As per Clause 16.5, Completion Certificate is to be issued after completion of Punchlist issued with PCOD. Punchlist items are to be completed within 120 days from PCOD and further 180 days will be made available with penalty of 200,000/- per week. However, Final Completion Certificate was issued on 9 Sep 2015 which is well beyond available time frame to complete Punchlist Items. It is learned that penalty / settlement was made by the former Concessionaire and as such there is no risk due to delay in Completion Certificate.	🟢
Operation and Maintenance	As per Section XVIII of Concession Agreement, Concessionaire shall maintain project highway in conformity with Maintenance Requirements, the Maintenance Manual or Maintenance Program as the case may be. Concessionaire is fulfilling O & M obligations and there is no adverse comment from IE. As per O & M Inspection Report pursuant to Sub Clause 19.2 of Concession Agreement prepared by IE, Concessionaire is advised to carryout day to day routine maintenance activity no major defects has identified.	🟢
Major Maintenance (MM)	As per Schedule L (Page No L-13), BC of 25 mm thickness as renewal coat, is required when surface roughness is exceeding 3000 mm / km to bring it to less than 2000 mm and structural overlay is required when characteristic deflection exceeds 0.80 mm. As per Sub Clause 4.3.2.3 of Schedule L, renewal / strengthening course to be provided on as required basis (once 5 years). Major maintenance at majority of location was completed and work in progress at balance length while visiting site on Oct 2019. Concessionaire confirmed the methodology adopted during last MM was designed in such a way that life of existing pavement will be good enough till next MM Cycle. MM cycle along with escalation cost for balance concession period shall be 1) Year 2022/23 for MS 1 - MM Cost 75.03 crore 2) Year 2023/24 for MS 2 – MM Cost 45.01 crore 3) Year 2027/28 for MS1 – MM Cost 76.22 crore 4) Year 2028/29 for MS2 – MM Cost 64.78 crore	🟠

Diligence Area	Findings	Risk
	5) Year 2031 for entire length– MM Cost 96.57 crore	
Maintenance Manual and Yearly Program	As per Article 18.3 of Concession Agreement, Concessionaire required to submit proposed Programme not later than 45 days before beginning of each accounting year. Concessionaire has duly submitted the Maintenance Program for Year 2022/23	●
Pavement Design	Pavement design was done and approved by IE for 20 year of design traffic as per IRC 37 – 2001 considering 7 % CBR. Key fact of pavement design is as follows: - Pavement design for 20 years - Design Traffic 65 MSA till year 2025 - Total Traffic till year 2031 – 100 MSA Adopted Pavement thickness: BC – 40 mm, DBM 135 mm, WMM -250 mm and GSB – 230 mm. Adopted pavement design for MCW is in line with the Sub Clause 5.0 Pavement Design of Schedule D. Pavement design for Service Road is to be designed for 25 MSA as per Schedule D and accordingly following pavement thickness was proposed for Service Road. PC – 20 mm, DBM – 50 mm, WMM – 250 mm, GSB – 150 mm.	●
Pavement Condition	As per Roughness survey report based on survey conducted in the month of January 2022 from KM 120 to KM 229. Based on test report 86 km on LHS and 105 km on RHS is in good condition (roughness less than 2000 mm / km) and 23km on LHS and 4km on RHS is in Fair condition (roughness value more than 2000 mm / km but less than 3000 mm/ km).	●
Pavement Condition Survey Test	As per Sub Clause 3.4.2.2 of Schedule L, roughness value to be measured at least twice in a year (before monsoon in the month of April and after monsoon in the month of Oct) and BBD survey is to be carried out every year as per IRC 81. FWD survey was conducted by the concessionaire in December 2020.	●
Penalty	There is no penalty imposed / recommended by NHAI / IE.	●
Change of Scope	NHAI issued COS notices to the Company Pursuant to Article 17 of the CA for following Items: 1) COS of Rs. 80.53 lakh towards installation of Hybrid ETC lane of all lanes of Toll Plaza 2) COS of Rs. 46.52 lakh towards construction of 2 nos Highway Nest at each Toll Plaza 3) COS of Rs. 35.18 lakh for Toilet Block (2 nos at each toll plaza, 4 nos total) 4) COS of Rs. 2.43 crore towards installation of MSWIM (8 nos at each toll plaza total 16 nos) and SWB (2 nos at each toll plaza, total 4 nos) There is no other COS notice from NHAI for submission of proposal.	●
Balance Work	Final Completion Certificate was granted on 9 Mar 2015 stating project road has been completed successfully and tested as per Schedule J of Concession Agreement. All works as per Concession Agreement There is no balance work.	●
Toll Plaza and TMS	There are two toll plazas along project corridor at Km 156+600 (TP 1) having 4 + 4 lanes and Km 204+700 (TPS 2) having 4 + 4 lanes. Flexible pavement has provided at tapper portion and center portion of toll lanes has provided	●

Diligence Area	Findings	Risk
	with rigid pavement. Plaza office at TP1 was under renovation at the time of site inspection. Existing Rigid Pavement at Toll Plaza 2 (Jaipur side) is in poor condition required rehabilitation / reconstruction. TMS at both toll plaza installed in year 2018 by M/s Bhari and tolling is continuing with current equipment. The existing system is in order and do not envisaged any issue. The replacement of system is expected in Year 2025 and Year 2031.	
Major Issue Identified by IE	As per IE MPR there is no major issues in the project. Current issue as per IE MPR is as follows: 1. ROW Cleaning 2. Cleaning of Bridge 3. Median Plantation trimming and cleaning 4. Routine Maintenance of Road Furnitures (MBCB, Road Signs etc.) 5. Illegal opening of MBCB 6. Encroachment – Penalty issued as per letter no. 626 dated 1 May 2019	
Road Safety	Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement. As noticed in IE MPR, there is two Black Spot in project road as follows: 1) KM 171.500 (Bhandarej Mod) rectification work in progress 2) KM 222+530 (Lai ki Kothi) rectification work in progress As per AECOM site visit, following additional measures are recommended to enhance safety for road users: • Vertical drop between MCW and Bus bays to be removed • Provide blinkers at all median opening (13 nos out of 33 nos do not have blinkers) • Provide missing median plant to reduce glare affect during night • Wrong placement of Sign Board • Provide PGR between MCW and SR at all locations • Antiglare arrangement at narrow median (width less than 2 m) Safety Audit through independent agency (M/s VR Tech) has conducted in the month of Feb 2019. It is recommended to implement suggestion made by the Safety Consultant.	
Geometric Design	The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows: Design Speed – 100 kmph, Minimum Radius 400 m as ruling and 250 m as absolute minimum, K value for Summit Curves 70 and Valley Curves 42 for Stopping Sight Distance. Project road confirms requirement of Schedule D.	
As-Built Drawing	As per provision of Contract Sub Clause 33.2 (iv), the Concessionaire is to deliver relevant records and reports pertaining to the Project Highway and its design, engineering, construction, operation and maintenance including all and all operation and maintenance records and programmes and manuals pertaining thereto and complete As-Built Drawing on the Date of	

Diligence Area	Findings	Risk
	Divestment. Soft copy has provided and found to be in order and site team confirms having of Signed As-Built Drawing at project office at TP 1.	
Handback requirement	As specified in Schedule L, all defects and deficiencies specified in this Schedule –L shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date. Also following specific requirement has stated in Schedule L • Overlay to be carried out in the last year of Concession Period (Ref. Schedule L Sub Clause 3.3.7, Carriageway) • Characteristic deflection shall not be less than 0.50 mm (Ref: Schedule L Sub Clause 3.4.2.5, Structural Condition Survey) • Roughness value shall be less than 2500 mm / km (Ref: Sub Clause 33.2 of CA) As stated in Article 34.11, from the date which is 2 years prior to the expiry of the Concession Period a sum equal to the fess realisable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or a higher a sum estimated by the IE for renewal works, shall be retained in Escrow Account or a Bank Guarantee of equal amount to be furnished to NHAI.	

1.4 Asset Condition

In general, the condition of asset is in Good condition at the time of survey as of Oct 2019. As per AECOM study, with existing arrangement for Operation and Maintenance and with every 5 years cycle of Major Maintenance (Overlay) cycle, project road will continue to fulfill Level of Service as set forth in Schedule L and requirement of Article 18 of Concession Agreement except following improvements are required:

- Safety enhancement
- Roughness Survey and BBD Survey to be conducted as per frequency stated in Schedule L

The summary of asset condition (as of Oct 2019) is tabled as follow:

Sn	Asset	Condition
1	Main Carriageway	Project road is four lane having paved width of 2 x 9 m along at grade section and 2 x 11 m at approach of grade separated structures. The pavement condition of existing pavement is in Good condition where MM ha completed. Existing condition of pavement where MM work yet to be taken up was in Fair to Poor Condition.
2	Service Road	5.50 m width of service road has provided at approach of Grade Separated Structures and at built up area. Total one side length of 56.636 km has provided as service road. The pavement condition of service road is in good condition. Service Road is being used as stockpile for hay (cattle feed). Also, routine maintenance of service road was found in poor condition.
3	Median	4.5 m raised median along rural sections and 1.5 m raised median along Built Up area and approach of grade separated structures has provided. Median plantation in rural areas (4.5 m width) is in order. Antiglare arrangement by providing flat stone has provided at narrow median having width 1.5 m. Approximately 200 nos of

Sn	Asset	Condition
		stone used for antiglare are damaged which required replacement for better function of antiglare.
4	Median Opening	56 nos of Median openings have provided out of which 21 median openings are with shelter lanes and remaining 35 nos of median opening are without shelter lanes. Solar blinkers have been provided on 16 nos of median opening and 40 nos of median openings are without blinkers. It is suggested to provide blinkers are all median opening as all median openings are safety hazard.
5	Drainage arrangement	Lined drain has provided between Main Carriageway and Service road at built up area and at outer edge of slip road at approach of grade separated structures (FO, PUP / CUP). Existing drainage system along rural area is in order.
6	Major and Minor Junctions	11 nos of major junctions and 62 nos of minor Junctions are found along project road.
7	Safety Barrier	21.028 km of Metal Beam Crash barrier has provided along outer edge and median side and RCC Crash barrier has provided over approach of GS Structure on top of RE Wall at approximately in 10 km length. Existing metal beam crash barriers are found in fair condition, except at 60 m length found to be damaged.
8	Pedestrian Guard Rail	Pedestrian Guard Rail has provided in between MCW and SR at some built up area to guide pedestrian safely to cross road at designated location. However, PGR has not provided at complete required length i.e. between MCW and SR. As per Inventory condition survey report 8530 m is found at site. Total length required length of PGR is 47,636 m.
9	Toll Plaza	Km 156+600 at Sikandra (TP 1): - (4+1) lanes in each direction Km 204+700 at Rajadhok (TP 2): - (4+1) lanes in each direction Existing toll plaza including administrative building, TMS are in order and complying project requirement. Existing rigid pavement at TP 2 is in poor condition which required repair and rehabilitation.
10	Highway Lighting	Highway lighting has provided at approach of Toll Plaza, approach of major Junction at median. Also, highway lighting provided by Municipality from Km 221 to Km 228. 21 nos of High Mast has provide at Toll Plaza, ROB, Major Junctions and Flyovers. Existing condition of highway lighting is in order.
11	Bus Bays and Bus Shelters	26 nos of bus bays with shelter has observed at site and conditions of bus bays and shelters are found to be in good condition.
12	Truck Laybys	6 nos of truck laybys has been provided with facility of toilets and drinking water facilities. The facilities as provided confirm requirement of Schedule C of CA.
13	Traffic Sign and Marking	745 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good except 21 nos of sign boards are required to be replaced with new. Road Marking was in progress.

Sn	Asset	Condition
14	Major Bridge	1 no of Major Bridge having span arrangement of 2 x 37.11 + 5 x 38.11 (total length of 264.77 m) has provided and structural condition of bridge is "Good". Drainage Spout cover and elastomeric strip seal are found to be defective which are required to be provided.
15	Minor Bridge	17 numbers of Minor Bridge are in fair to good condition. Maintenance / cleaning of Expansion Joint, drainage spouts and protection work are required. One Minor Bridge slab reinforcement exposed.
16	Flyover	1 No of FO having span arrangement of 1 x 36 (total length 36 m) is found structurally sound condition. Cleaning of expansion joint / replacement elastomeric strip seal, replacement of drainage spout and 2 m length of railing are required to be replaced.
17	UP	7 Nos of UPs are structurally in good condition. All UPs are having span arrangement of 1 x 10 m having vertical clearance of 4 m.
18	ROB	1 No of ROB having span arrangement of 1x17.1 on LHS and 1 x 27.6 m is found in good condition. Cleaning of expansion joint and replacement of elastomeric strip seal, replacement of drainage spout is required.
19	Cross Drainage	Total 89 nos of cross drainage structures has found and condition of structure are found to be in order. It is noticed some of culverts are blocked and vent cleaning is required.

The project road has been visited by Consultant's team of Engineers in the month of Oct 2019.

Note: The project road has a long operational history and we had forecasted the operations & maintenance costs/ strategies for the entire balance concession period primarily based on i) the original pavement design during construction phase, ii) the various investigations and surveys carried out to assess the technical performance and quality of the project road and iii) other information provided to us by the Client, and we don't expect any material change in operations & Maintenance costs/ strategies year on year.

1.5 Toll Plaza and TMS

Toll Plaza including collection and TMS is operated / maintained by JMTL. Existing TMS is installed by M/s Bhari Infra in Year 2018. Existing system is as per requirement of applicable Manual all equipment are found to be working condition.

NHAI issued circular on 30 Nov 2017 for installation of Hybrid ETC lane at all toll lane and NHAI shall borne all cost of equipment and O & M cost under COS. Concessionaire has installed Hybrid ETC system at all toll lanes and MSWIM under COS. Existing toll lane configuration with type of equipment is summarized as follows:

Item	TP 1 (Km 156.600)	TP 2 (Km 204.700)
Total Number of Lane	8	8
Total number of Regular Lane	6	6
Total Number of Extra Width Lane	2	2

Item	TP 1 (Km 156.600)	TP 2 (Km 204.700)
Tolling Equipment		
Number of Dedicated ETC Lane	-	-
Number of Hybrid ETC Lane	8	8
Number of Reversible Lane	-	-

As per AECOM assessment total cost of TMS System is approximately 3.77 crore. The life TMS equipment is considered 7 years and 70 % of cost of TMS is forecasted as replacement cost which will occurred in every 7 year i.e. in Year 2025 and 2031.

1.6 Change of Scope (COS)

As per Article XVIL, Sub Clause 17.1 to 17.4, NHAI may, notwithstanding anything to the contrary contained in the Agreement, require provision of such addition / deletion to the works and services on or about the Project Highway which are beyond the scope of Project as contemplated by the Agreement. All such changes shall be made by NHAI by an order ("the Change of Scope Order"). The list of COS along with status of COS order is tabled below:

Sn	Description of Work	Status of COS Order	Amount	Work Status	Remarks
1	Implementation of Hybrid ETC Lane of all lanes of Toll Plaza	IE recommended to NHAI. COS order from NHAI pending	80.53 lakh	Completed	
2	Development of Platform for highway Nest including filing of Concrete Paver Block	IE recommended to NHAI. COS order from NHAI pending	46.52 lakh	Completed	
3	Construction of Toilet Block	COS order issued by NHAI	35.18 lakh	Completed	
4	Providing MSWIM and SWB	COS order issued by NHAI	2.43 crore	Completed	

There is no other COS in pipe line.

1.7 Balance Work

All work has completed as per Scope of Works under this Contract and there is NO balance work.

1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule L, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

i) Ensure the safety of personnel deployed on and users of the project facilities or part thereof
ii) Keep the Project Facilities from undue deterioration and wear
iii) Permit unimpaired performance of statutory duties and functions of any party in relation to

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule L elaborates requirement various service factor desirable level and acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (overlay) is required to be provided at least once in every 5th year (from COD) and in the last year of concession period. Also, overlay is required if Characteristic Deflection is more than 0.80 mm and roughness value exceeded more than 3000 mm / km.

Structural overlay is required if design MSA is less than anticipated MSA till end of Concession Period. As per Pavement design report, anticipated MSA till end of Concession Period (i.e. year 2031) is 100 MSA (maximum) and pavement design adopted during construction for 65 MSA (till Year 2025) therefore structural overlay is required on or before FY 2026.

1.8.1 Staff Requirement

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at Toll plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.8.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	In house
2	Preventive Maintenance	Out source
3	Operation cost of Toll Plaza and Administration Building	In house
4	Security of Toll Plaza and Cleaning	Out Source
5	Highway Lighting	In house
6	Maintenance of ATMS / TMS	Out Source - AMC
7	Corridor Management	Out Source
8	Major Maintenance	Out Source

1.8.3 Handback Requirement

As per Clause 33.2 of Concession Agreement, all project assets including the road, pavement, structure and equipment shall have been renewed and cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in

this Agreement. All sections of traffic lane shall have a roughness value not more than 2500 mm and characteristic deflection shall not be more than 0.50 mm. To satisfy above requirement, 30 mm BC overlay is required at end of Concession Period.

Also, NHAI shall hold a sum equal to the Fees realisable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or higher sum estimated by the IE for renewal works shall be retained in Escrow Account provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, no such retention shall be made.

1.9 Insurance

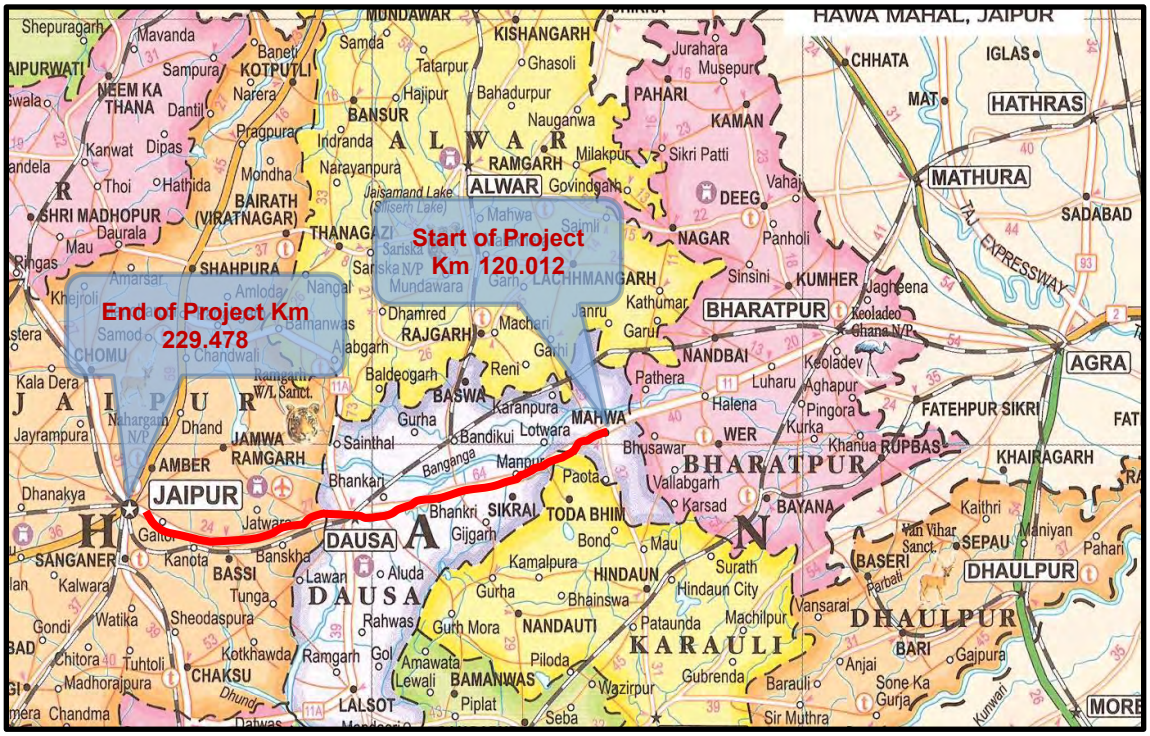
As per Sub Clause 27.2 of Concession Agreement, Concessionaire shall obtain and maintain at no cost to NHAI during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Industrial All Risk Insurance Policy Schedule
2	Burglary – Standard Policy Schedule
3	Electronic Equipment Insurance
4	Standard Fire & Special Perils Policy
5	Money Insurance Policy
6	Business Interruption (FIRE) Policy
7	Policy Schedule For Fidelity Guarantee
8	Policy Schedule for Public Liability
9	Policy Schedule for Package Insurance Policy

1.10 Introduction of Asset

1.10.1 Project Corridor

The project road is a section of National Highway No. 21 New (NH 11 Old) start from KM 120.012 at Mahua and ends at KM 229.478, Jaipur. NH 21, one of the major arterial roads of the country originates from Bareilly in Uttar Pradesh and ends at Jaipur in Rajasthan. The total length of highway is 465 km. Agra to Jaipur Section was known as NH 11 before MORTH new numbers of highway in year 2010. Major cities along NH 21 are Budaun, Agra, Bharatpur and Dausa. The project road starts Km 120.012 at Mahua and ends at Km 229.478 at Bharatpur. The total length of the project road is 109.466 km. The project corridor is shown in map below.



Location Map

Project Start KM 120

Project End KM 229+478

1.10.2 Salient Features of the Project:

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	109.466 km	109.088 km
Carriageway	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of underpasses and FO Approach	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of underpasses and FO Approach
Shoulder	2.0 m earthen for MCW at Rural Area	2.0 m earthen for MCW at Rural Area
Service Road / Slip Road	57.256 km one side length having width of 5.50 m	56.636 km one side length having width of 5.50 m
ROW	45 to 60 m	45 to 60 m
Major / Minor Junction	11 Nos Major	11 Major and 62 Nos Minor
RCC Drain	Covered drain at Urban Section and open pucca drain between MCW and SR	RCC Covered Drain 54.496 km as per Site Inventory
Median Opening		56 Nos
Toll Plaza	2 Nos	2 Nos
Truck Lay-bys	3 Nos at each sides (6 Nos Total)	6 Nos total on both sides
Bus Bays with shelter	15 Nos at each side (30 Nos Total)	26 Nos Total
Highway Lighting	Rest Area, Toll Plaza and Interchanges	Provided as per Schedule C (Total 498 nos of Double Arm and 104 nos of Single arm lighting provided)
High Mast	At Major Junctions, ROB / Flyover	Provided as per Schedule C (21 nos of high mast provided)
Highway Patrol	2 nos	2 nos
Ambulance	2 nos	2 nos
Crane	2 nos	2 nos
Traffic Aid Post	At Toll Plaza	At Toll Plaza 2
Medical Aid Post	At Toll Plaza	At Toll Plaza 2

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	1 No	1 No
Minor Bridge	17 Nos	17 Nos
Flyovers	1 No	1 No
ROB and RUB	1 No	1 No
VUP	5 Nos	7 Nos
Culverts	96 Nos	89 Nos

1.11 Review of Pavement

1.11.1 Pavement Design

During construction of road, pavement deign was carried out for 65 MSA till year 2026 i.e. 20 years design traffic for HS 4) and for other location design pavement is for full Concession Period). Summary of Report is presented as below:

Section	Design Traffic in MSA for Full Concession Period	Design Traffic MSA	CBR	Pavement Thickness (mm)			Remarks
				BC	DBM	WMM + GSB	
HS 1 Km 128	63	65	7 %	50	135	480	
HS 2 Km 163	80	65	7 %	50	135	480	
HS 3 Km 205	68	65	7 %	50	135	480	
HS 4 Km 222	100	65	7 %	50	135	480	

The proposed design at the time of construction confirms requirement of Concession Agreement. It is to be noted that based on current survey data provided by the Client design traffic for HS 1 and HS 2 is higher than HS 3 and HS 4 while comparing balance design MSA till end of Concession Period.

1.11.2 Analysis of Existing Pavement Condition

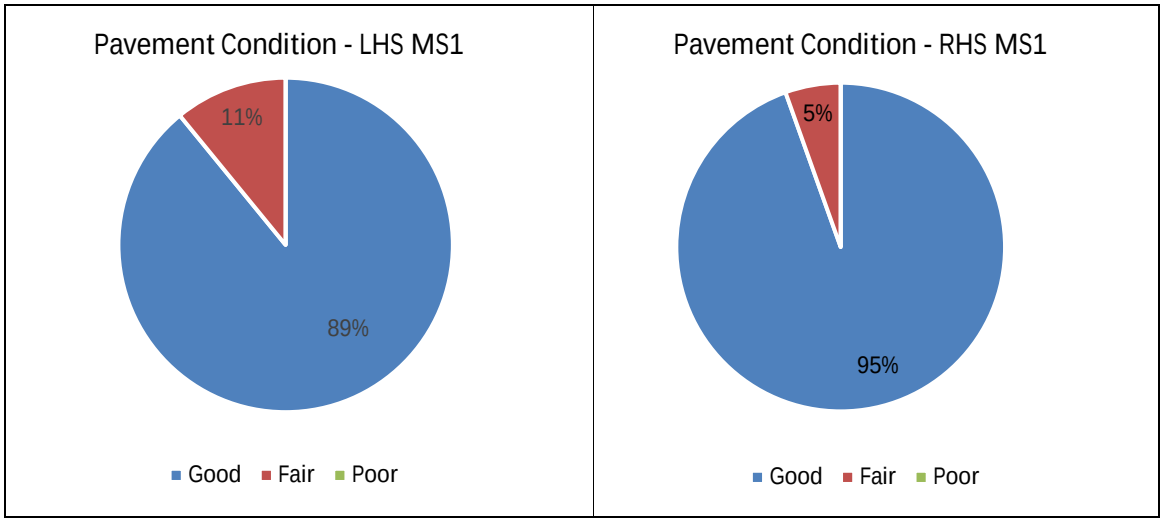
To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

a) Roughness Survey:

Km 120 to 175 (MS 1): Roughness Survey has been carried in the month of January. Pavement classification done as per following criteria:

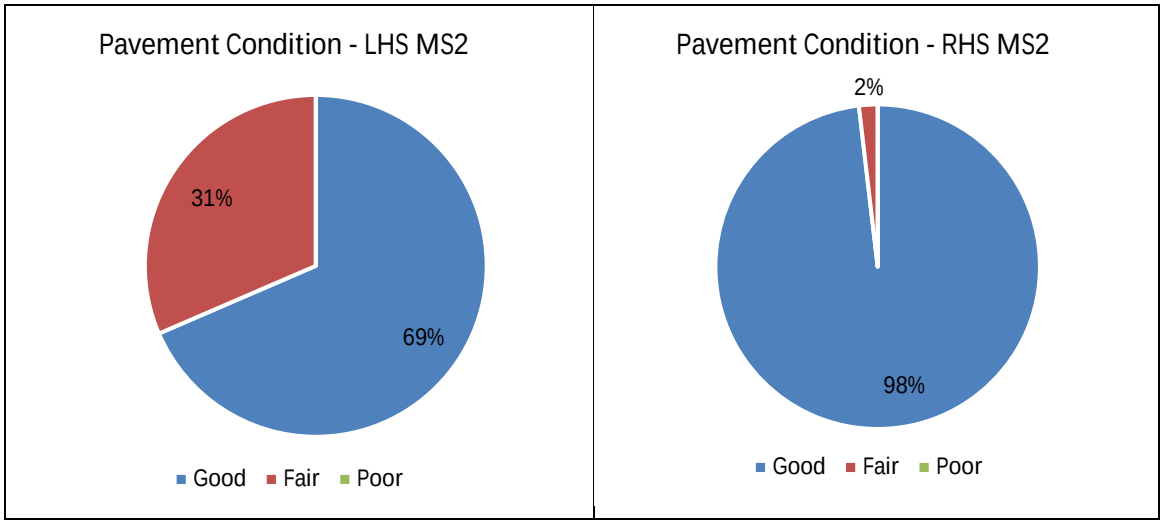
Riding Condition	Roughness Index (mm/km)	Length (in km)	
		LHS	RHS
Good	<2000	49	52
Fair	2000-3000	6	3
Poor	>3000	0	0

Graphical presentation of roughness survey report is appended below:



LHS –Mahua to Jaipur *RHS – Jaipur to Mahua*

Km 176 to Km 229 (MS 2): - Based on roughness survey conducted in January 2022 and pavement condition result is presented as below:



b) Analysis of Existing Pavement – FWD Test

Evaluation of existing pavement using Falling Weight Deflectometer (FWD) survey was carried out in year Dec 2020 for Km 120 to 176 after completion of Major Maintenance and before carrying major maintenance in Km 176 to Km 229. Summary of FWD Survey report is presented as below:

- KM 120 to KM 176 (MS 1):

Description	Length in km	
	LHS	RHS
less than 10 MSA	14.1	1.2
10 to till Year 2026 (37 MSA for LHS and 76 MSA for RHS)	13.4	12.6

MSA above Year 2026(37 MSA for LHS and 76 MSA for RHS)	28.5	42.2
Total Tested Length	56	56

It is noted that in MS 1, FWD test after MM reveals that balance life of some section is less than required life of pavement till next MM which is to be completed before Mar 2023. Concessionaire informed due to this reason regular pavement maintenance by providing patch work, crack sealing as deemed required being carried out round the year therefore no overly is to be planned before next MM Cycle. Further additional 50 mm DBM has considered in 19 km (one side length) for next MM cycle i.e. FY 2022/23.

- KM 176 to KM 229 (MS 2):

Description	Length in km	
	LHS	RHS
less than 10 MSA	5.5	1.5
10 to till next MM Cycle (37 MSA for LHS and 76 MSA for RHS)	3.7	6.4
above MSA above next MM Cycle (37 MSA for LHS and 76 MSA for RHS)	43.8	45.1
Total Tested Length	53	53

Note:
Required remaining life of pavement till end of Concession Period for MS 1 -70 MSA LHS & 146 MSA RHS, for MS 2 -49 MSA LHS & 100 MSA RHS.

c) Test Pit

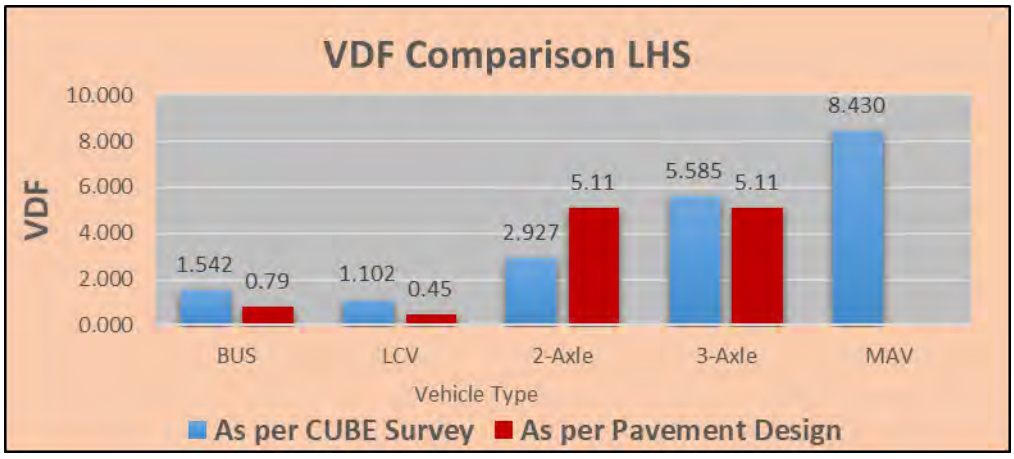
Test pit data not available.

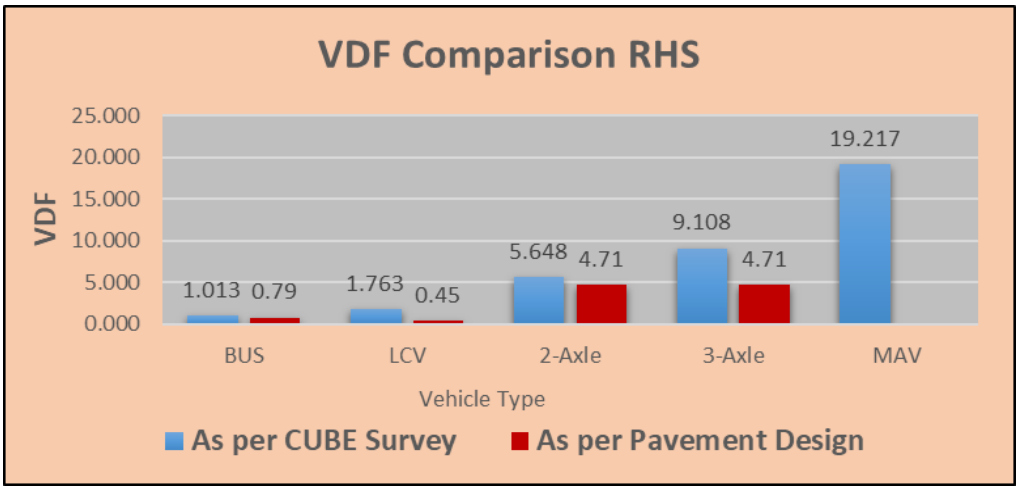
d) Core Test

Test result not available.

e) Axle Load Survey

VDF as adopted during pavement design and VDF as per current Axle Load Survey data conducted in Year 2018 at Toll Plaza 1 (TP1 VDF) and Toll Plaza 2 (TP2 VDF) are presented as below:





VDF for MAV was not calculated during pavement design.

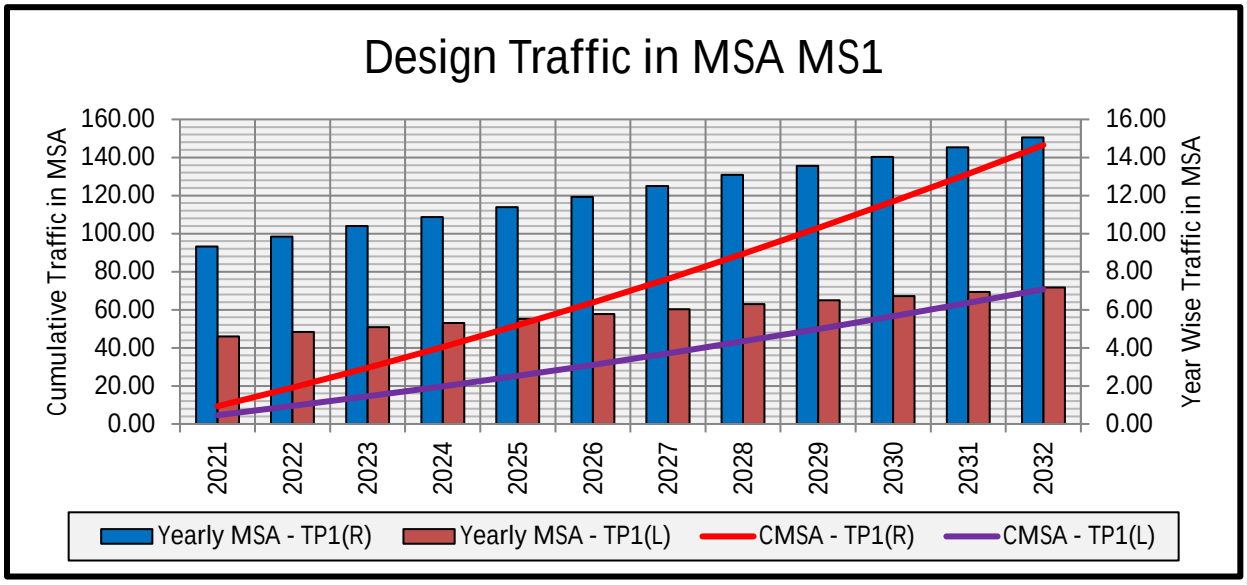
Note: More recent Axle Load surveys were not undertaken as the project road has a long operational history and we did not believe material changes in these loading patterns would have occurred during the period post the survey date.

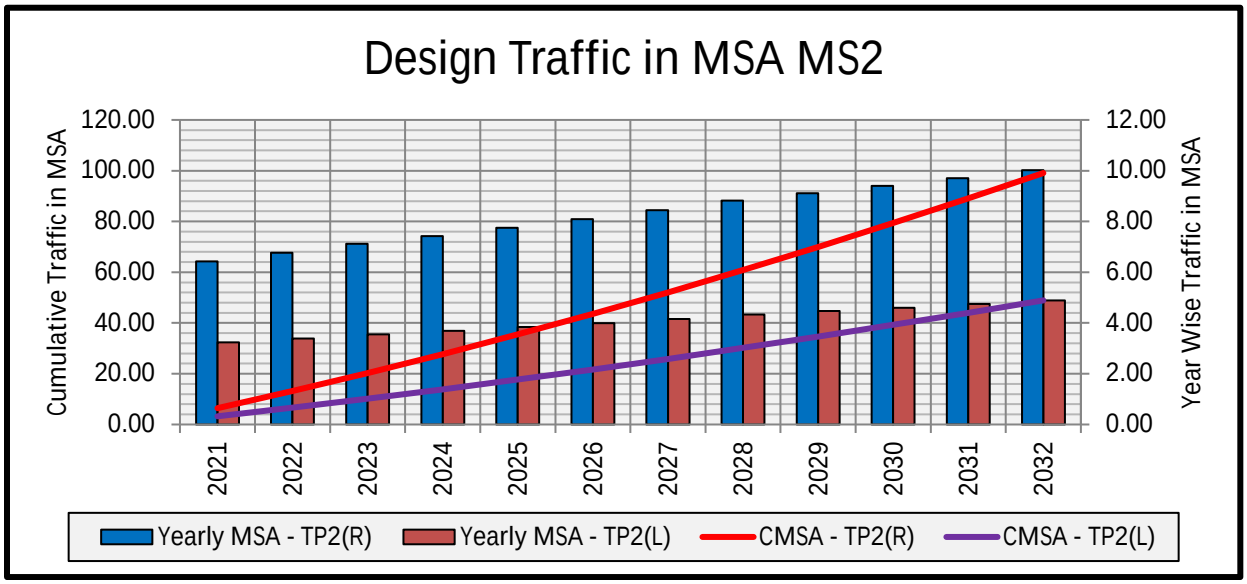
f) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from Year 2019 to Year 2031

Homogenous Section	Location		As per Pavement Design	As per Current Survey
	From	To		
MS 1	120+012	175+000	66 MSA	70 MSA LHS, 146 MSA RHS
MS 2	175+000	229+476	63 MSA	49 MSA LHS, 100 MSA RHS





AECOM is in the opinion that considering existing pavement condition, year of construction and roughness index, executed MM in MS1 and MS2 shall hold good till next MM cycle. in FY 2023 / 24.

1.12 Major Maintenance

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. It is noted that Concessionaire has carried out MM in Year 2018 in MS1 and work in progress along MS 2.

The summary of MM executed in MS 1 and Planned MM in MS 2 is summarized as below:

MM Work in Year 2018 – 2019 & 2019 – 2020

Chainage		Length	LHS	RHS
From	To	(km)	Both Lane	Both Lane
MS 1 (KM 120.012 to Km 175				
120+000	175+000	55.000	45 km Microsurfacing 10 Km 30 mm BC	55 km 30 mm BC 2.4 km of DBM and
MS 2 (KM 175 to Km 229.476)				
174+741	187+800	13.059	Microsurfacing (with rehabilitation where required	35 mm BC (with rehabilitation where required)
187+800	198+800	11.000	30 mm BC (with rehabilitation where required	
198+800	220+000	21.200	Microsurfacing (with rehabilitation where required	
220+000	222+000	2.000	30 mm BC (with rehabilitation where required	35 mm BC (with rehabilitation where required

Chainage		Length (km)	LHS	RHS
From	To		Both Lane	Both Lane
222+000	229+100	7.100	Microsurfacing (with rehabilitation where required	

The above proposal is vetted by IE and consented for execution. As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. MM Cycles for balance concession period is to be planned as follows:

Proposed MM Cycle for balance Concession Period

i) Main Carriageway

Sn	Year	Treatment Proposed	
		LHS	RHS
1	2022 / 23 (MS 1)	Microsurfacing – 8.96 km	Micro Surfacing – 25.3 km
		40 mm BC – 11.80 km	30 mm BC – 19.00 km
		50 mm DBM + Microsurfacing – 25.27 km	50 mm DBM + Microsurfacing – 9.30 km
		40 mm BC + 50 mm DBM – 8.80 km	30 mm BC + 50 mm DBM – 1.00 km
2	2023 / 24 (MS 2)	Microsurfacing – 38.70 km	Micro Surfacing – 35.2 km
		30 mm BC – 8.60 km	30 mm BC – 14.00 km
		50 mm DBM + Microsurfacing – 1.50 km	50 mm DBM + Microsurfacing – 0.40 km
		30 mm BC + 50 mm DBM – 5.60 km	30 mm BC + 50 mm DBM – 4.20 km
3	2027 / 28 (MS 1)	Microsurfacing – 13.30 km	Micro Surfacing – 18.2 km
		40 mm BC – 11.80 km	30 mm BC – 23.6 km
		50 mm DBM + Microsurfacing – 25.10 km	50 mm DBM + Microsurfacing – 1.80 km
		40 mm BC + 50 mm DBM – 4.40 km	30 mm BC + 50 mm DBM – 11.00 km
4	2028 / 29 (MS 2)	Microsurfacing – 8.10 km	Micro Surfacing – 10.6 km
		30 mm BC – 37.60 km	30 mm BC – 34.2 km
		50 mm DBM + Microsurfacing – 6.10 km	50 mm DBM + Microsurfacing – 8.20 km
		40 mm BC + 50 mm DBM – 2.60 km	30 mm BC + 50 mm DBM – 1.40 km
5	2031	30 mm BC Overlay along entire length	

ii) Service Road:

a. Year 2022/23 for MS1 and Year 2023/24 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

b. Year 2027/28 for MS1 and Year 2028/29 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

c. Year 2031 – Microsurfacing on 100 % length

Structure Major Maintenance

a) Replacement of Wearing Coat every fifth year

1.13 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period (12 years). O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. TMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per current NHAI Policy, all toll lanes shall have compulsory Fast Tags at all lanes and payment to be collected through ETC system only. Due to which it is expected to reduce operation cost mainly for manpower cost. Implementation of Hybrid ETC is considered from Year 2022/23 considering overloading shall be collected.

As per AECOM calculation average yearly O & M Cost is Rs. 25.01 crore per year. Year wise cost summary is appended in next page.

O and M Cost including GST without Escalation

Abstract of Cost for Operation & Maintenance Cost – Jaipur Mahua Tollway Limited (JMTL)

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Head Office and Admin Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										
2	2022-23	53,223,955	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	250,060,929
3	2023-24	9,321,755	30,405,806	6,808,172	42,693,877	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	233,823,633
4	2024-25	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
5	2025-26	17,526,874	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	214,363,849
6	2026-27	20,170,239	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	217,007,213
7	2027-28	22,504,705	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	219,341,679
8	2028-29	9,321,755	30,405,806	6,808,172	42,693,877	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	233,823,633
9	2029-30	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
10	2030-31	9,321,755	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	206,158,729
11	2031-32	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
	Total	181,311,988	304,058,059	68,081,722	205,619,543	262,253,287	17,783,180	680,987,017	59,277,273	425,639,467	2,205,011,536

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Head Office and Admin Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
Total Cost in Crore		18.13	30.41	6.81	20.56	26.23	1.78	68.10	5.93	42.56	220.50

1.14 Major Maintenance Cost

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Major Maintenance cost for balance Concession summarized as below:

Sn	Year	Cost with Escalation and GST
2	2022 / 23 (For MS1)	75.03 crore
3	2023 / 24 (For MS2)	45.01 crore
4	2027 / 28 (For MS1)	76.22 crore
5	2028 / 29 (For MS2)	64.78 crore
6	2030/31(MS1 and MS 2)	96.57 crore

1.15 List of Document Reviewed

The following documents were reviewed during our study for the preparation of this DD report:

		Status	Remarks
1	Concession Agreement – all Vols.	Available	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	Available	
3	Detail Highway Inventory and Condition Survey Report	Available	Inventory list
4	Detail Structure Inventory and Condition Survey Report	Available	
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	Not Available	
6	Balance Work List with BOQ if any	Not Applicable	
7	Past Technical DD Report	Not Available	
8	Change of Scope Documents	Available	
9	Provisional COD Letter along with Punch List	Available	
10	Final COD Letter with Exclusion List if any	Available	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	Available	
12	NCR Status	Not Available	

		Status	Remarks
13	Operation and Maintenance Manual, Yearly Maintenance Program	Manual Of 2009 And 2011	
14	Current Operation and Maintenance Arrangement / Strategy	Available	Maintenance program for 2022-23
15	Detail of TMS and ATMS / HTMS installed at site	Available	TMS Data
16	Pavement Design Report	Available	
17	Historical Major Maintenance and Strategy	Available	
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	Available	
19	As Built Drawing	Available	
20	MPR during Construction Stage (only last three months)	Not Available	
21	MPR of Independent Engineer during Maintenance stage	Available	6 Months
22	MPR Lender Report	Not Available	
23	Monthly Inspection Report during O and M	Available	
24	Historical O&M and MM Cot Cost	Available	O & M Contract with vendor
25	Major Maintenance Forecast	Available	
26	Traffic Data (Actual till now and projection till end of Concession Period)	Available	
27	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	Available	Safety Audit Report of Feb 2019
28	Other Documents		

2 Pavement Evaluation and Future Maintenance Requirements

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.2 Pavement Design

As per the Concession Agreement pavement is required to be designed for the 20 Years for minimum 90 MSA.

a) Review of Pavement Design

During construction of road, pavement deign was carried out for 65 MSA till year 2026 i.e. 20 years design traffic for HS 4) and for other location design pavement is for full Concession Period). Summary of Report is presented as below:

Section	Design Traffic in MSA for Full Concession Period	Design Traffic MSA	CBR	Pavement Thickness (mm)			Remarks
				BC	DBM	WMM + GSB	
HS 1 Km 128	63	65	7 %	50	135	480	
HS 2 Km 163	80	65	7 %	50	135	480	
HS 3 Km 205	68	65	7 %	50	135	480	
HS 4 Km 222	100	65	7 %	50	135	480	

The proposed design has approved by IE / NHAI during construction therefore consider as compliance of Concession Agreement. It is to be noted that based on current survey data provided by the Client design traffic for HS 1 and HS 2 is higher than HS 3 and HS 4 while comparing. VDF adopted for calculation of design traffic by concessionaire is given below:

Vehicle Type	VDF Adopted	
	Mahua - Jaipur	Jaipur- Mahua
Standard Bus	0.79	0.70
LCV	0.45	0.45
Truck	5.11	4.71

2.3 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.3.1 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement in the month of January 2022 for both MS 1 (Km 120 to 175) and MS 2 (Km 175 to Km 229. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer.

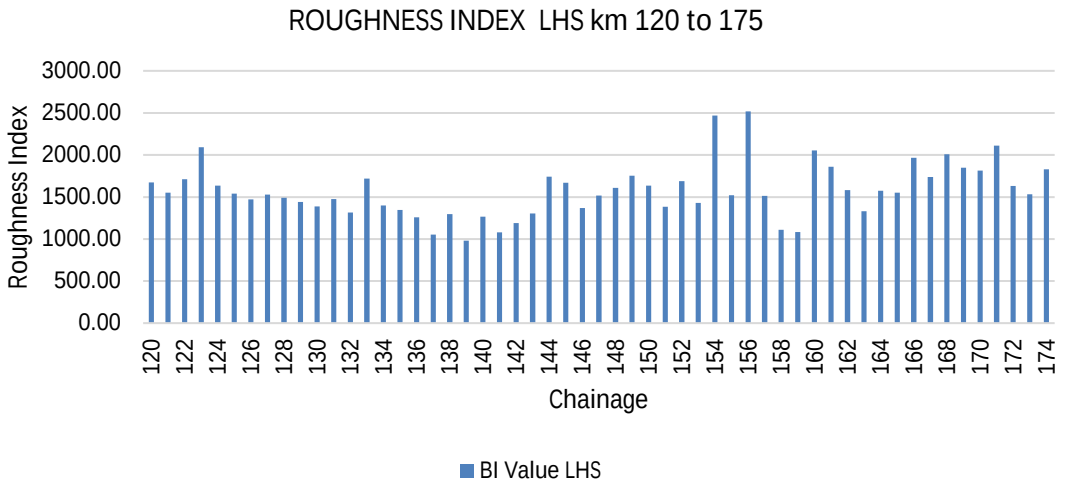
Based on the Roughness value, project road was classified into following three categories:

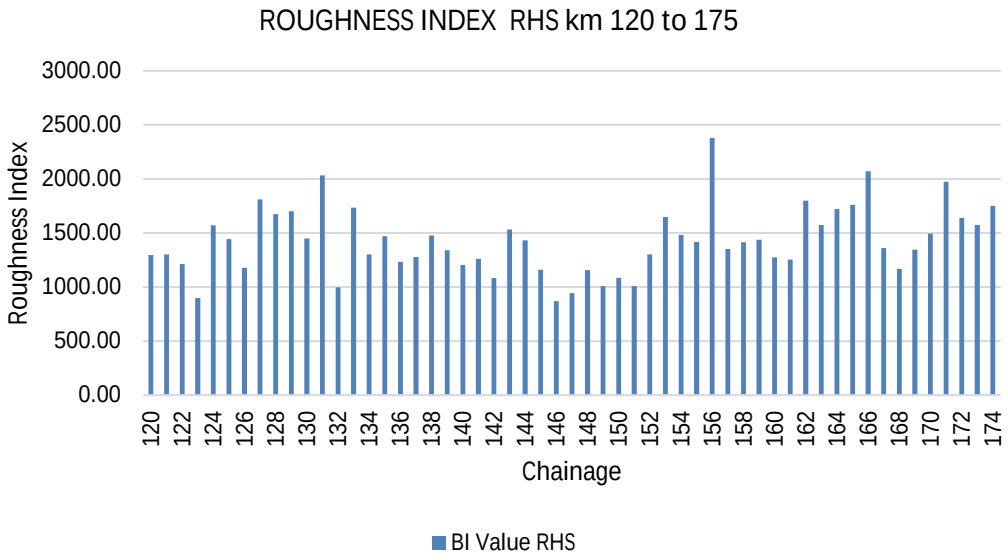
Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000 - 3000
Poor	>3000

The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:
MS 1 (KM 120 to KM 175)

Summary of Roughness Index

Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		Length - km	
		Inner	Outer
Good	< 2000	49	52
Fair	2000 - 3000	6	3
Poor	>3000	0	0

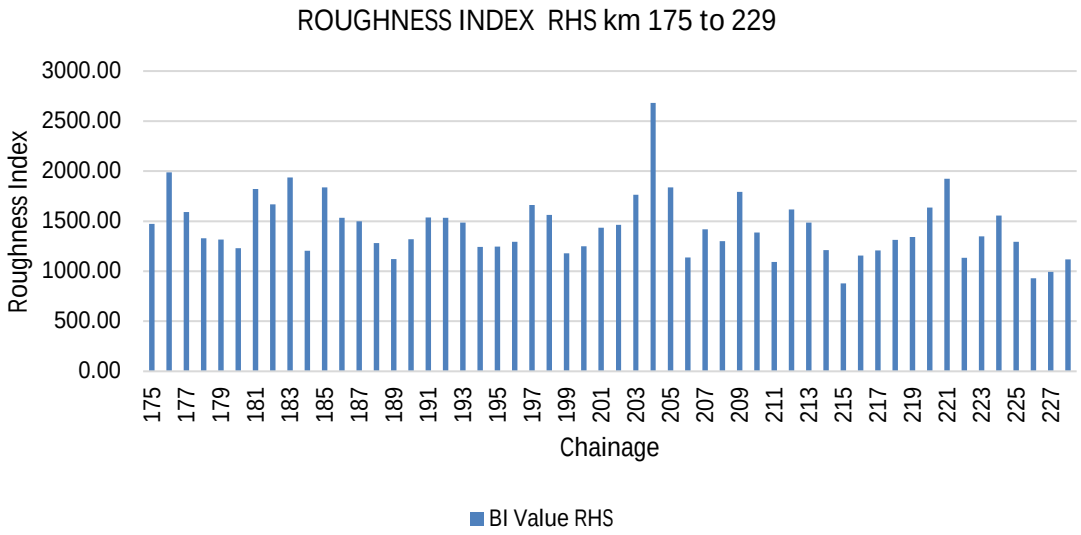


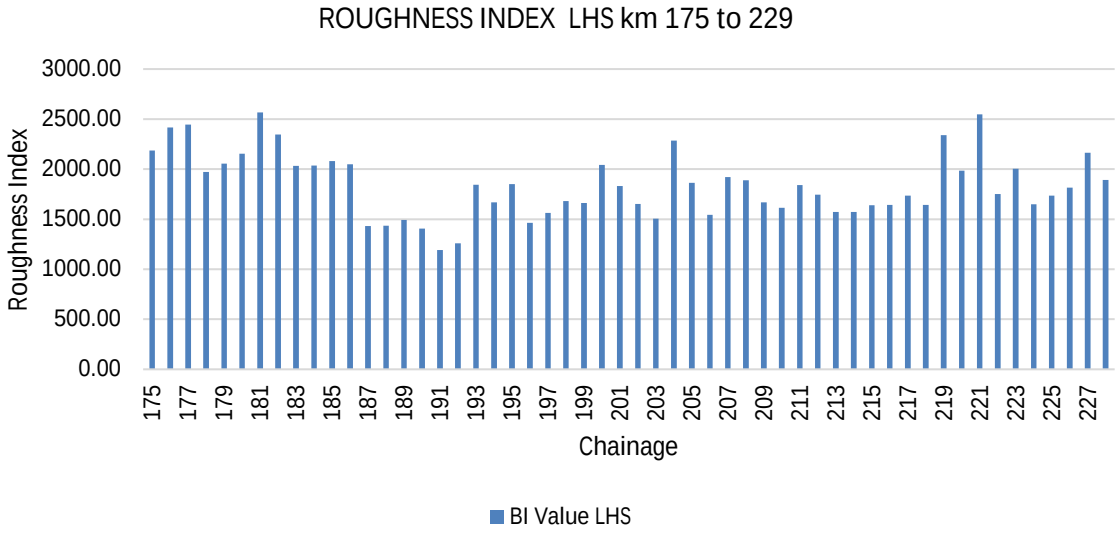


MS 2 (KM 175 to KM 229)

Summary of Roughness Index

Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		Length - km	
		Inner	Outer
Good	< 2000	37	53
Fair	2000 - 3000	17	1
Poor	>3000	0	0





2.3.2 Test Pit

Test pit data not available.

2.3.3 Core Test

Core data not available.

2.3.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD survey in the month of Dec 2020 after completion of Major Maintenance in MS 1 and before carrying out major maintenance in MS 2. FWD survey report along with analysis has provided. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented below and the detail data and calculations as provided by the Client.

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
120	120.2	21	189	771	786
120.2	120.4	46	185	770	756
120.4	120.6	6	190	783	784
120.6	120.8	5	189	408	784
120.8	121	3	19	781	782
121	121.2	3	175	468	782
121.2	121.4	8	49	414	529
121.4	121.6	21	10	781	776
121.6	121.8	10	188	767	253
121.8	122	5	10	705	375
122	122.2	6	4	728	759
122.2	122.4	258	18	103	527
122.4	122.6	21	14	534	155
122.6	122.8	5	74	291	195
122.8	123	31	74	534	542
123	123.2	11	192	540	542
123.2	123.4	10	8	542	536
123.4	123.6	62	16	195	536
123.6	123.8	61	20	516	277
123.8	124	184	2	525	258
124	124.2	25	12	525	258
124.2	124.4	2	11	524	368
124.4	124.6	6	11	8	368
124.6	124.8	3	29	539	85
124.8	125	3	29	1095	175
125	125.2	2	2	1107	339
125.2	125.4	3	5	1101	126
125.4	125.6	8	9	456	126
125.6	125.8	56	8	44	67
125.8	126	3	134	1104	350
126	126.2	191	134	39	28
126.2	126.4	155	188	760	200
126.4	126.6	4	40	211	39
126.6	126.8	60	172	392	30
126.8	127	29	6	649	82
127	127.2	2	6	659	82
127.2	127.4	2	11	402	375
127.4	127.6	1	41	642	273
127.6	127.8	3	41	402	650
127.8	128	11	85	391	632
128	128.2	2	10	394	262
128.2	128.4	1	77	91	146
128.4	128.6	10	70	94	146

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
128.6	128.8	3	27	321	50
128.8	129	1	52	520	222
129	129.2	1	12	643	483
129.2	129.4	3	3	403	69
129.4	129.6	3	3	603	399
129.6	129.8	2	19	648	222
129.8	130	3	2	644	6
130	130.2	5	5	169	201
130.2	130.4	10	23	56	179
130.4	130.6	4	2	121	29
130.6	130.8	5	2	58	27
130.8	131	6	3	67	27
131	131.2	14	3	476	98
131.2	131.4	105	111	74	51
131.4	131.6	61	14	36	76
131.6	131.8	27	14	221	52
131.8	132	4	32	461	52
132	132.2	40	32	762	325
132.2	132.4	1	141	770	36
132.4	132.6	2	12	600	429
132.6	132.8	10	67	781	448
132.8	133	135	13	759	780
133	133.2	18	55	32	754
133.2	133.4	16	4	316	12
133.4	133.6	10	4	773	699
133.6	133.8	4	9	33	35
133.8	134	61	125	55	750
134	134.2	3	125	644	360
134.2	134.4	134	138	206	36
134.4	134.6	9	101	45	11
134.6	134.8	36	38	61	149
134.8	135	36	38	61	149
135	135.2	36	38	61	149
135.2	135.4	135	38	81	149
135.4	135.6	135	39	60	733
135.6	135.8	135	103	149	32
135.8	136	135	103	77	298
136	136.2	135	103	466	764
136.2	136.4	136	103	47	769
136.4	136.6	134	102	143	344
136.6	136.8	110	102	86	152
136.8	137	135	103	203	169
137	137.2	135	139	44	208

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
137.2	137.4	133	139	103	208
137.4	137.6	61	141	86	54
137.6	137.8	59	139	78	70
137.8	138	134	139	70	34
138	138.2	134	140	97	11
138.2	138.4	133	138	10	174
138.4	138.6	132	136	711	174
138.6	138.8	230	241	702	777
138.8	139	174	241	397	304
139	139.2	229	233	470	304
139.2	139.4	231	106	309	103
139.4	139.6	227	235	69	137
139.6	139.8	231	235	56	772
139.8	140	230	241	51	370
140	140.2	232	240	9	253
140.2	140.4	171	240	17	253
140.4	140.6	216	238	12	68
140.6	140.8	239	243	31	26
140.8	141	244	243	22	26
141	141.2	245	244	13	124
141.2	141.4	172	245	7	1030
141.4	141.6	245	243	20	33
141.6	141.8	240	243	23	177
141.8	142	242	243	565	907
142	142.2	248	239	19	450
142.2	142.4	172	243	162	450
142.4	142.6	247	248	49	813
142.6	142.8	169	248	344	738
142.8	143	244	248	390	748
143	143.2	241	245	682	934
143.2	143.4	247	158	166	303
143.4	143.6	8	74	28	19
143.6	143.8	9	74	20	19
143.8	144	99	7	222	40
144	144.2	5	90	18	265
144.2	144.4	174	11	36	22
144.4	144.6	174	11	36	22
144.6	144.8	174	11	36	22
144.8	145	174	11	36	22
145	145.2	11	16	39	230
145.2	145.4	12	10	62	28
145.4	145.6	57	57	929	930
145.6	145.8	4	57	921	1023

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
145.8	146	28	9	920	1021
146	146.2	3	12	927	1000
146.2	146.4	2	12	187	421
146.4	146.6	2	50	238	421
146.6	146.8	12	50	75	657
146.8	147	2	5	639	673
147	147.2	7	3	654	265
147.2	147.4	47	86	402	265
147.4	147.6	127	168	625	84
147.6	147.8	23	168	618	84
147.8	148	122	24	603	703
148	148.2	10	11	621	700
148.2	148.4	8	78	604	700
148.4	148.6	6	2	616	705
148.6	148.8	2	9	395	699
148.8	149	5	69	617	96
149	149.2	3	69	393	96
149.2	149.4	4	12	389	635
149.4	149.6	12	12	11	635
149.6	149.8	3	12	91	228
149.8	150	3	5	390	178
150	150.2	3	28	397	395
150.2	150.4	9	28	15	395
150.4	150.6	48	62	151	612
150.6	150.8	3	3	489	60
150.8	151	26	15	472	60
151	151.2	4	38	660	428
151.2	151.4	2	125	657	4
151.4	151.6	8	21	662	385
151.6	151.8	54	21	197	10
151.8	152	26	126	87	610
152	152.2	131	127	63	83
152.2	152.4	22	129	17	627
152.4	152.6	5	129	8	617
152.6	152.8	153	44	133	617
152.8	153	3	175	35	38
153	153.2	133	3	91	89
153.2	153.4	132	26	396	13
153.4	153.6	132	26	396	13
153.6	153.8	132	26	396	13
153.8	154	24	26	271	13
154	154.2	15	131	47	201
154.2	154.4	49	159	472	757

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
154.4	154.6	8	195	286	433
154.6	154.8	109	195	108	433
154.8	155	78	17	287	66
155	155.2	37	185	430	437
155.2	155.4	9	196	56	431
155.4	155.6	288	196	430	424
155.6	155.8	68	16	422	439
155.8	156	72	16	426	439
156	156.2	287	17	432	446
156.2	156.4	275	17	415	441
156.4	156.6	275	17	415	441
156.6	156.8	275	17	415	441
156.8	157	203	187	430	427
157	157.2	46	96	431	437
157.2	157.4	19	190	432	429
157.4	157.6	9	193	419	434
157.6	157.8	199	43	432	434
157.8	158	41	194	772	249
158	158.2	191	194	429	153
158.2	158.4	194	194	776	833
158.4	158.6	199	192	708	833
158.6	158.8	200	196	257	805
158.8	159	192	193	21	805
159	159.2	199	193	778	216
159.2	159.4	198	82	37	32
159.4	159.6	194	192	699	33
159.6	159.8	200	192	48	33
159.8	160	195	191	786	783
160	160.2	195	45	798	803
160.2	160.4	200	277	27	608
160.4	160.6	36	9	9	112
160.6	160.8	200	9	60	829
160.8	161	199	8	785	836
161	161.2	2	8	788	791
161.2	161.4	36	190	800	823
161.4	161.6	2	9	783	816
161.6	161.8	20	7	777	816
161.8	162	13	34	793	796
162	162.2	2	14	779	9
162.2	162.4	6	18	786	24
162.4	162.6	123	25	16	790
162.6	162.8	127	71	93	68
162.8	163	65	132	429	425

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
163	163.2	26	19	11	806
163.2	163.4	132	19	354	1116
163.4	163.6	129	4	965	1131
163.6	163.8	131	133	367	809
163.8	164	131	17	137	1135
164	164.2	132	17	196	160
164.2	164.4	21	7	12	56
164.4	164.6	128	130	982	140
164.6	164.8	129	126	940	289
164.8	165	38	126	969	1162
165	165.2	24	35	955	1129
165.2	165.4	170	185	997	1078
165.4	165.6	22	91	97	1125
165.6	165.8	12	175	141	1098
165.8	166	64	175	988	1065
166	166.2	5	179	960	935
166.2	166.4	9	13	700	822
166.4	166.6	3	13	711	7
166.6	166.8	7	14	715	21
166.8	167	5	145	84	726
167	167.2	179	162	73	726
167.2	167.4	178	42	710	711
167.4	167.6	22	42	676	715
167.6	167.8	26	28	692	70
167.8	168	14	181	710	744
168	168.2	157	15	680	719
168.2	168.4	118	2	686	719
168.4	168.6	11	8	697	73
168.6	168.8	177	46	701	73
168.8	169	16	46	693	680
169	169.2	181	6	681	134
169.2	169.4	179	6	686	697
169.4	169.6	15	34	489	9
169.6	169.8	41	4	503	719
169.8	170	86	10	491	19
170	170.2	220	10	671	19
170.2	170.4	46	9	690	251
170.4	170.6	124	9	650	713
170.6	170.8	2	9	689	136
170.8	171	5	9	700	47
171	171.2	5	12	580	47
171.2	171.4	5	17	324	611
171.4	171.6	62	17	443	123

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
171.6	171.8	225	21	138	138
171.8	172	187	21	35	36
172	172.2	64	113	145	593
172.2	172.4	7	38	47	593
172.4	172.6	11	228	589	587
172.6	172.8	3	228	149	189
172.8	173	38	80	36	8
173	173.2	228	21	38	620
173.2	173.4	45	21	245	90
173.4	173.6	37	181	426	43
173.6	173.8	15	237	364	43
173.8	174	5	16	14	613
174	174.2	108	237	319	609
174.2	174.4	220	18	566	368
174.4	174.6	3	18	584	368
174.6	174.8	168	6	582	316
174.8	175	168	104	331	60
175	175.2	225	223	332	313
175.2	175.4	170	217	330	300
175.4	175.6	226	221	328	300
175.6	175.8	222	223	324	305
175.8	176	5	218	308	295
176	176.2	159	135	312	302
176.2	176.4	144	124	324	302
176.4	176.6	160	158	329	294
176.6	176.8	155	158	327	294
176.8	177	133	129	321	310
177	177.2	160	137	314	298
177.2	177.4	140	130	329	309
177.4	177.6	159	135	329	309
177.6	177.8	160	155	331	300
177.8	178	156	151	323	318
178	178.2	132	151	307	314
178.2	178.4	139	134	323	314
178.4	178.6	159	104	325	310
178.6	178.8	161	131	331	310
178.8	179	161	138	328	309
179	179.2	126	155	322	308
179.2	179.4	157	157	306	315
179.4	179.6	157	137	329	317
179.6	179.8	156	139	328	285
179.8	180	161	155	327	312
180	180.2	142	139	326	308

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
180.2	180.4	144	149	324	314
180.4	180.6	141	138	324	441
180.6	180.8	144	150	463	441
180.8	181	144	152	466	441
181	181.2	145	64	465	401
181.2	181.4	138	155	12	401
181.4	181.6	138	155	12	401
181.6	181.8	138	155	12	401
181.8	182	138	155	12	401
182	182.2	138	155	12	401
182.2	182.4	138	155	12	401
182.4	182.6	139	141	454	325
182.6	182.8	168	141	262	325
182.8	183	174	157	268	262
183	183.2	172	177	271	257
183.2	183.4	173	182	275	257
183.4	183.6	171	164	275	265
183.6	183.8	172	157	274	246
183.8	184	174	157	276	253
184	184.2	172	177	460	440
184.2	184.4	168	176	453	440
184.4	184.6	169	176	461	427
184.6	184.8	155	175	448	427
184.8	185	167	179	437	438
185	185.2	170	181	465	419
185.2	185.4	173	156	465	415
185.4	185.6	161	161	472	415
185.6	185.8	165	179	449	438
185.8	186	172	179	473	438
186	186.2	125	175	462	428
186.2	186.4	131	9	453	426
186.4	186.6	130	129	470	434
186.6	186.8	132	115	454	429
186.8	187	131	123	451	443
187	187.2	126	128	460	443
187.2	187.4	132	126	463	426
187.4	187.6	128	130	460	426
187.6	187.8	128	120	459	429
187.8	188	14	120	458	445
188	188.2	10	213	83	445
188.2	188.4	121	27	62	7
188.4	188.6	4	395	16	564
188.6	188.8	421	76	152	557

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
188.8	189	39	399	503	46
189	189.2	426	32	502	516
189.2	189.4	34	32	507	31
189.4	189.6	403	395	90	104
189.6	189.8	9	403	513	104
189.8	190	5	5	78	23
190	190.2	368	12	499	23
190.2	190.4	9	6	471	10
190.4	190.6	13	6	499	510
190.6	190.8	8	9	64	510
190.8	191	5	9	492	24
191	191.2	6	405	496	11
191.2	191.4	7	119	476	11
191.4	191.6	5	4	496	121
191.6	191.8	5	4	508	121
191.8	192	4	4	492	535
192	192.2	23	22	391	567
192.2	192.4	76	7	385	426
192.4	192.6	45	7	385	409
192.6	192.8	13	8	383	421
192.8	193	362	8	379	429
193	193.2	29	38	390	392
193.2	193.4	14	38	387	432
193.4	193.6	322	62	371	414
193.6	193.8	325	110	362	272
193.8	194	4	385	386	272
194	194.2	298	17	388	412
194.2	194.4	4	19	367	394
194.4	194.6	10	9	383	394
194.6	194.8	4	353	393	63
194.8	195	320	358	394	63
195	195.2	25	358	384	382
195.2	195.4	9	363	386	367
195.4	195.6	5	9	389	385
195.6	195.8	52	7	386	385
195.8	196	56	350	374	52
196	196.2	277	16	387	377
196.2	196.4	306	45	390	374
196.4	196.6	321	387	385	92
196.6	196.8	312	4	381	334
196.8	197	4	383	16	334
197	197.2	4	383	355	346
197.2	197.4	7	15	292	12

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
197.4	197.6	3	4	16	21
197.6	197.8	18	4	151	25
197.8	198	8	20	25	15
198	198.2	6	20	93	10
198.2	198.4	112	11	76	333
198.4	198.6	335	73	24	333
198.6	198.8	337	19	48	23
198.8	199	193	7	44	15
199	199.2	197	6	5	13
199.2	199.4	2	77	10	8
199.4	199.6	196	77	31	42
199.6	199.8	95	7	5	13
199.8	200	44	8	177	13
200	200.2	142	8	20	13
200.2	200.4	20	167	14	13
200.4	200.6	95	22	114	17
200.6	200.8	193	22	17	52
200.8	201	195	12	72	68
201	201.2	22	22	33	4
201.2	201.4	196	22	48	7
201.4	201.6	197	156	89	6
201.6	201.8	2	2	21	5
201.8	202	47	2	92	5
202	202.2	147	217	243	364
202.2	202.4	147	151	381	364
202.4	202.6	196	154	378	356
202.6	202.8	196	60	374	356
202.8	203	198	236	382	367
203	203.2	190	232	379	103
203.2	203.4	195	83	371	372
203.4	203.6	192	232	376	372
203.6	203.8	194	232	381	120
203.8	204	195	235	380	252
204	204.2	197	104	373	365
204.2	204.4	195	43	374	365
204.4	204.6	195	43	374	350
204.6	204.8	195	43	374	350
204.8	205	151	53	319	127
205	205.2	10	170	317	391
205.2	205.4	195	193	230	379
205.4	205.6	196	193	168	384
205.6	205.8	41	219	325	378
205.8	206	255	251	322	387

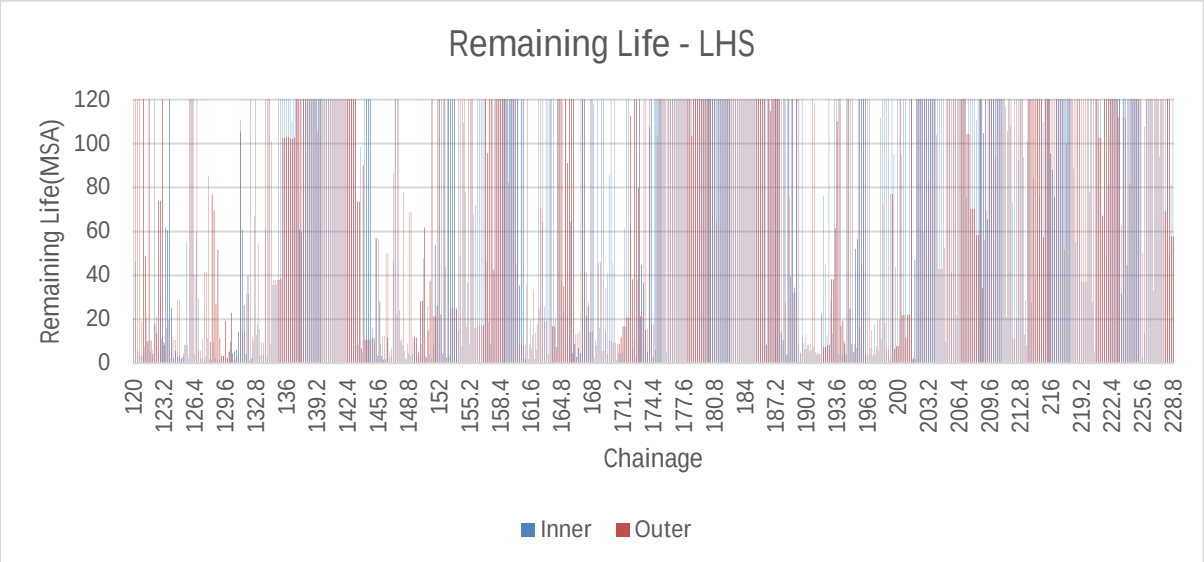
Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
206	206.2	257	251	323	387
206.2	206.4	22	252	325	379
206.4	206.6	260	255	327	252
206.6	206.8	260	252	327	252
206.8	207	129	252	323	387
207	207.2	260	251	327	380
207.2	207.4	76	104	159	222
207.4	207.6	291	104	325	238
207.6	207.8	291	70	325	107
207.8	208	291	70	325	107
208	208.2	291	70	325	107
208.2	208.4	111	58	3	107
208.4	208.6	281	58	325	377
208.6	208.8	287	229	193	78
208.8	209	287	34	320	389
209	209.2	105	56	288	385
209.2	209.4	292	69	319	154
209.4	209.6	66	253	323	291
209.6	209.8	141	255	321	387
209.8	210	291	255	325	357
210	210.2	289	256	324	386
210.2	210.4	169	93	324	383
210.4	210.6	288	253	328	383
210.6	210.8	295	253	167	385
210.8	211	289	253	329	385
211	211.2	294	126	351	182
211.2	211.4	289	117	356	384
211.4	211.6	21	106	264	432
211.6	211.8	236	244	354	77
211.8	212	108	244	358	77
212	212.2	73	11	363	114
212.2	212.4	149	11	361	418
212.4	212.6	20	253	355	424
212.6	212.8	93	253	363	430
212.8	213	288	253	363	423
213	213.2	265	249	362	416
213.2	213.4	94	13	356	428
213.4	213.6	29	8	347	422
213.6	213.8	101	252	347	428
213.8	214	292	252	356	431
214	214.2	28	253	350	46
214.2	214.4	84	253	357	46
214.4	214.6	39	243	354	340

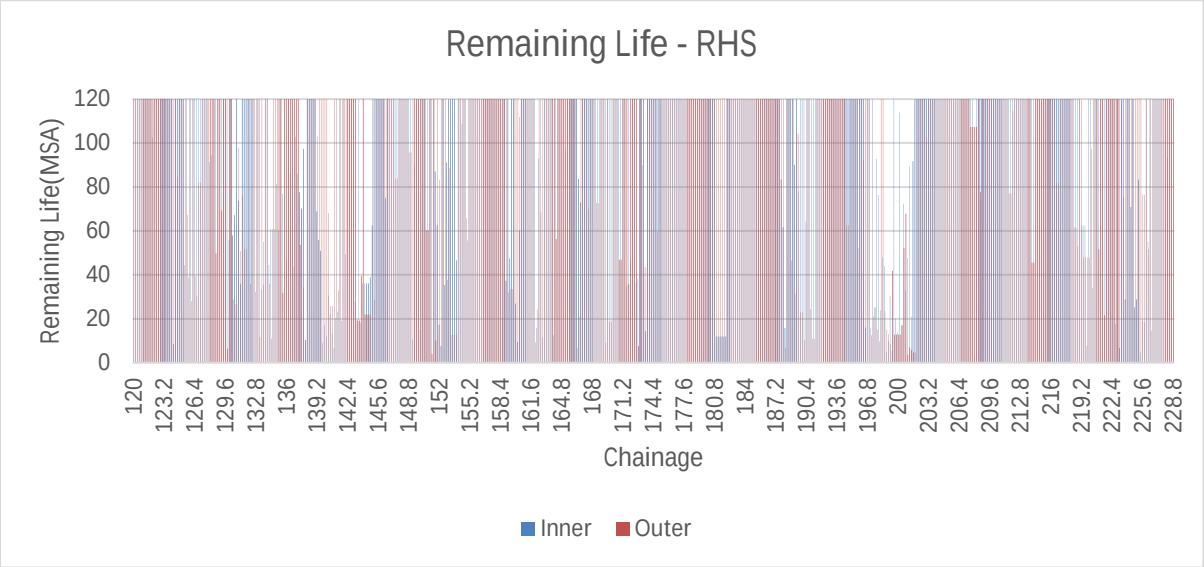
Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
214.6	214.8	187	234	353	347
214.8	215	77	234	356	266
215	215.2	265	236	442	341
215.2	215.4	110	58	427	334
215.4	215.6	267	264	433	338
215.6	215.8	264	236	433	338
215.8	216	242	266	392	341
216	216.2	95	267	402	337
216.2	216.4	88	262	390	327
216.4	216.6	76	262	400	341
216.6	216.8	147	258	402	82
216.8	217	267	196	394	82
217	217.2	204	196	400	344
217.2	217.4	261	176	403	339
217.4	217.6	259	52	400	339
217.6	217.8	267	100	404	340
217.8	218	265	268	396	340
218	218.2	266	268	398	340
218.2	218.4	266	151	400	340
218.4	218.6	89	151	200	62
218.6	218.8	55	255	396	62
218.8	219	263	255	398	53
219	219.2	253	251	170	313
219.2	219.4	37	251	370	313
219.4	219.6	37	251	62	48
219.6	219.8	37	251	62	48
219.8	220	37	251	62	48
220	220.2	462	78	8	48
220.2	220.4	459	220	396	97
220.4	220.6	28	465	396	340
220.6	220.8	5	377	34	334
220.8	221	452	377	187	334
221	221.2	130	103	567	52
221.2	221.4	130	103	620	540
221.4	221.6	68	67	620	540
221.6	221.8	446	452	635	22
221.8	222	48	287	630	530
222	222.2	81	264	636	524
222.2	222.4	261	263	442	526
222.4	222.6	265	248	635	162
222.6	222.8	259	248	635	534
222.8	223	265	264	635	542
223	223.2	264	112	18	173

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
223.2	223.4	241	154	633	475
223.4	223.6	31	63	7	475
223.6	223.8	252	112	615	75
223.8	224	252	112	628	373
224	224.2	45	236	29	527
224.2	224.4	253	82	636	463
224.4	224.6	253	261	618	463
224.6	224.8	251	261	71	185
224.8	225	254	218	639	185
225	225.2	253	218	25	157
225.2	225.4	140	229	29	539
225.4	225.6	252	258	83	232
225.6	225.8	3	50	5	76
225.8	226	14	108	19	76
226	226.2	246	262	19	146

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
226.2	226.4	178	259	240	52
226.4	226.6	250	163	55	234
226.6	226.8	254	261	239	233
226.8	227	33	261	15	232
227	227.2	250	262	234	232
227.2	227.4	249	261	235	231
227.4	227.6	94	261	238	231
227.6	227.8	255	262	238	225
227.8	228	152	69	137	233
228	228.2	249	69	241	231
228.2	228.4	237	262	242	139
228.4	228.6	50	232	93	139
228.6	228.8	82	58	137	230
228.8	229	246	58	239	230

It is noted that in MS 1, FWD test after MM reveals that balance life of some section is less than required life of pavement till next MM which is to be completed before Mar 2023. Concessionaire informed due to this reason regular pavement maintenance by providing patch work, crack sealing as deemed required being carried out round the year therefore no overly is to be planned before next MM Cycle. Overlay requirement is calculated considering 200 m as one section.





2.3.5 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

Axle Load Survey was conducted in the Month July 2018 and analysis has been provided. Comparison between VDF based on traffic survey conducted in July 2018 and VDF adopted during Pavement Design is given below:

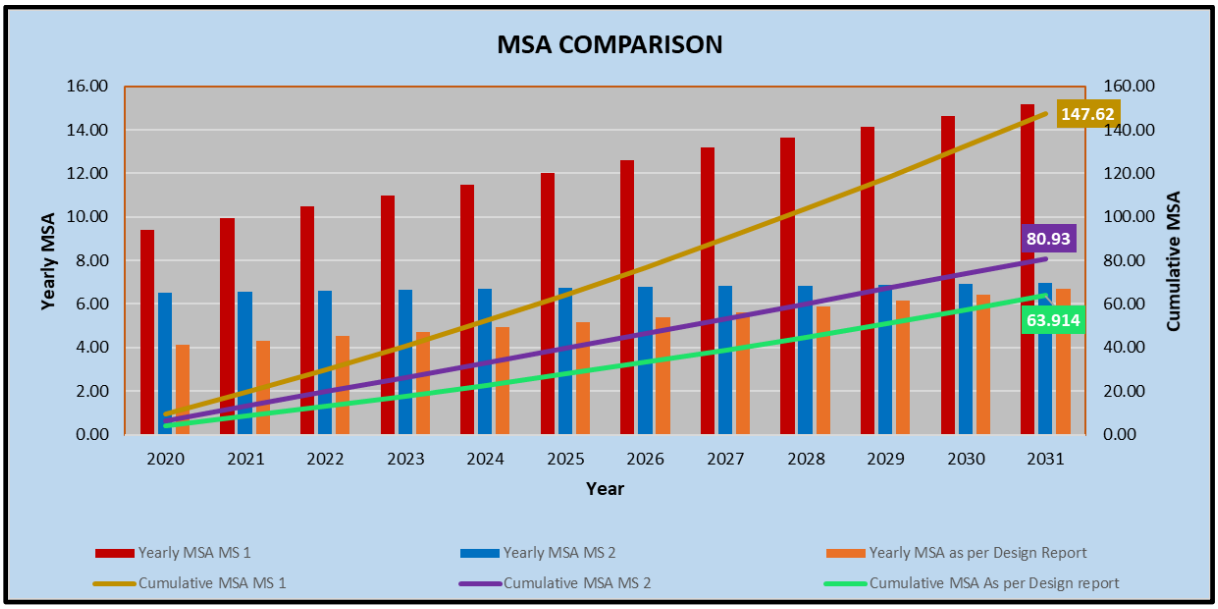
VDF Comparison

S. No	Vehicle Type	As per Pavement Design Report		As per Cube Survey		
		From Mahua-Jaipur	From Jaipur-Mahua	From Mahua-Jaipur	From Jaipur-Mahua	Adopted Value
1	BUS	0.79	0.79	1.542	1.542	1.542
2	LCV	0.45	0.45	1.102	1.763	1.763
3	2-Axle	5.11	4.71	2.927	5.648	5.648
4	3-Axle	5.11	4.71	5.585	9.108	9.108
5	MAV			8.430	19.217	19.217

2.3.6 Homogeneous Section and Design MSA

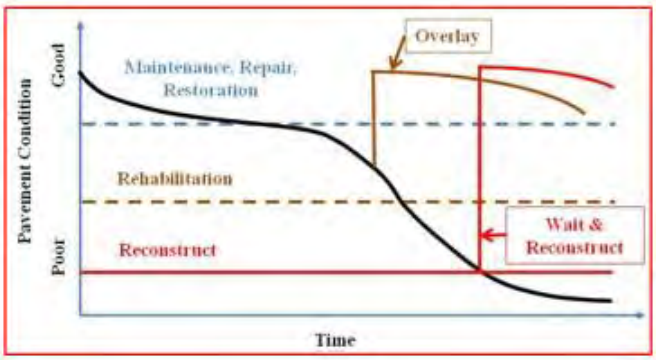
As per current traffic pattern, two homogeneous sections considered for calculation Design MSA. However, during pavement design four homogeneous section was considered. MSA has calculated based on traffic data provided for balance Concession period and VDF as calculated above for balance Concession period. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided is tabled below.

Homogenous Section	Location		As per Pavement Design	As per Current Survey
	From	To		
MS 1	120+012	175+000	66 MSA	70 MSA LHS, 146 MSA RHS
MS 2	175+000	229+476	63 MSA	49 MSA LHS, 100 MSA RHS



2.4 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Concessionaire has conducted detail pavement investigation in April 2018 and Major Maintenance was carried out accordingly. KM wise major maintenance as proposed and executed in Year 2018 / 2019 is as below:

Last MM Work executed

Chainage		Length (km)	LHS	RHS
From	To		Both Lane	Both Lane
120000	175000	55000	45 km Microsurfacing and 10 Km 30 mm BC	2.4 km of DBM and 55 km 30 mm BC
174741	187800	13059	Microsurfacing (with rehabilitation where required	35 mm BC (with rehabilitation where require)
187800	198800	11000	30 mm BC (with rehabilitation where required	
198800	220000	21200	Microsurfacing (with rehabilitation where required	
220000	222000	2000	30 mm BC (with rehabilitation where required	
222000	229100	7100	Microsurfacing (with rehabilitation where required	

The above proposal is vetted by IE and consented for execution. As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. Proposed MM cycles for balance concession period is as follows:

Proposed MM Cycle for balance Concession Period

Requirement of overlay is calculated considering 200 m lane as one section. The section length considered is executable at site as per Cube Highways. The detail lane wise 200 m interval calculation is provided in soft copy. The summary of MM cycle is presented below:

iii) Main Carriageway

Sn	Year	Treatment Proposed	
		LHS	RHS
1	2022 / 23 (MS 1)	Microsurfacing – 8.96 km	Micro Surfacing – 25.3 km
		40 mm BC – 11.80 km	30 mm BC – 19.00 km
		50 mm DBM + Microsurfacing – 25.27 km	50 mm DBM + Microsurfacing – 9.30 km
		40 mm BC + 50 mm DBM – 8.80 km	30 mm BC + 50 mm DBM – 1.00 km
2	2023 / 24 (MS 2)	Microsurfacing – 38.70 km	Micro Surfacing – 35.2 km
		30 mm BC – 8.60 km	30 mm BC – 14.00 km
		50 mm DBM + Microsurfacing – 1.50 km	50 mm DBM + Microsurfacing – 0.40 km
		30 mm BC + 50 mm DBM – 5.60 km	30 mm BC + 50 mm DBM – 4.20 km
3	2027 / 28 (MS 1)	Microsurfacing – 13.30 km	Micro Surfacing – 18.2 km
		40 mm BC – 11.80 km	30 mm BC – 23.6 km
		50 mm DBM + Microsurfacing – 25.10 km	50 mm DBM + Microsurfacing – 1.80 km
		40 mm BC + 50 mm DBM – 4.40 km	30 mm BC + 50 mm DBM – 11.00 km

Sn	Year	Treatment Proposed	
		LHS	RHS
4	2028 / 29 (MS 2)	Microsurfacing – 8.10 km	Micro Surfacing – 10.6 km
		30 mm BC – 37.60 km	30 mm BC – 34.2 km
		50 mm DBM + Microsurfacing – 6.10 km	50 mm DBM + Microsurfacing – 8.20 km
		40 mm BC + 50 mm DBM – 2.60 km	30 mm BC + 50 mm DBM – 1.40 km
5	2031	30 mm BC Overlay along entire length	

iv) Service Road:

a. Year 2022/23 for MS1 and Year 2023/24 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

b. Year 2027/28 for MS1 and Year 2028/29 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

c. Year 2031 – Microsurfacing on 100 % length

Structure Major Maintenance

a) Replacement of Wearing Coat every fifth year

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, construction of highway on the site set forth in Schedule A and as specified in Schedule B, together with provision of Project Facilities as specified in Schedule C, and in conformity with the Specifications and Standards set forth in Schedule-D. Project road has completed in compliance to Concession Agreement and there is no balance work to be considered in CAPEX. In general CAPEX is considered for following works:

1. Balance work as per Original scope of work – Not applicable
2. Replacement of defective Equipment at Toll Plaza, software and ECB – Not Applicable
3. Penalty for due to Failure of rectification of defects and deficiency during O & M Period

The summary of all work and cost considered under Initial CAPEX is tabled as below:

Sn	Description of Work	Quantity	Amount
A	Balance Work		
B	Immediate rehabilitation of existing pavement	Completed	
	Rehabilitation of Rigid Pavement at Toll Plaza 1	30 m length x 50m (450 cum)	
C	Replacement of defective Equipment at Toll Plaza and software		
D	Penalty for due to Failure of rectification of defects and deficiency during O & M Period		

3.1 Initial Repair & Rehabilitation Work

Based on our site investigation, the following repair and rehabilitation work is considered essentially to be carried out immediately therefore it is considered under CAPEX.

1. Major Rehabilitation of Pavement: Existing 50 % rigid pavement at Toll Plaza 2 is poor condition which required immediate repair and rehabilitation. BoQ considered for major maintenance of work is as follows:

Sl. No.	Description of Work	Unit	Quantity	Unit Rate	Amount
	Rigid Pavement at Toll Plaza 2				
1	Dismantling of Existing Rigid Pavement (30 x 50 x 0.30)	cum.	450	1200	5,40,000
2	Providing PQC over existing Base	cum	450	7000	31,50,000
3	Other Safety Items (Speed Breaker, Pavement Marking)	LS	1	5,00,000	5,00,000
	Total Cost for Rehabilitation of Pavement without GST				41,90,000

*We understand that the said repair works with respect to the rigid pavement at toll plaza 2 has been completed by the Concessionaire under Routine Maintenance.

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

Sn	Year	Treatment Proposed	
		LHS	RHS
1	2022 / 23 (MS 1)	Micro surfacing – 8.963 km	Micro Surfacing – 25.3 km
		40 mm BC – 11.8 km	30 mm BC – 19.00 km
		50 mm DBM + Micro surfacing – 25.27 km	50 mm DBM + Microsurfacing – 9.30 km
		40 mm BC + 50 mm DBM – 8.8 km	30 mm BC + 50 mm DBM – 1.00 km
2	2023 / 24 (MS 2)	Microsurfacing – 38.70 km	Micro Surfacing – 35.2 km
		30 mm BC – 8.60 km	30 mm BC – 14.00 km
		50 mm DBM + Microsurfacing – 1.50 km	50 mm DBM + Microsurfacing – 0.40 km
		30 mm BC + 50 mm DBM – 5.60 km	30 mm BC + 50 mm DBM – 4.20 km
3	2027 / 28 (MS 1)	Microsurfacing – 13.30 km	Micro Surfacing – 18.2 km
		40 mm BC – 11.80 km	30 mm BC – 23.6 km
		50 mm DBM + Microsurfacing – 25.10 km	50 mm DBM + Microsurfacing – 1.80 km
		40 mm BC + 50 mm DBM – 4.40 km	30 mm BC + 50 mm DBM – 11.00 km
4	2028 / 29 (MS 2)	Microsurfacing – 8.10 km	Micro Surfacing – 10.6 km
		30 mm BC – 37.60 km	30 mm BC – 34.2 km
		50 mm DBM + Microsurfacing – 6.10 km	50 mm DBM + Microsurfacing – 8.20 km
		40 mm BC + 50 mm DBM – 2.60 km	30 mm BC + 50 mm DBM – 1.40 km
5	2031	30 mm BC Overlay along entire length	

v) Service Road:

d. Year 2022/23 for MS1 and Year 2023/24 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

e. Year 2027/28 for MS1 and Year 2028/29 for MS 2– 30 mm BC on 50 % and Microsurfacing on 50 % length

f. Year 2031 – Microsurfacing on 100 % length

Structure Major Maintenance

a) Replacement of Wearing Coat every fifth year

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provided by the Cube Highways as follows applicable for 2021/22:

Bitumen Price @ 1st March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG10	37160	2650	34510
VG30	37960	2650	35310
VG40	39350	2650	36700

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

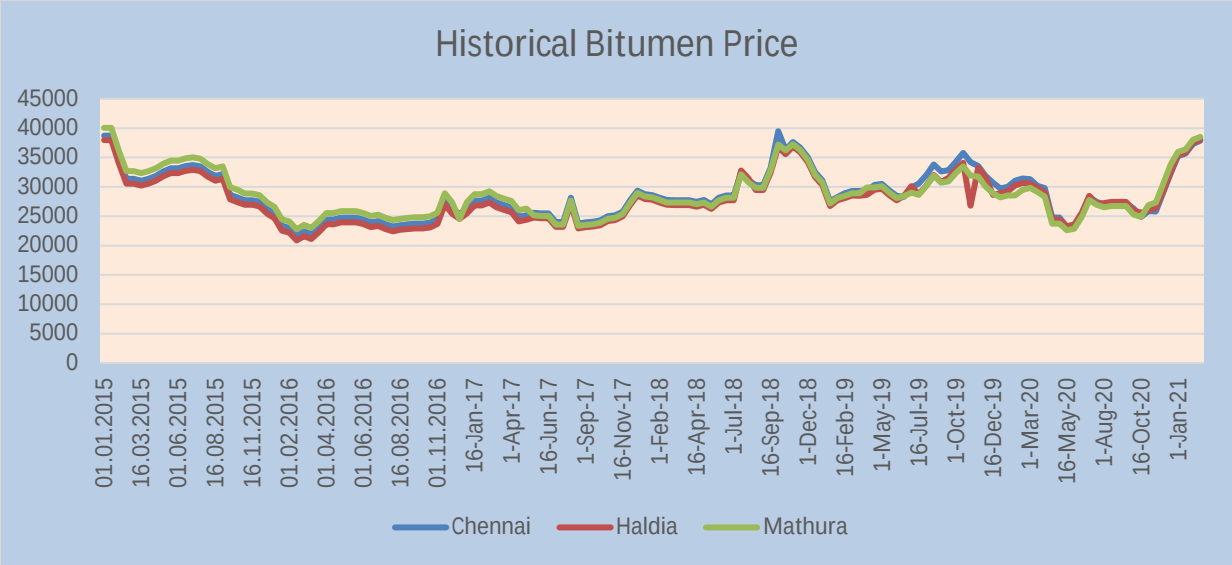
viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on FY 2022.

xii) The historical bitumen price from year 2015 to till date is present in below graph.



xiii) Cube Highway forecast Bitumen for upcoming year as follows:

a) FY 2023

VG 40 – 32,367, VG 30 – 30,977 Rs / MT

b) FY 2024 onwards till end of Concession Period, Bitumen Price is considered same rate as below:

VG 40 – 27,614, VG 30 – 26,224 Rs / MT

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY 22	2.83%	1.000
FY 23	4.66%	1.047
FY 24	5.65%	1.106
FY 25	5.37%	1.165
FY 26	5.52%	1.229
FY 27	5.25%	1.294
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948

Year	Growth Rate	Escalation Factor
FY 38	3.98%	2.026
FY 39	4.00%	2.107
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate of Major Items

Sn	Items Description	Unit	Rates (Rs.) FY 2022-24	Rate (Rs) for FY 24 onwards
1	Dense Bituminous Macadam – CAPEX	Cum	10,544	8,167
2	Bituminous Concrete	Cum	13,123	9,845
3	Microsurfacing	Sqm	176	176
4	Replacement of Joint Sealant in PQC	m	132	132
5	Raising of Road Kerb	m	439	439
6	Road Marking	sqm	439	439
7	Kerb and Crash Barrier Painting	sqm	121	121
8	Shoulder Filling	cum	307	307
9	Road Studs - Normal	nos	220	220
10	Road Studs - Solar	nos	1647	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in next page.
Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Unit Rate for 2022/24	Unit Rate for 2025 onwards	Treatment Cycles Amount				
					MMR (2022/23)	MMR (2023/24)	MMR (2027/28)	MMR (2028/29)	MMR (2030/31)
A	**Main Carriageway - Flexible Pavement**								
1	Tack Coat	Sqm	13	13	11,502,914	5,615,059	11,590,317	11,912,750	27,368,308
2	Bituminous Concrete	Cum	13,123	9,845	270,501,139	94,493,998	160,184,304	219,697,373	578,277,064
3	Milling of existing BC	Sqm	77	77	-	-	31,432,282	13,828,354	-
4	Raising of Road Kerb	m	439	439	23,310,812	23,310,812	23,310,812	23,310,812	-
5	Painting of Road Kerb	sqm	121	121	3,855,045	3,855,045	3,855,045	3,855,045	7,710,091
6	Microsurfacing	sqm	176	176	86,286,245	131,608,554	99,191,049	56,996,890	-
7	DBM	Cum	10,544	8,167	172,984,254	47,095,759	166,701,925	73,339,033	-
B	**Structure(Including Flyover, Elevated,VUP,PUP and bridges)**				-	-		-	
1	Tack Coat	Sqm	13	13	121,206	121,206	-	121,206	121,206
2	Bituminous Concrete	Cum	13,123	9,845	3,698,963	2,774,959	-	2,774,959	2,774,959
3	Milling of existing BC	Sqm	77	77	723,478	723,478	-	-	723,478
C	**Toll Plaza - Rigid**				-	-		-	
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	132	132	-	-	-	-	-
2	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum	6,477	6,477	-	-	-	-	-
3	Joint sealant replacement every 5th Year (5 %)	m	132	132	-	-	-	-	-
D	**Service Road**				-	-		-	
1	Tack Coat	Sqm	13	13	1,040,636	1,040,636	1,040,636	1,040,636	-

Sl. No.	Activity	Unit	Unit Rate for 2022/24	Unit Rate for 2025 onwards	Treatment Cycles Amount				
					MMR (2022/23)	MMR (2023/24)	MMR (2027/28)	MMR (2028/29)	MMR (2030/31)
2	BC - VG 30	Cum	12,576	9,298	30,435,808	22,502,625	22,502,625	22,502,625	-
3	Road Marking - SR	Sqm	439	439	-	-	-	-	-
4	Microsurfacing	Sqm	176	176	14,197,830	14,197,830	14,197,830	14,197,830	56,791,321
E	**Other Works**				-	-		-	
1	Replacement of Road Studs				-	-	-	-	-
	Road Studs	Nos	220	220	130,680	130,680	130,680	130,680	261,360
	Solar Studs	Nos	1,647	1,647	-	-	-	-	-
2	Road Marking - MCW	Sqm	439	439	16,903,087	16,903,087	16,903,087	16,903,087	33,806,174
3	Maintenance of Earthen Shoulder	cum	307	307	2,670,257	2,670,257	2,670,257	2,670,257	4,005,385
F	**Contingency - 2 % above amount**				**12,767,247**	**7,340,880**	**11,074,217**	**9,265,631**	
	Major Maintenance Cost Per				**651,129,602**	**374,384,865**	**564,785,068**	**472,547,169**	**711,839,345**
	GST				**78,135,552**	**44,926,184**	**67,774,208**	**56,705,660**	**85,420,721**
	Major Maintenance Cost				**729,265,154**	**419,311,049**	**632,559,277**	**529,252,829**	**797,260,067**
	Amount in Crores				**72.93**	**41.93**	**63.26**	**52.93**	**79.73**
	Escalation Factor				1.05	1.11	1.36	1.42	1.54
	Esclated Amount keping Bitumen Component w/o Escalation				75.03	45.01	76.22	64.78	96.57

5 OPERATION AND MAINTENANCE COST

5.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 18 – Operation &Maintenance & Schedule – L Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 18 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)
6. Major Maintenance (Functional Overlay and Strengthening Layer)

NHAI has decided to implement 100 % Fast Tags at all lanes and toll collection only shall be through ETC. AECOM has forecast O & M in following two Scenarios:

1) O & M Cost without Fast Tags (as per Concession Agreement)
2) O & M Cost with 100 % Fast Tags

5.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2018, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	NSV Survey
3	Roughness Value (IRI), Rutting	NSV Survey
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	ATMS (ECB)	As per manufacturer's / supplier's recommendation
10	TMS	As per manufacturer's / supplier's recommendation

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each items.

5.3 Requirement of CA (Schedule L and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-L (the "Maintenance Requirements").

5.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine and preventive maintenance covers maintenance of following assets:

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping

- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 20,682 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 11,308 / km / month excluding GST

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light will be operated for 10 hours a day round the year
b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 11 Rs / Kwh.

The calculated electricity cost for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	Km	11.73	137,216	1,609,543
2	Highway Lighting Electricity Charge	Kwh	256,756	12.08	3,100,324
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos	32	3,293	105,382
5	Office Building	LS	24	71,352	1,712,455
	Total				6,808,172

5.6 TMS Cost and ATMS

Following consideration has made during calculation of O & M cost for TMS and ATMS:

a) AMC cost towards TMS is considered 1.5 lakh per lane per year
b) 70 % of equipment shall be replaced in every 7-year interval with the system as adopted as per Concession Agreement.

c) However, NHAI has decided to implement 100 % HYBRID ETC lane at all toll lanes, it is expected increase in AMC (considered 12 % of Total Equipment Cost) and replacement of equipment in every five year as per NHAI Policy and accordingly same has considered.

Average O & M Cost as per AECOM calculation is 1.50 crore per year and additional cost of 2.76 crore for replacement of equipment at every 5 (five) years.

5.7 Corridor Management

The following equipments along with operation manpower is required to provide as per CA:

2 nos of Crane of 30 MT
Traffic Aid Post with 2 nos of route patrol vehicle
2 nos of Ambulance

O & M Cost estimated towards incident management with operation manpower is Rs. 26.23 crore per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1. Management, Administration / HR and Supervision Staff: in-house manpower
2. Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as **Rs. 6.80** core per year

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 4.25 crore** per year. Year wise O & M Cost (OPEX) is presented in next page.

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost - Jaipur Mahua Tollway Limited (JMTL)											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	53,223,955	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	250,060,929
3	2023-24	9,321,755	30,405,806	6,808,172	42,693,877	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	233,823,633
4	2024-25	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
5	2025-26	17,526,874	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	214,363,849
6	2026-27	20,170,239	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	217,007,213
7	2027-28	22,504,705	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	219,341,679
8	2028-29	9,321,755	30,405,806	6,808,172	42,693,877	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	233,823,633
9	2029-30	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
10	2030-31	9,321,755	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	206,158,729
11	2031-32	13,306,983	30,405,806	6,808,172	15,028,974	26,225,329	1,778,318	68,098,702	5,927,727	42,563,947	210,143,957
	Total	**181,311,988**	**304,058,059**	**68,081,722**	**205,619,543**	**262,253,287**	**17,783,180**	**680,987,017**	**59,277,273**	**425,639,467**	**2,205,011,536**
	Total Cost in Crore	**18.13**	**30.41**	**6.81**	**20.56**	**26.23**	**1.78**	**68.10**	**5.93**	**42.56**	**220.50**

6 PROJECT ROAD ANALYSIS

6.1 Reconnaissance Survey

This project road is a Mahua - Jaipur section of Agra Jaipur Expressway of New NH 21. Project road starts from Km 120+012 at Mahua to Km 229+478 at Jaipur in the state of Rajasthan. The total length of the project road is 109 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of October 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretch and length is given as below:

Detail of Project Stretch

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Improvement,Operation and Maintenance of Rehablitation and Strengthening of Existing 2-Lane Road and Widening to 4-lane Divided Highway	120+012	229+478	109.466	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and cross road details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

Start Point of Project Road at Km 120+012	End Point of Project Road at Km 229.478

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 120+012 of Agra Jaipur Section of NH-11 (New NH-21)	Km 120+478 of Agra Jaipur Section of NH-11 (New NH-21)	
2	Project Road End	Km 229+478 of Agra Jaipur Section of NH-11 (New NH-21)	Km 229+100 of Agra Jaipur Section of NH-11 (New NH-21)	
3	Project Length	109.466 km	109.466 km	
6	Carriageway	4 lane highway with paved width 8.5 m on either side in Rural Area, 11 m paved at approach of underpass and Flyover	4 lane highway with paved width 8.5 m on either side in Rural Area, 11 m paved at approach of underpass and Flyover	
7	Shoulders	2.0 m earthen shoulder for main carriageway & 1.5 m Raised Footpath for Service Roads.	2.0 m earthen shoulder for main carriageway & 1.5 m Drain cum Footpath for Service Roads.	
8	Median	4.50 m wide in rural areas and 2.0 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	
9	Service Roads	LHS: 28.628 km RHS: 28.628 km Total One Side Length -	LHS: 28.233 km RHS: 28.403 km Total One Side Length – 56.636	
10	Major Bridge	1 No.	1 No.	
11	Minor Bridge	17 Nos.	17 Nos.	
12	Pipe, Box & Slab Culverts	98 Nos	89 Nos	
13	Major/Minor Junctions	11 Major Junction	11 Major Junction + 62 Minor Junction	
14	Underpass	5 Nos	7 Nos	
15	Grade Separator	1 No.	1 No.	
15	ROB/RUB	1 No.	1 No.	
16	Toll Plazas	2 Nos.	2 Nos.	
17	Truck Lay-byes/Truck Parking	6 Nos.	6 Nos	
18	Bus bays/Bus Stops	30 Nos	26Nos	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td>
</td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

Six type of TCS has been proposed in Schedule-B of CA and same has adhered along project road.

6.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at two Toll Plazas where Rigid Pavement has been provided. Pavement condition is generally Good throughout the project corridor. 50 % of Existing rigid pavement at Toll Plaza 2 i.e. Rajdok is poor required repair and rehabilitation.

6.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

Comparison of Service Road Location between Schedule B and as per Site

	As per Schedule B					As Per Site				
Sn	Location		Side	Length (m)	Width (m)	Location		Side	Length (m)	Width (m)
	From	To				From	To			
1	125.500	126.750	Both	1.250	5.5	125.475	126.700	Both	1.225	5.5
2	129.950	131.650	Both	1.700	5.5	129.950	131.550	Both	1.600	5.5
3	132.850	134.550	Both	1.700	5.5	132.850	135.310	Both	2.460	5.5
4	143.400	145.400	Both	2.000	5.5	143.400	145.250	Both	1.850	5.5
5	151.400	154.450	Both	3.050	5.5	152.620	154.700	Both	2.080	5.5
6	160.300	160.800	Both	0.500	5.5	160.200	160.625	Both	0.425	5.5
7	171.050	171.900	Both	0.850	5.5	171.000	171.725	Both	0.725	5.5
8	174.200	176.450	Both	2.250	5.5	174.570	176.350	LHS	1.780	5.5
						174.500	176.450	RHS	1.950	5.5
						181.100	182.400	Both	1.300	5.5
9	183.000	184.850	Both	1.850	5.5	182.725	184.850	Both	2.125	5.5
10	201.350	202.800	Both	1.450	5.5	201.300	202.120	Both	0.820	5.5
11	207.550	210.050	Both	2.500	5.5	207.300	210.050	Both	2.750	5.5
12	219.950	221.000	Both	1.050	5.5	219.300	221.063	Both	1.763	5.5
13	221.000	229.478	Both	8.478	5.5	221.700	229.030	Both	7.330	5.5
			Total	57.256				Total	56.636	

It is understood from site team, difference in Service Road Length is settled during construction stage and no further consequences due to decrease in service road length.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 1.5 m wide median with Antiglare

4.5m wide Median with Shrubs

56 nos. of Median Openings are found along project road. Most of median openings are not having storage lane and blinkers. List of median openings is tabled below:

Sn	Location		Blinker	Length (m)	Storage Lanes
	From	To			
1	120.180	120.200	NO	20	NO
2	121.860	121.880	NO	20	NO
3	122.790	122.810	NO	20	NO
4	123.850	123.875	NO	25	NO
5	125.000	125.030	YES	30	NO
6	126.050	126.080	NO	30	NO
7	127.770	127.790	NO	20	B/S
8	128.550	128.570	NO	20	LHS
9	130.455	130.485	NO	30	NO
10	130.980	131.010	NO	30	NO
11	133.850	133.880	YES	30	NO
12	137.605	137.630	YES	25	B/S
13	138.950	138.970	NO	20	NO
14	140.010	140.035	NO	25	LHS
15	143.880	143.910	YES	30	NO
16	147.050	147.070	NO	20	RHS
17	150.390	150.420	NO	30	RHS
18	154.460	154.500	YES	40	NO
19	158.475	158.500	NO	25	RHS
20	160.600	160.630	YES	30	NO
21	163.050	163.075	NO	25	LHS
22	165.540	165.565	NO	25	NO
23	167.430	167.450	NO	20	NO
24	171.520	171.550	YES	30	NO
25	172.925	172.955	NO	30	NO
26	176.460	176.480	NO	20	NO
27	177.180	177.200	YES	20	NO
28	177.225	177.245	NO	20	RHS
29	177.280	177.305	NO	25	LHS
30	178.650	178.670	NO	20	NO
31	179.450	179.475	YES	25	NO
32	182.830	182.860	NO	30	NO
33	183.040	183.080	YES	40	NO
34	183.480	183.520	YES	40	NO
35	185.600	185.625	YES	25	B/S
36	188.440	188.470	NO	30	RHS
37	190.000	190.030	NO	30	RHS

Sn	Location		Blinker	Length (m)	Storage Lanes
	From	To			
38	193.320	193.350	NO	30	B/S
39	194.650	194.675	NO	25	LHS
40	195.850	195.880	YES	30	NO
41	198.570	198.600	NO	30	LHS
42	200.690	200.720	YES	30	B/S
43	204.030	204.050	NO	20	LHS
44	206.100	206.125	NO	25	NO
45	207.450	207.480	NO	30	NO
46	209.580	209.620	YES	40	NO
47	211.120	211.145	NO	25	RHS
48	212.920	212.950	NO	30	LHS
49	216.875	216.900	NO	25	LHS
50	220.490	220.520	YES	30	NO
51	222.520	222.545	NO	25	NO
52	223.260	223.270	NO	10	NO
53	224.350	224.380	NO	30	NO
54	225.225	225.250	NO	25	NO
55	225.725	225.750	NO	25	NO
56	227.140	227.170	NO	30	NO

Median Opening with Solar Blinker

Medain Opening without Solar Blinker

6.2.5 Road Side Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Location and type of drain as provided is presented below:

Location of RCC Drain

S N.	CHAINAGE		Side	Length (m)
	FROM	TO		
1	125.475	126.700	Both	2.450
2	129.950	131.550	Both	3.200
3	132.850	134.580	Both	3.460
4	143.400	145.250	Both	3.700
5	152.620	154.625	Both	4.010
6	160.210	160.620	Both	0.820
7	171.000	171.725	Both	1.450
8	175.170	176.350	LHS	1.180
9	174.500	176.450	RHS	1.950
10	181.100	182.400	Both	2.600
11	182.725	184.850	Both	4.250
12	201.300	202.120	Both	1.640
13	207.250	210.050	Both	5.600
14	219.300	221.063	Both	3.526
15	221.700	229.030	Both	14.660
			Total	54.496

Location of Median Cut Drain

S No	Location		Length (m)
	From	To	
1	155.330	155.705	375
2	159.725	159.950	225
3	160.200	160.480	280
4	160.750	160.995	245
5	161.600	162.220	620
6	161.875	162.400	525
7	164.500	164.750	250
8	165.560	166.000	440
9	196.640	197.000	360
10	197.500	198.200	700
11	198.880	199.100	220
12	213.800	214.300	500
13	219.000	219.300	300
14	224.600	225.000	400
		TOTAL	5440

RCC Covered Drain at Project Road	Median Cut Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 36 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	11	11
Minor Junctions		62

Major Junction at KM 114+310	Minor Junction at KM 79+380

Details of Major Junctions along the project are presented in the table below.

Details of Major Junctions

I. MAJOR JUNCTIONS							
Sn	Existing Chainage	Type of Junction	Side	Cross Road Leading to	Width of Cross Road (m)	Surface Type	Median Opening Provided (Y/N)
1	133.875	T	LHS	Mehndipur	4 Lane	BT	Y
2	143+900	X	LHS	Sikrai	5.5	BT	Y
			RHS	Manpur	5.5	BT	
3	154+500	X	LHS	Gangapur	5.5	BT	Y
			RHS	Alwar	7.5	BT	
4	176+540	Y	LHS	Dausa Bypass	7.5	BT	Y
5	177+300	X	LHS	Dausa	7.5	BT	Y
			RHS	Kundal	5.5	BT	
6	182+030	X	LHS	Dausa	5.5	BT	Grade Separator
			RHS	Rampur	4 Lane	BT	
7	182+860	Y	LHS	Dausa Bypass	7.5	BT	Y
8	200+720	T	LHS	Chitori	7.0	BT	Y
9	209+610	Y	LHS	Bassi	7.0	BT	Y
10	220+500	T	RHS	Nayla	5.5	BT	Y
11	224+380	T	RHS	Sumel	5.5	BT	Y

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	20.338
	Median	0.750
Pedestrian Guard Rail	Carriageway Edge	8.530

PGR and W-Beam present on the project road

6.2.8 Toll Plaza and Other Facilities

As per Schedule-C; maximum number of two toll plazas are proposed at suitable locations in consultation with Independent Engineer/NHAI such that there is no possibility of traffic bypassing.
The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.
The locations of two Toll Plaza are as mentioned below: -

7 Sikandra Toll Plaza TP1 at km.156+600

8 Rajdok Toll Plaza TP2 at km.204+700

Sikandra Toll Plaza at Km 156+600 | Rajdok Toll Plaza at 204+700

It is noted full fledge Administrative Office, Operation and Maintenance Base camp has constructed at Rajdok Toll Plaza Km 204+700. At Sikandra Toll Plaza Km 156+600, office building has provided over toll lanes.

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at flyover (interchange) as per Schedule C. Additionally, High Mast has provided at Toll Plaza, major junction, ROBs and flyover confirming Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

SN	Existing Chainage		Length in m	Side	Nos.	Type	Remarks
	From	To					
1	136.200	136.450	250	LHS	10	Single Arm	
2	156.100	156.400	300	MEDIAN	8	Double Arm	
3	156.900	157.250	350	LHS	12	Double Arm	
4	168.150	168.400	250	LHS	8	Single Arm	
5	177.225	177.600	375	MEDIAN	8	Double Arm	
6	177.520	178.520	1000	BOTH	44	Single Arm	
8	181.600	182.750	1150	MEDIAN	24	Double Arm	
9	186.950	187.250	300	LHS	10	Single Arm	
10	204.190	204.425	235	MEDIAN	8	Double Arm	
11	204.900	205.120	220	MEDIAN	8	Double Arm	
12	221.700	221.750	50	BOTH	4	Double Arm	Provided by Municipality
13	221.750	222.000	250	BOTH	22	Single Arm	
14	222.000	222.150	150	BOTH	10	Single Arm	
15	222.150	223.000	850	BOTH	72	Double Arm	
16	223.000	224.000	1000	BOTH	64	Double Arm	
17	224.000	225.000	1000	BOTH	78	Double Arm	
18	225.000	226.000	1000	BOTH	78	Double Arm	
19	226.000	227.000	1000	BOTH	64	Double Arm	
20	227.000	228.000	1000	BOTH	70	Double Arm	

High Mast Location

SN	Chainage	Type	Nos	Fixtures
1	133.850	High mast	1	8
2	143.750	High mast	1	8
3	156.750	High mast	2	6
4	156.750	High mast	1	4
5	175.500	High mast	1	8
6	176.600	High mast	1	5
7	177.300	High mast	2	8
8	178.200	High mast	1	6
9	181.900	High mast	2	8
10	182.600	High mast	1	6
11	183.150	High mast	1	4
12	204.740	High mast	4	8
13	211.200	High mast	1	8
14	211.500	High mast	1	8
15	220.300	High mast	1	8

High Mast Light at Chainage 143.750	Highway Lighting at Km 224

As per requirement of Schedule C, highway lighting is to be provided at approach of Grade Separated Structure, underpasses, toll plaza and its approaches, rest areas and bus stops.

6.2.10 Bus Bays and Bus Shelter

There are 26 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter at Km 120+012	Bus Shelter at Km 177+050

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N	CHAINAGE	SIDE	TYPE	Detail			
				PAVEMENT	PASSENGER SHELTER	LIGHTING	SIGN BOARDS
1	126.075	LHS	Steel shelter RCC seats	BT	Available	NO	YES
2	140.300	LHS	Steel shelter RCC seats	BT	Available	NO	YES
3	160.425	LHS	Steel shelter RCC seats	BT	Available	NO	YES
4	165.200	LHS	Steel shelter RCC seats	BT	Available	NO	YES
5	171.225	LHS	Steel shelter RCC seats	BT	Available	NO	YES
6	177.050	LHS	Steel shelter RCC seats	BT	Available	NO	YES
7	188.435	LHS	Steel shelter RCC seats	BT	Available	NO	YES
8	193.075	LHS	Steel shelter RCC seats	BT	Available	NO	YES
9	200.500	LHS	Steel shelter RCC seats	BT	Available	NO	YES
10	209.450	LHS	Steel shelter RCC seats	BT	Available	NO	YES
11	211.000	LHS	Steel shelter RCC seats	BT	Available	NO	YES
12	226.350	LHS	Steel shelter RCC seats	BT	Available	NO	YES
13	227.850	LHS	Steel shelter RCC seats	BT	Available	NO	YES
14	120.012	RHS	Steel shelter RCC seats	BT	Available	NO	YES
15	120.150	RHS	Steel shelter RCC seats	BT	Available	NO	YES
16	125.050	RHS	Steel shelter RCC seats	BT	Available	NO	YES
17	130.480	RHS	Steel shelter RCC seats	BT	Available	NO	YES
18	133.600	RHS	Steel shelter RCC seats	BT	Available	NO	YES
19	144.200	RHS	Steel shelter RCC seats	BT	Available	NO	YES
20	154.675	RHS	Steel shelter RCC seats	BT	Available	NO	YES
21	160.650	RHS	Steel shelter RCC seats	BT	Available	NO	YES
22	193.000	RHS	Steel shelter RCC seats	BT	Available	NO	YES
23	207.870	RHS	Steel shelter RCC seats	BT	Available	NO	YES
24	209.800	RHS	Steel shelter RCC seats	BT	Available	NO	YES
25	217.000	RHS	Steel shelter RCC seats	BT	Available	NO	YES
26	226.400	RHS	Steel shelter RCC seats	BT	Available	NO	YES

6.2.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	136.300	LHS	NA	Available	Available
2	168.250	LHS	NA	Available	Available
3	186.900	LHS	NA	Available	Available

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
4	211.300	LHS	NA	Available	Available
5	202.995	RHS	NA	Available	Available
6	162.480	RHS	NA	Available	Available

As per Schedule C, total six numbers are to be provided and same numbers has provided.

Toilet Block and Truck Laybye

6.2.12 Signage and Marking

Road Signs

766 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Place Identification Board on the Project Road | Sign Board fixed at Project Road

Summary of different sign board found along the project road is presented below:

TYPE OF SIGN BOARD	Nos
Accident zone	17
Bus bay	14
Cantilever Gantry	8
Cattle crossing	1
Chevron	84
Cross Junction	3
Destination Board	16
Direction Board	40
Double Hazard Marker	31
Emergency Nos	33
Go Slow	4
Hazard Marker	115
Height Limit	2
Hospital	9
Informatory Board	11
Keep Left	3
Left lane For Heavy Vehicle	1
Major Bridge	2
Median Opening	65
No Over taking	6
No Parking	13
No Rickshaw	1
No Stop	4
Object Marker	36
Over Head Gantry	2
Over Taking Prohibited	1
Pedestrian crossing	52
Petrol Pump	16
Place Identification Board	30
Police	4
Railway LIne	3
Road diverted	1
Road Left	10
Road Narrow Ahead	1
Road Right	5
Route Marker	10
Rubble Strip	2
School Ahead	16

TYPE OF SIGN BOARD	Nos
Service road starts	10
sign	1
Speed Limit	48
Stop	1
Toll Boards	11
Toll Cantilever Gantry	1
Truck lay bye	4
Turn Left	4
Turn Right	9
Warning	1
Wild Animals	3
Y Junction	1

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road marking along the carriageway

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road | Plantation at 4.5 m Median

6.3 Toll Plaza and Associated Facilities

Toll Plaza and Associated Facilities

Concession Agreement Provision: As per Schedule-C; maximum number of two toll plazas are proposed at suitable locations in consultation with Independent Engineer/NHAI such that there is no possibility of traffic bypassing.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

The locations of two Toll Plaza are as mentioned below: -

1. Sikandra Toll Plaza TP1 at km.156.600
2. Rajadhok Toll Plaza TP2 at km.204.700

6.3.1 Sikandra Toll Plaza TP1 at Km 156.600:

Concessionaire Agreement Provision: Open system of toll collection shall be provided on the Project Highway with collection of user fee from vehicles only at Toll Plaza. There shall be total number of minimum 8 lanes having a semi-automatic system of toll collection comprising equipment's of vehicle classification, ticket issuing, data processing and power supply. One toll lane in each direction shall be provided for traffic not required to pay fees. Appropriate technology shall be used in this regard so that not more than 6 vehicles per lane queue up during the peak hours.

Site Observations:

1. During the site visit, it was observed that the Toll Plaza located at Km 156+600 has 4 LHS+4 RHS lanes.
2. All the lanes (4LHS +4RHS) are in hybrid mode including the dedicated ETC lane(1LHS+1RHS).
3. The Toll Plaza is not equipped with the Administrative Building as per the provisions mentioned in Concessionaire Agreement. Control and Server Rooms are located above the Toll Booths.
4. There is no reversible lane.
5. There are total numbers of 8 WIMs (4 LHS+4 RHS) in this plaza.
6. There are 2 nos. Static Weigh Bridges; one in each direction of travel.
7. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc. are as per the provisions of Concessionaire Agreement.
8. There are 2 PTZ cameras; one in each direction of travel.

Facilities available at Sikandra Toll Plaza at Km 156.600

The available facilities at existing Toll Plaza along with condition are presented in Table below:

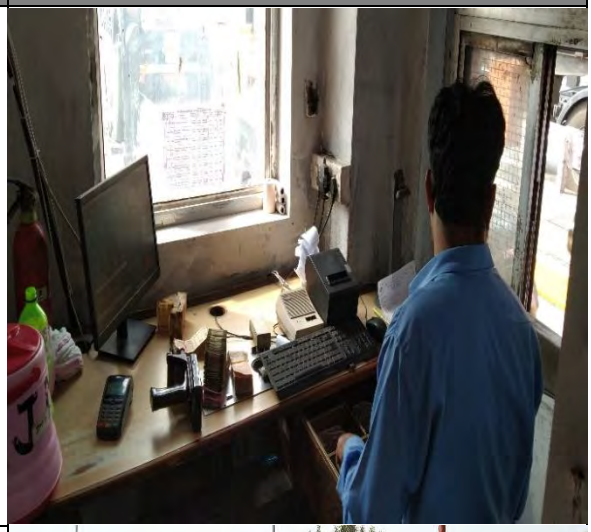
Facilities available at Sikandra Toll Plaza

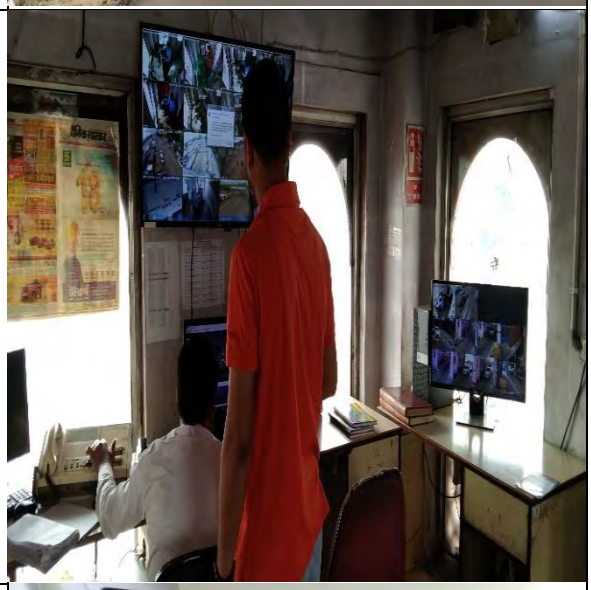
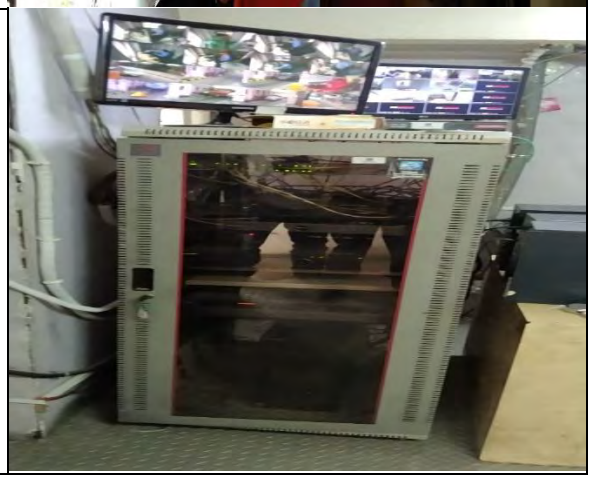
Parameter	Concessionaire Agreement Provision	Current Status
AVC (Automatic Vehicle Classifier) System	Should be installed in each lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector	All such basic equipment's are required to be installed and functional in all the lanes.	Installed and working in all the lanes.

Parameter	Concessionaire Agreement Provision	Current Status
Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.		
Preventions for overloading	WIM should be installed Static Weigh Bridge should be installed in each direction of travel.	WIM installed in 4 LHS +4 RHS lanes. SWB installed in 1 LHS+1 RHS lanes. All WIMs and SWBs are installed and operational.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	No Administrative Building. Control and Server rooms are located above the toll booths.

Pictorial representation for present site conditions for Sikandra Toll Plaza at Km 156.600:

S. No.	Description	Site Status
1.	Toll Plaza is at Km 156+600 has 4 LHS+ 4 RHS lanes.	

S. No.	Description	Site Status
2.	Toll booths are equipped with all the required systems/equipment's.	
3.	All the required equipment's are placed outside the toll booth.	
4.	WIMs are installed in 4 LHS +4 RHS lanes.	

S. No.	Description	Site Status
5.	There are 2 nos. Static Weigh Bridges; one in each direction of travel.	
6.	Toll Management System (TMS) has been installed by BHARI INFRA in April 2018 and even day to day operations as well as AMC is also taken care by same vendor.	
7.	TMS Server Room is equipped with all the required servers and switches.	

2.6.2 Rajadhok Toll Plaza TP2 at Km 204.700:

Concession Agreement Provision: Open system of toll collection shall be provided on the Project Highway with collection of user fee from vehicles only at Toll Plaza. There shall be total number of minimum 8 lanes having a semi-automatic system of toll collection comprising equipment's of vehicle classification, ticket issuing, data processing and power supply. One toll lane in each direction shall be provided for traffic not required to pay fees. Appropriate technology shall be used in this regard so that not more than 6 vehicles per lane queue up during the peak hours.

Site Observations:

1. During the site visit, it was observed that the Toll Plaza located at Km 204+700 has 5 LHS+4 RHS lanes.
2. All the lanes (4LHS +4RHS) are in hybrid mode including dedicated ETC lanes (1 LHS+1RHS).
3. The Toll Plaza is equipped with the conventional Administrative Building as per the provisions mentioned in Concessionaire Agreement having all the necessary requirements.
4. There is no reversible lane.
5. There are total numbers of 8 WIMs (4 LHS+4 RHS) in this plaza.
6. There are 2 nos. Static Weigh Bridges; one in each direction of travel.
7. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc. are as per the provisions of Concessionaire Agreement.
8. There are 2 nos. PTZ cameras; one in each direction of travel.

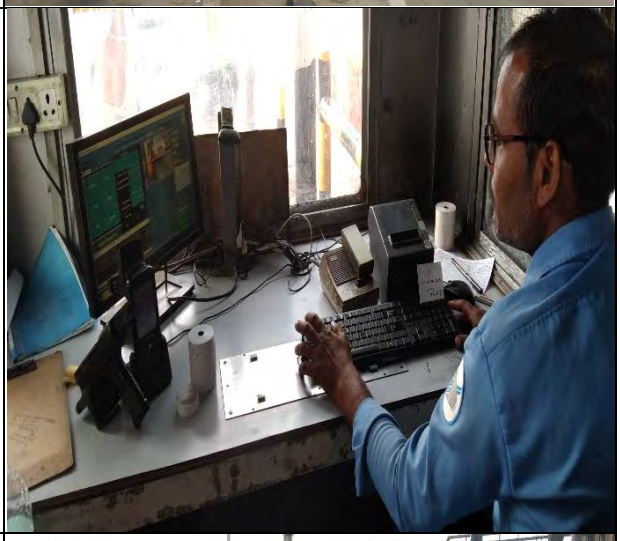
Facilities available at Rajadhok Toll Plaza at Km 204+700

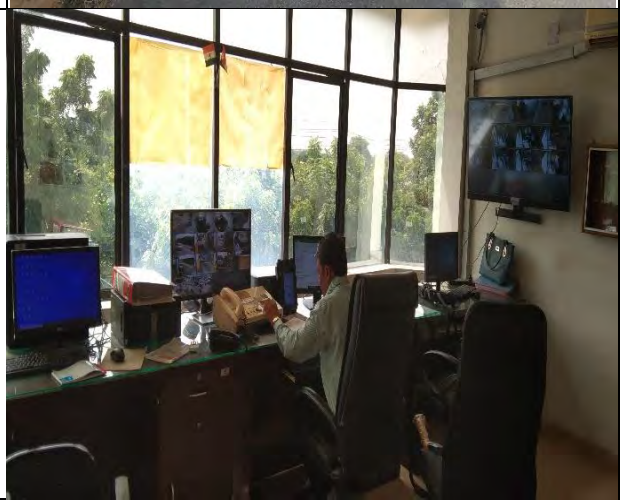
The available facilities at existing Toll Plaza along with condition are presented in Table below:

Table: Facilities available at Rajadhok Toll Plaza

Parameter	Concessionaire Agreement Provision	Current Status
AVC (Automatic Vehicle Classifier) System	Should be installed in each lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.	All such basic equipment's are required to be installed and functional in all the lanes.	Installed and working in all the lanes.
Preventions for overloading	WIM should be installed. Static Weigh Bridge should be installed in each direction of travel.	WIMs installed in 4 LHS +4 RHS lanes. SWB installed in 1 LHS+1 RHS lanes. All WIMs and SWBs are installed and operational.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Administrative Building available with all necessary requirements.

Pictorial representation for present site conditions for Rajadhok Toll Plaza at Km 204.700

S. No.	Description	Site Status
1.	Toll Plaza is at Km 204+700 has 4 LHS+ 4 RHS lanes.	
2.	Toll booths are equipped with all the required systems/equipment's.	
3.	All the required equipment's are placed outside the toll booth.	

S. No.	Description	Site Status
4.	WIMs are installed in 4 LHS +4 RHS lanes.	
5.	There are 2 nos. Static Weigh Bridges; one in each direction of travel.	
6.	Toll Management System (TMS) has been installed by BHARI INFRA in April 2018 and even day to day operations as well as AMC is also taken care by same vendor.	

S. No.	Description	Site Status
7.	TMS Server Room is equipped with all the required servers and switches.	
8.	Route Patrol Vehicle and Ambulance parked in the Toll premises.	
9.	Administrative Building with all necessary requirements such as Control Room, server room, POS, meeting room etc.	

S. No.	Description	Site Status
10.	Tunnel inside the Toll Booths	

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 1 no of Major Bridge of total length of 318.50 m having span arrangement of 2 x 37.11 + 5 x 38.11 is in good condition

- 17 nos. of Minor bridges having total length varies from 11 m to 52 m are generally found in good condition.
- 7 nos. of Underpass having span arrangement of 1 x 10 are found in good condition.
- 1 nos. of Single Span Railway over Bridge total of total length of 17.1 m on LHS and 27.6 m on RHS is in good condition
- 1 no of Flyover of total length of 36 m having span arrangement of 1 x 36 is found in good condition
- 89 (pipe/slab/box) nos. of culverts found at site

6.4.2 Detailed Description of Structures

b) 2.3.2.1 Major bridge – CH.221+363

It consists of new bridge on both the carriageways. It has span arrangement of 7x39.75 + 1x40.25m. The super structure comprises of PSC Girder. The Foundation adopted is well foundation. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint and wearing coat is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

Expansion joint in poor condition

Span Arrangement

Major Bridge at Ch. 221+363

c) 2.3.2.2 Minor Bridge

Salient features along with condition of 17 Minor bridges are discussed.

d) Minor Bridge – CH.131+825

It consists of new bridge on LHS and old bridge on RHS. Span arrangement of 2x8.52 m has provided on both sides. The super structure comprises of RCC Solid Slab. Foundation of both bridges are not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Poor Maintenance of Ventway

Minor Bridge at Ch. 131+825

e) Minor Bridge – CH.148+606

It consists of new bridge on LHS and old bridge on RHS. Span arrangement of 1x11.0m has provided on both sides. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. The existing bridge is using as underpass. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 148+606

f) Minor Bridge – CH.149+750

It consists of new bridge on LHS and old bridge on RHS. Span arrangement of bridge is 3x7.0m on both sides. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance,

replacement of filler joint and wearing coat is required. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 149+750

g) Minor Bridge – CH.154+952

It consists of new bridge on both carriageways. The bridge has a span arrangement of 6x6.0m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and replacement of wearing coat is required. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 154+952

h) Minor Bridge – CH.161+016

It consists of new bridge on LHS and old bridge on RHS. Span arrangement of bridge is 5x6.0m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on PCC Wall type abutment & Pier.The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts,

repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and replacement of wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 161+016

i) Minor Bridge – CH.164+279

It consists of new bridge on both carriageways. The bridge has a span arrangement of 2x15.0m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

Span arrangement

Expansion joint in poor condition

Minor Bridge at Ch. 164+279

j) Minor Bridge – CH.166+417

It consists of new bridge on both carriageways. The bridge has a span arrangement of 2x11.0m. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance,

replacement of filler joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 166+417

k) Minor Bridge – CH.170+319

It consists of new bridge on both carriageways. The bridge has a span arrangement of 4x6.0m. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

Span Arrangement

Pitching in fair condition

Minor Bridge at Ch. 170+319

l) Minor Bridge – CH.188+612

It consists of new bridge on LHS and Old on RHS. The bridge has a span arrangement of 2x5.6m. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts,

repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 188+612

m) Minor Bridge – CH.194+129

It consists of new bridge on LHS and old bridge on RHS. The bridge has a span arrangement of 2x17.10 + 1 x 17.75 m on both sides. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 194+129

It is noted overlay work was in progress at approach of bridge during site visit.

n) Minor Bridge – CH.210+371

It consists of new bridge on LHS and old bridge on RHS. The bridge has a span arrangement of 2x9.32 + 1 x 9.63 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on new bridge and Stone Masonry Wall on old bridge. The general condition of the bridge is good. It requires regular repair

works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 210+371

o) Minor Bridge – CH.213+607

It consists of new bridge on LHS and old bridge on RHS. The bridge has a span arrangement of 3x6.83m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on new bridge and Stone Masonry Wall on old bridge.The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 213+607

p) Minor Bridge – CH.214+943

It consists of new bridge on LHS and old bridge on RHS. The bridge has a span arrangement of 2x7.17 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on new bridge and Stone Masonry Wall on old bridge. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching

etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

Pitching in fair condition

Span Arrangement

Minor Bridge at Ch. 214+943

q) Minor Bridge – CH.218+079

It consists of new bridge on LHS and old bridge on RHS. The bridge has a span arrangement of 3x8.08 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on new bridge and Stone Masonry Wall on old bridge.The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. It is observed Reinforcement of super structure slab of old bridge is exposed and required immediate attention. has A few pictures showing the conditions of Minor Bridge are presented as follows:

Slab reinforcment exposed

Span Arrangement

Minor Bridge at Ch. 218+079

r) Minor Bridge – CH.223+434

It consists of new bridge on both sides. The bridge has a span arrangement of 5x7.75 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on PCC Wall type abutment & Pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts,

repairing of stone pitching etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. has A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Bridge Railing

Minor Bridge at Ch. 223+434

s) Minor Bridge – CH.225+679

It consists of new bridge on both sides. The bridge has a span arrangement of 2x6.8 + 1 x 7.0 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on PCC Wall type abutment & Pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, vent cleaning etc. As periodic maintenance, replacement of expansion joint and wearing coat is required. has A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 225+679

t) Minor Bridge – CH.227+207

It consists of new bridge on both sides. The bridge has a span arrangement of 2x6.8 + 1 x 7.0 m on both sides. The super structure comprises of RCC Solid Slab. The Foundation is not visible. Tar Paper bearings are adopted for resting of superstructure on PCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, vent cleaning etc. As periodic maintenance, replacement of

expansion joint and wearing coat is required. has A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 227+207

2.3.2.3 Under-Passes (UPs)

There is a total of 07 PUPs has been provided. All UPs are single span of 1 x 10 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

View of Carriageway

Span Arrangement

UP at Ch. 135+000

Super structure in fair condition

Span Arrangement

UP at Ch.144+700

Super structure in fair condition

Span Arrangement

UP at Ch. 153+600

Super structure in fair condition

Span Arrangement

UP at Ch. 181+575

View of Carriageway

Span Arrangement

UP at Ch. 182+265

View of Carriageway

Span Arrangement

UP at Ch. 208+000

Super structure in fair condition

Span Arrangement

UP at Ch. 219+800

2.3.2.4 Railway over Bridge (ROBs)

ROB at Ch. 178+049

It consists of old bridge on LHS and new bridge on RHS on over railway tracks. The old ROB has a span arrangement of 1x17.10m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on PCC wall type abutment. The new ROB has a span arrangement of 1x27.6m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC wall type abutment.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after 15 years from date of construction. It is noted exposed reinforcement on abutment wall which required immediate rectification.
A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Slabreinforcement exposed

Super structure in fair condition

ROB at Ch. 178+049

2.3.2.5 Grade Separators (Flyover)

Grade Separator at Ch. 182+050

It consists of new flyover on both carriageways. It has a span arrangement of 1x36 m. The super structure comprises of RCC Girder. The Foundation is not visible. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after 15 years from date of construction.

A few pictures showing conditions of Grade Separator are presented as follows: -

View of Carriageway

Span Arrangement

Drainage spout chocked

Expansion joint

Flyover at Ch. 182+050

2.3.2.6 Culverts:

There are 89 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

Slab Culvert at Ch. 132+684

Slab Culvert at Ch. 137+047

Slab Culvert at Ch. 138+750

Slab Culvert at Ch. 159+333

Slab Culvert at Ch. 162+259

Slab Culvert at Ch. 163+518

Slab Culvert at Ch. 167+401

Slab Culvert at Ch173+901

Slab Culvert at Ch. 191+218

Slab Culvert at Ch. 207+376

6.4.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	221+363	LHS	2x37.11 + 5x38.11	12.5	MJB	Y	□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	2x37.11 + 5x38.11	8			□	□	□	□	□	□	□	□	□		□	Stable	
2	131+825	LHS	2x5.82	12.5	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	2x5.82	12.5			□	□	□		□	□	□	□	□			Stable	
3	148+606	LHS	1x11	12.5	MNB	Y	□	□	□	□	□	□	□	□	□			Stable	
		RHS	1x11	12.5			□	□	□	□	□	□	□	□	□			Stable	
4	149+750	LHS	3x7	12.5	MNB	Y	□	□	□		□	□	□	□	□		□	Stable	
		RHS	3x7	12.5			□	□	□		□	□	□	□	□		□	Stable	
5	154+952	LHS	6x6	12.5	MNB	Y	□	□	□		□	□	□	□	□		□	Stable	
		RHS	6x6	12.5			□	□	□		□	□	□	□	□		□	Stable	
6	161+016	LHS	5x6	12.5	MNB	Y	□	□	□		□	□	□	□	□		□	Stable	
		RHS	5x6	12.5			□	□	□		□	□	□	□	□		□	Stable	
7	164+279	LHS	2x15.5	12.5	MNB	Y	□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	2x15.5	12.5			□	□	□	□	□	□	□	□	□		□	Stable	
8	166+417	LHS	4x11	12.5	MNB	Y	□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	4x11	12.5			□	□	□	□	□	□	□	□	□		□	Stable	
9	170+319	LHS	4x6	12.5	MNB	Y	□	□	□	□	□	□	□	□	□		□	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		RHS	4x6	12.5			□	□	□	□	□	□	□	□	□		□	Stable	
10	188+612	LHS	2x5.6	12.5	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	2x5.6	12.5			□	□	□		□	□	□	□	□			Stable	
11	194+129	LHS	2x17.1+1x17.75	12.5	MNB	Y	□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	2x17.1+1x17.75	8.5			□	□	□	□	□	□	□	□	□		□	Stable	
12	210+371	LHS	2x9.32+1x9.63	12.5	MNB	Y	□	□	□		□	□	□	□	□		□	Stable	
		RHS	2x9.32+1x9.63	12.5			□	□	□		□	□	□	□	□		□	Stable	
13	213+607	LHS	3x6.83	12.5	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	3x6.83	10			□	□	□		□	□	□	□	□			Stable	
14	214+943	LHS	2x7.17	12.5	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	2x7.17	11.5			□	□	□		□	□	□	□	□			Stable	
15	218+079	LHS	3x8.08	12.5	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	3x8.08	12.5			□	□	□		□	□	□	□	□			Stable	
16	223+434	LHS	5x7.75	20.75	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	5x7.75	20.75			□	□	□		□	□	□	□	□			Stable	
17	225+679	LHS	2x6.8+1x7	18.75	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	2x6.8+1x7	18.75			□	□	□		□	□	□	□	□			Stable	
18	227+207	LHS	2x6.8+1x6	18.75	MNB	Y	□	□	□		□	□	□	□	□			Stable	
		RHS	2x6.8+1x6	18.75			□	□	□		□	□	□	□	□			Stable	
19	135+000	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		RHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
20	144+700	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		RHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
21	153+600	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
		RHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
22	181+575	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		RHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
23	182+265	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		RHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
24	208+000	LHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		LHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
25	219+800	RHS	1X10X4.0	12.5	UP	NA	□	□	□		□	□	□	□	□		□	Stable	
		LHS	1X10X4.0	12.5			□	□	□		□	□	□	□	□		□	Stable	
26	182+050	LHS	1X36.0	12.5	FO		□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	1X36.0	12.5			□	□	□	□	□	□	□	□	□		□	Stable	
27	178+049	LHS	1x17.1	11	ROB		□	□	□	□	□	□	□	□	□		□	Stable	
		RHS	1x27.6	12.5			□	□	□	□	□	□	□	□	□		□	Stable	

Condition Summary of Culverts based on Visual Observation is presented below:

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
1	120+070	Slab Culvert		●	●					●	No	No	√			
2	121+624	HPC			●	●				●	No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
3	122+516	HPC			●	●				●	No	No	√		4 Nos	
4	123+433	HPC			●	●				●	No	No	√		4 Nos	
5	124+345	HPC			●	●				●	No	No	√		4 Nos	
6	125+049	HPC			●	●				●	No	No	√		4 Nos	
7	125+947	HPC			●	●				●	No	No	√		4 Nos	
8	126+047	HPC			●	●				●	No	No	√		4 Nos	
9	126+963	HPC			●	●				●	No	No	√		4 Nos	
10	127+217	HPC			●	●				●	No	No	√		4 Nos	
11	127+637	HPC			●	●				●	No	No	√		4 Nos	
12	127+837	HPC			●	●				●	No	No	√		4 Nos	
13	128+539	HPC			●	●				●	No	No	√		4 Nos	
14	129+126	HPC			●	●				●	No	No	√		4 Nos	
15	129+723	HPC			●	●				●	No	No	√		4 Nos	
16	130+831	Slab Culvert		●	●					●	No	No	√			
17	131+13	HPC			●	●				●	No	No	√		4 Nos	
18	132+684	Slab Culvert		●	●					●	No	No	√			

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
19	133+069	Slab Culvert		●	●					●	No	No	√			
20	133+252	Slab Culvert		●	●					●	Yes	No	√			
21	134+143	Slab Culvert		●	●					●	No	No	√			
22	135+971	Slab Culvert		●	●					●	No	No	√			
23	137+047	Slab Culvert		●	●					●	No	No	√			
24	137+198	Slab Culvert		●	●					●	No	No	√			
25	137+96	Slab Culvert		●	●					●	No	No	√			
26	138+102	Slab Culvert		●	●					●	No	No	√			
27	138+367	Slab Culvert		●	●					●	No	No	√			
28	138+569	Slab Culvert		●	●					●	No	No	√			
29	138+75	Slab Culvert		●	●					●	No	No	√			
30	139+084	Slab Culvert		●	●					●	No	No	√	□		

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
31	139+756	Slab Culvert		●	●					●	No	No	√			
32	143+833	Slab Culvert		●	●					●	No	No	√			
33	145+272	Slab Culvert		●	●					●	No	No	√			
34	155+983	Slab Culvert		●	●					●	No	No	√			
35	157+919	Slab Culvert		●	●					●	No	No	√			
36	158+806	Slab Culvert		●	●					●	No	No	√			
37	159+333	Slab Culvert		●	●					●	No	No	√			
38	160+674	Slab Culvert		●	●					●	No	No	√			
39	161+529	Slab Culvert		●	●					●	No	No	√			
40	161+876	Slab Culvert		●	●					●	No	No	√			
41	162+259	Slab Culvert		●	●					●	No	No	√			
42	162+833	Slab Culvert		●	●					●	No	No	√			

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
43	163+518	Slab Culvert		●	●					●	No	No	√			
44	163+789	Slab Culvert		●	●					●	No	No	√			
45	165+217	Slab Culvert		●	●					●	No	No	√			
46	166+74	Slab Culvert		●	●					●	No	No	√			
47	167+401	Slab Culvert		●	●					●	No	No	√			
48	167+541	Slab Culvert		●	●					●	No	No	√			
49	172+95	Slab Culvert		●	●					●	No	No	√			
50	173+901	Slab Culvert		●	●					●	No	No	√			
51	176+888	Slab Culvert		●	●					●	No	No	√			
52	177+46	HPC			●	●				●	No	No	√		4 Nos	
53	178+662	HPC			●	●				●	No	No	√		4 Nos	
54	180+317	HPC			●	●				●	No	No	√		4 Nos	
55	181+116	Slab Culvert		●	●					●	No	No	√			

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
56	182+117	HPC			●	●				●	No	No	√		4 Nos	
57	182+606	Slab Culvert		●	●					●	No	No	√			
58	183+234	Slab Culvert		●	●					●	No	No	√			
59	185+661	Slab Culvert		●	●					●	No	No	√			
60	186+224	HPC			●	●				●	No	No	√	□	4 Nos	
61	186+418	HPC			●	●				●	No	No	√	□	4 Nos	
62	189+238	Slab Culvert		●	●					●	No	No	√			
63	191+248	Slab Culvert		●	●					●	No	No	√			
64	192+23	HPC			●	●				●	No	No	√	□	4 Nos	
65	193+45	HPC			●	●				●	No	No	√	□	4 Nos	
66	195+935	Slab Culvert		●	●					●	No	No	√			
67	197+793	Slab Culvert		●	●					●	No	No	√			
68	198+632	Slab Culvert		●	●					●	No	No	√			

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
69	200+166	Slab Culvert		●	●					●	No	No	√			
70	200+833	Slab Culvert		●	●					●	No	No	√			
71	201+394	Slab Culvert		●	●					●	No	No	√			
72	201+76	Slab Culvert		●	●					●	No	No	√			
73	202+316	Slab Culvert		●	●					●	No	No	√			
74	202+76	Slab Culvert		●	●					●	No	No	√			
75	203+668	Slab Culvert		●	●					●	No	No	√			
76	204+217	Slab Culvert		●	●					●	No	No	√			
77	204+645	HPC			●	●				●	No	No	√		4 Nos	
78	206+075	Slab Culvert		●	●					●	No	No	√			
79	207+059	Slab Culvert		●	●					●	No	No	√			
80	207+376	Slab Culvert		●	●					●	No	No	√			

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/A	Head Wall	Wing Wall	Return Wall	Protection works	Parapet /Hand rail	Buried / Choked	Presence of	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
81	208+658	Slab Culvert		●	●					●	No	No	√			
82	209+784	Slab Culvert		●	●					●	No	No	√			
83	211+769	Slab Culvert		●	●					●	No	No	√			
84	212+821	Slab Culvert		●	●					●	No	No	√			
85	214+067	Slab Culvert		●	●					●	No	No	√			
86	214+33	Slab Culvert		●	●					●	No	No	√			
87	215+886	Slab Culvert		●	●					●	No	No	√			
88	219+252	Slab Culvert		●	●					●	No	No	√			
89	227+813	Slab Culvert		●	●					●	No	No	√			

AECOM Imagine it. Delivered.

TECHNICAL DUE DILIGENCE REPORT

Jhansi Vigakhet Tollway Limited

Report Number:

ACM-60657056-TDD-JVTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Jhansi- Vigakhet Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Jhansi- Vigakhet Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
MD	PS	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Jhansi- Vighakhet Tollway Limited

5th Floor, OSE Commercial Block, Asset 5B,
Aerocity Hospitality District,
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**

Project Background 3
Project Salient Features 3
Project Principal Participants 4
Project Operation and Maintenance Cost 4
Limitation of Scope 7

1. INTRODUCTION **8**

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 11

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Estimation of Design Traffic 13
2.3 Test Pit 14
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 14
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 14
2.6 Roughness Survey using Network Survey Vehicle (NSV) 14
2.7 Determination of Pavement Major Maintenance 15
2.8 Base Year Pavement Rehabilitation Requirement 15
2.9 Future Maintenance Requirements 15

3. CAPEX REQUIREMENT **17**

3.1 CAPEX needs 17
3.3 Unit Rate Analysis 20
3.4 Cost Estimate 21

4. MAJOR MAINTENANCE COST **22**

4.1 Major Maintenance Cycle 22
4.2 Major Maintenance Quantity 22
4.3 Unit Rate Analysis 22
4.4 Cost Estimate 25

5. OPERATION AND MAINTANANCE COST - OPEX **27**

5.1 O & M Requirement as per CA 27
5.2 O & M Strategy 30
5.3 Routine and Preventive Maintenance 30
5.4 Preventive Maintenance 30
5.5 Highway Lighting 31
5.6 ATMS and TMS Cost 32
5.7 Incident Management 32
5.8 Manpower Cost 32
5.9 Office Expenses 32

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **34**

6.1 Reconnaissance Survey 34
6.2 Road Inventory and Condition Survey 34
6.4 Inventory and Condition Survey of Structures 45

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
JVTL	Jhansi Vighakhet Tollways Limited
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge

MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s M/s Jhansi Vigakhet Tollway Limited ("JVTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and JVTL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Jhansi – Lalitpur Section from Km 49+700 to Km 99+305 of NH 26 in the State of Uttar Pradesh awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India ("NHAI"). The construction of project road was completed under Annuity (BOT) basis and existing Concessionaire is maintaining highway till Mar 2027 which is being operated by "M/s Jhansi Lalitpur Tollway Limited". The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer Jhansi – Lalitpur Section from Km 49+700 to Km 99+005 of NH 26 in the State of Uttar Pradesh
Project Length	49.305 km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Jhansi Vigakhet Tollway Limited
Signing of Agreement	27 Dec. 2019
Appointed Date	20 Oct 2020
O & M Handover Date	Mar 2027
Concession Period	30 years
End of Concession Period	19 Oct 2050
Likely End of Concession Period	Mar 2045*
Six Lanning under EPC by NHAI	NA
Number of Toll Plaza	1 nos, plaza having 8 lanes including extra width

* - as per information provided by the Company.

Project Principal Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Jhansi VighaketTollway Limited
3	Annuity Concessionaire	Gayatri Projects Limited
4	Independent Engineer	
5	Maintenance Contractor	Egis Road Operation India Private Limited G4S India for Security
6	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 18 months.

- Construction of New Service Road & Structures
- Widening of Cross Drainage Works
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

- The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 19.94 crore including GST as on FY 2022-23.

.

b) Major Maintenance (MM) Cost

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2031-32	40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length of Main Carriageway 30 mm BC in 50% of length, Micro surfacing in 50% of length of Service Road	84.01
2.	2038-39	30 mm BC in entire length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	54.33
3.	2044/45	30 mm BC in entire length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	77.30

The above cost of MM is based on Cube Input for rate of bitumen and escalation factor. The bitumen rate is considered flat from 2024 onwards till end of concession period and escalation is applied only for other component of MM works i.e. except bitumen cost.
As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways shall be after completion of revised Concession Period i.e. after FY 2045.

c) Operation and Maintenance (OpEX)

The project road is currently maintained by Annuity Concessionaire and O & M handover will be on Mar 2027. The Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway from Mar 2027 to end of Concession

Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,477,870
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	11,479,786
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	-
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	5,100,000
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	6,508,136
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	3,389,127
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	2,946,345
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	3,161,455
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	5,265,281
11	Community Development	Includes CSR related expenses.	377,618

Sl. No.	Description	Remarks	Amount (in INR)
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	1,975,909
15	IE Fees	Includes IE fees.	2,766,273
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	-
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	
		O & M Cost for Year 2022-23	61,489,529

A total of Rs. 6.15 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs

1. INTRODUCTION

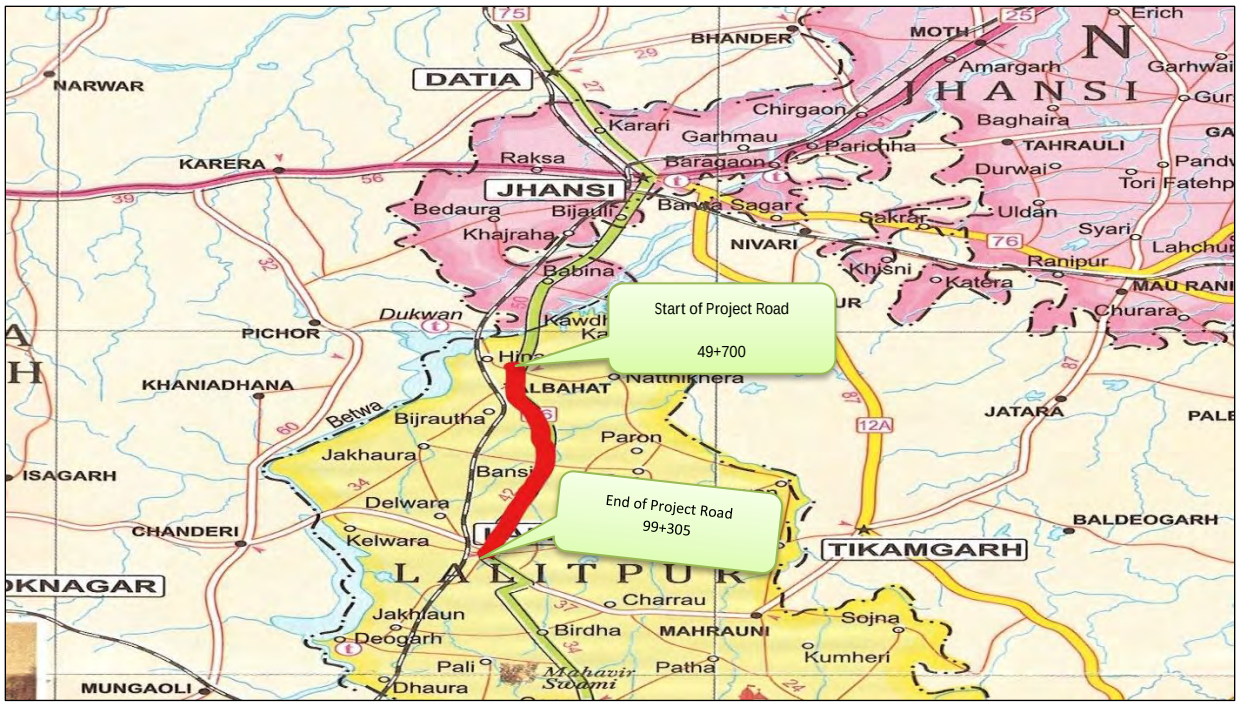
1.1 Project Background

We understand that Cube Highways Fund Advisors Private Limited ("Cube Highways") is the Investment Manager of the Cube Highways Trust ("Trust" or "InvIT"). The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Jhansi – Lalitpur Section from Km 49+700 to Km 99+305 of NH 26 in the State of Uttar Pradesh is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The construction of project road was completed under Annuity (BOT) basis and existing Concessionaire is maintaining highway till Mar 2027 which is being operated by "M/s Jhansi Vigakhet Tollway Limited" (hereinafter refer as "the Concessionaire or Company or JLTL"). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

Project Corridor

The Project Stretch is section of NH 26 in the State of Uttar Pradesh, starts from km 49+700 and ends at km 99+305 and it is a part of North- South corridor. The 49.305 km long Project Stretch has 4-lane configuration and is currently tolled at one location – Babina toll plaza at km 32.100 for complete length. The total Length of Highway is 49.7 Km. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	49.305 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement - MCW & Service Road Rigid Pavement -Toll Plaza
Shoulder	1 m earthen for MCW at Rural Area
Service Road / Slip Road	0.6 km one side length having width of 5.5 m
Major / Minor Junction	4 Major & 14 Minor
RCC Drain	Covered drain at SR of length of 1.20 Km
Median Opening	28 Nos
Toll Plaza	1 Nos – 8 lanes (4 + 4 lanes on each side)
Truck Lay-bys	Nil
Bus Bays with shelter	8 Nos Bus Shelter
Highway Lighting	61 Nos. Double Arm
High Mast	4 nos
Highway Patrol	1 nos (To be deployed after O&M handover)
Ambulance	1 nos (To be deployed after O&M handover)
Crane	1 nos (To be deployed after O&M handover)

b) Structure

Description	Project Features
Major Bridge	4 No
Minor Bridge	16 Nos
Flyovers	Nil
ROB and RUB	1 No
VUP	6VUP & 1 PUP
Culverts	71 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from cube highways and accordingly report is updated as March 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report

- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Ravelling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire in 2027, hence the data is not relevant.

2.3 Test Pit

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire in 2027, hence the data is not relevant.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

.

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire in 2027, hence the data is not relevant.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

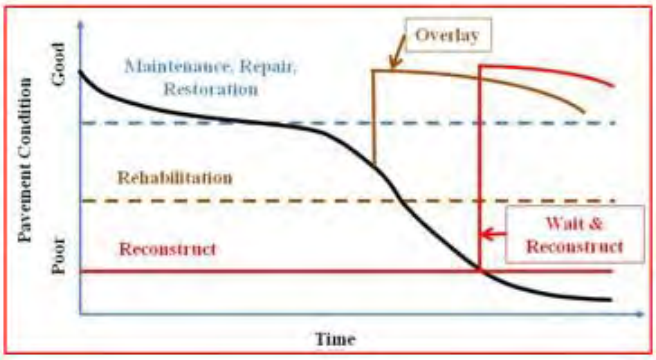
Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire in 2027, hence the data is not relevant.

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Project is being maintained by Annuity Concessionaire. Data not available.

2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Not applicable as project road in under Annuity.

2.9 Future Maintenance Requirements

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Six Lanning work is going beyond end of Concession Period therefore effect of six laning is considered while forecasting MM cycles.

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	**2031-32**	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2	**2038-39**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %
3	**2044-45**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 1200 m having width of 5.50 m
2. Construction of VUP- 1 Nos
3. Reconstruction of existing culvert for Slip Road – 1 Nos
4. Widening of Pipe Culvert for Service Road– Nil
5. RCC Drain –1200 m along service road
6. Rigid Crash Barrier- 1200 mtr
7. Road Furnitures – Transverse Marking 4.87 km, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
8. Addition Cantilever Sign Boards- 2 Nos
9. Toll Plaza
10. Landscaping and tree plantation
11. Way Side Amenities: to be constructed by NHAI
12. Incident Management – Highway Patrol, Ambulance, Crane
13. ATMS
14. Rainwater Harvesting
15. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from O & M Handover Date
4	Repair and Rehabilitation of Structure	12 months from O & M Handover Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date

Sn	Description of Work	Date of Completion
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from O & M Handover Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

O & M Handover Date: Mar 2027.

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in Schedule C, Engineering and Safety Improvements along the Project Highways shall confirm to IRC: SP: 84 -2014, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. Construction of new / widening of Service road /Slip road

   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:

   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.

2. Reconstruction of existing Service road /Slip road

   No existing service roads in this package.

3. Construction of new / widening of culverts / bridges / Grade separated structures

   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.

4. Repair / Rehabilitation of pavement (overlay)

   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.

5. Repair / Rehabilitation of structures

   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.

6. Junction improvement

   Not applicable

7. Construction of new drain

   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.

8. Road furniture

   a) Street Lighting – Not applicable

   b) High mast lighting – Not applicable

   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.

   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B

   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.

   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B

   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.

   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement

   i) Road marking – quantity considered along entire length of project road

   j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. Construction of new Toll plaza

   Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is not having PQC on tapper portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.

10. Landscaping and tree plantation

    The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.

11. Truck lay byes / toilet blocks

    Not applicable

12. Bus bays / bus shelters

    2 Nos to be provided as per schedule B.

13. Highway Patrol vehicles, Ambulance, Cranes

    One number at each toll location has been considered.

14. ATMS / TMS

    Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.

15. Rainwater harvesting systems

    Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.

16. Slope protection

    As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 16 March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	52452	2650	49802
VG40	55932	2650	53282

ii) Aggregates rates as per local market rates
iii) Equipment hire cost as per Standard Data Books published by MORTH
iv) Labour rates as per minimum wages applicable.
v) ATMS, TMS cost is based on offer from vendor.
vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.
vii) Items has breakdown in such a way that cost estimate can be easily established
viii) Computation of quantities for all items covering all the works to be carried out
ix) Calculation of repair and rehabilitation required for structure based on site condition.
x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.
xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	326
2	Granular Subbase	Cum	1,660
3	Wet mix macadam	Cum	2,360
4	Dense Bituminous Macadam VG-30	Cum	9,387
5	Bituminous Concrete VG-30	Cum	9,995
6	Pavement Quality Concrete (PQC)	Cum	6,496
12	RCC M 20 for Drain	Cum	5,322
13	Reinforcement Steel	MT	73,212
14	Metal "W" Beam crash barrier	Rm	2,500

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs	Remarks
1	Construction of VUP, SR, Drain with Mis Items	26,791,665	PPO/2122/00018
2	O&M Building (Admin Building Toll Plaza)	151,227,409	PPO/2122/00015
3	Cost of ATMS	0	Completed, completion certificate required
4	Cost of Hybrid ETC	0	Completed, completion certificate required
	Total	178,019,074	
	Add 12% for GST	21,362,289	
	Total including GST	199,381,363	

Total CAPEX – Rs. 19.94 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	**2031-32**	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2	**2038-39**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %
3	**2044-45**	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro surfacing in 50 %

Cost towards MM Cycle 2021/22 is considered in CAPEX.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

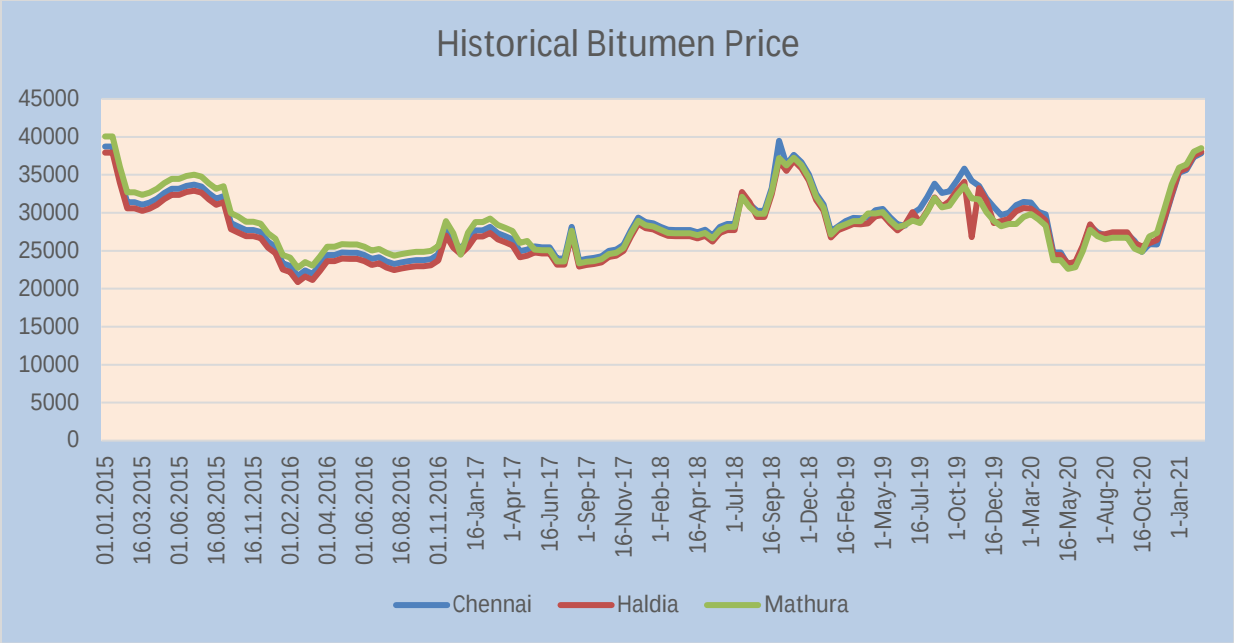
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro-surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 16 March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	31,573	2650	28,923
VG40	35,053	2650	32,403

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294

Year	Growth Rate	Escalation Factor
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665

Year	Growth Rate	Escalation Factor
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369

Year	Growth Rate	Escalation Factor
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	7,710
2	Bituminous Concrete	Cum	8,667
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	93
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in this report.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

S.N.	Activity	Unit	Quantity				Unit Rate 2022	Amount			
			2031-32	2038-39	2044-45	2050-51		2031-32	2038-39	2044-45	2050-51
	Main Carriageway - Flexible Pavement										
1	Tack Coat	Sqm	1,097,040	875,368	875,368		13	13,712,994	10,942,095	10,942,095	-
2	Bituminous Concrete - VG 40	Cum	39,237	26,261	26,261		8647	339,294,500	227,085,558	227,085,558	-
3	Dense Bituminous Macadam - VG 40	Cum	11,084				7697	85,306,123	-	-	-
8	Milling	Sqm	221,672				77	17,068,734	-	-	-
9	Microsurfacing	Sqm					176	-	-	-	-
10	Crack Sealing	Sqm						-	-	-	-
	Main Carriageway - Rigid							-	-	-	-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015)	Sqm						-	-	-	-
2	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum					6609	-	-	-	-
3	Joint sealant replacement every 5th Year (5 %)	m	8,916	8,916	8,916		220	1,961,562	1,961,562	1,961,562	-
4	Pot Hole Filling (1 %)	Sqm					549	-	-	-	-
5	Cross stitching of PQC slab (0.5 %)	Rm					549	-	-	-	-
6	Dismantling	Cum			-		3568	-	-	-	-
	Service Road							-	-	-	-
4	Tack Coat	Sqm	3,300	3,300	3,300		13	41,250		41,250	
5	DBM - VG 30	Cum					6950	-	-	-	-
6	BC - VG 30	Cum	99	99	99		8046	796,528	796,528	796,528	-
7	Microsurfacing	Sqm	3,300	3,300	3,300		176	580,800	580,800	580,800	-
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)										
1	Tack Coat	Sqm	10044	10044	10044		13	125,544	125,544	125,544	-
2	Wearing Coat (65mm)	Cum	402	301	301		8647	3,473,944	2,605,458	2,605,458	-
3	Dense Bituminous Macadam VG-40	Cum						-	-	-	-
4	Milling of existing Wearing Coat	Sqm	10044	10044	10044		77	773,350	773,350	773,350	-
5	Painting of Crash Barrier	sqm	4657	4657	4657		121	563,536	563,536	563,536	-
6	Microsurfacing	Sqm					176	-	-	-	-
	Structures Repair/ rectification										
2	Strip Seal	Rm					3129	-	-	-	-
4	Elastromeric Bearing replacement	Cub Cm.					1	-	-	-	-
5	POT PTFE Bearing	Nos					71352	-	-	-	-
6	Lifting Arrangement for Bearling Replacement	Nos					4940	-	-	-	-
	Other Works										
1	Raising of Road Kerb	m	96,516		96,516		400	38,606,520	-	38,606,520	-
2	Replacement of Road Studs							-	-	-	-
	Road Studs	Nos	12,637	12,637	12,637		220	2,780,140	2,780,140	2,780,140	-
	Solar Studs	Nos	1,576	1,576	1,576		1647	2,595,672	2,595,672	2,595,672	-
3	Painting of Road Kerb	Sqm	24,129	24,129	24,129		121	2,919,618	2,919,618	2,919,618	-
4	Road Marking - MCW	Sqm	36540	36540	36540		439	16,041,272	16,041,272	16,041,272	-
5	Shoulder Filling (40 to 50 mm)	Sqm	91410	91410	91410		22	2,011,020	2,011,020	2,011,020	-
6	Median Filling	Cum	2413		2413		439	1,059,266	-	1,059,266	-
8	PMC Cost for Overlay @ 10 lakh per month	Month	8	8	8		2000000	16,000,000	16,000,000	16,000,000	-
	Major Maintenance Cost Per Year							545,712,372	287,782,153	327,489,189	-
	Major Maintenance Cost Per Year with GST							611,197,857	322,316,011	366,787,892	-
								61.12	32.23	36.68	-
	Escalation Factor		**2021/22**					1.601	2.107	2.664	
	Esclated Amount keping Bitumen Component w/o Escalation							84.01	54.33	77.30	

5. OPERATION AND MAINTANANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall always procure that during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance
        - Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
        - Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
        - Road property management – this includes management of access, encroachment and ribbon development
        - General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations

- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.

b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:

   i. Where the other road crosses an underpass, the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.

   ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.

c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.

d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.

e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimsed staff requirement at Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 17,387 / km / month excluding GST.

5.4 Preventive Maintenance

The cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 10,256 / km / month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 16.10 Rs / Kwh based on monthly electricity bill.
c) Cost Adopted till O & M Handing Over is Rs. 51,00,000 per Year.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	1.92	104,284	200,225
2	Highway Lighting Electricity Charge	Kwh	383,834	16.10317	6,180,944
3	Operation and Maintenance of DG Set	Nos	2	140,235	280,469
4	Solar Blinker	Nos	-	3,000	-
5	Office Building Electricity Charge	LS			780,000
	Total				74,41,639

5.6 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is Rs 1.12 crore per year and additional cost of Rs 25.10 crore for replacement of equipment at every 7 (seven) years for TMS/ATMS.

5.7 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 1.45 crore per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.
   As per Company, overloading shall not be collected from this asset therefore only four Toll Collector is considered for 8 lane plaza from FY 2023 onwards. at this stage.

The cost of manpower is estimated as Rs. 2.75 core for FY 2022/23 including GST.

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 1.39 crore per year for FY 2022-23.

Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23			5,100,000	9,897,263		1,778,318	27,589,875	3,161,455	13,962,619	61,489,529
3	2023-24			5,100,000	11,930,738		1,778,318	27,589,875	3,161,455	13,962,619	63,523,005
4	2024-25			5,100,000	13,286,389		1,778,318	27,589,875	3,161,455	13,962,619	64,878,655
5	2025-26			5,100,000	14,642,040		1,778,318	27,589,875	3,161,455	13,962,619	66,234,306
6	2026-27			5,100,000	14,642,040		1,778,318	27,589,875	3,161,455	13,962,619	66,234,306
7	2027-28	3,641,224	11,521,895	6,390,734	69,248,233	14,575,549	1,778,318	27,589,875	3,161,455	15,326,652	153,233,935
8	2028-29	4,831,246	11,521,895	6,390,734	8,541,612	14,575,549	1,778,318	27,589,875	3,161,455	14,340,237	92,730,921
9	2029-30	6,203,816	11,521,895	6,390,734	9,897,263	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	95,081,523
10	2030-31	7,204,189	11,521,895	6,390,734	11,930,738	14,575,549	1,778,318	27,589,875	3,161,455	14,099,835	98,252,588
11	2031-32	3,641,224	11,521,895	6,390,734	13,286,389	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	95,908,058
12	2032-33	4,831,246	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	14,127,278	98,618,390
13	2033-34	6,203,816	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	99,826,301
14	2034-35	7,204,189	11,521,895	6,390,734	69,248,233	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	155,432,867
15	2035-36	7,930,845	11,521,895	6,390,734	8,541,612	14,575,549	1,778,318	27,589,875	3,161,455	14,264,494	95,754,777
16	2036-37	8,657,380	11,521,895	6,390,734	9,897,263	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	97,535,087
17	2037-38	3,641,224	11,521,895	6,390,734	11,930,738	14,575,549	1,778,318	27,589,875	3,161,455	14,291,937	94,881,725
18	2038-39	4,831,246	11,521,895	6,390,734	13,286,389	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	97,098,080
19	2039-40	6,203,816	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	14,291,937	100,155,619
20	2040-41	7,204,189	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	100,826,674
21	2041-42	7,930,845	11,521,895	6,390,734	6,508,136	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	93,419,426
22	2042-43	8,657,380	11,521,895	6,390,734	71,281,709	14,575,549	1,778,318	27,589,875	3,161,455	16,158,073	161,114,988
23	2043-44	3,641,224	11,521,895	6,390,734	9,897,263	14,575,549	1,778,318	27,589,875	3,161,455	16,158,073	94,714,386
24	2044-45	4,831,246	11,521,895	6,390,734	11,930,738	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	95,742,429
25	2045-46	6,203,816	11,521,895	6,390,734	13,286,389	14,575,549	1,778,318	27,589,875	3,161,455	15,938,528	100,446,559
26	2047-48	7,204,189	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	16,728,892	103,592,946
27	2048-49	7,930,845	11,521,895	6,390,734	14,642,040	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	101,553,329
28	2049-50	8,657,380	11,521,895	6,390,734	6,508,136	14,575,549	1,778,318	27,589,875	3,161,455	13,962,619	94,145,961
29	2050-51	3,641,224	11,521,895	6,390,734	8,541,612	14,575,549	1,778,318	27,589,875	3,161,455	27,925,238	105,125,900
	Total	140,927,803	265,003,594	172,486,872	506,013,162	335,237,634	49,792,904	772,516,498	88,520,727	417,053,076	2,747,552,269
	Total Cost in Crore	14.09	26.50	17.25	50.60	33.52	4.98	77.25	8.85	41.71	274.76

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Jhansi - Lalitpur section of NH 26. Project road starts from Km 49+700 at Khandi Village in to Km 99+305 at Lalitpur in the state of Uttar Pradesh. The total length of the project road is 49.305 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Jhansi to Lalitpur Pkg-2 Section of NH – 26 on TOT Basis in the State of Uttar Pradesh	49+700	99+305	49.305	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor

Various key features along the project road such as slope protections, median openings,

Start Point of Project Road at Km 49+700

End Point of Project Road at Km 99+305

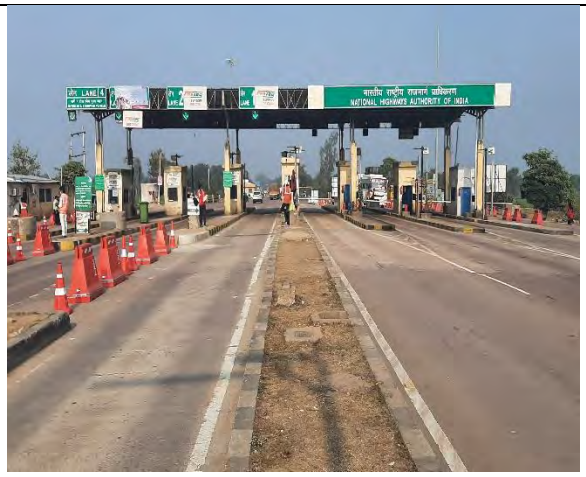
- Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 49+700 at Khandi Village of NH-26	Km 49+700 at Khandi Village of NH-26
2	Project Road End	Km 99+305 at Lalitpur of NH-26	Km 99+305 at Lalitpur of NH-26
3	Project Length	49.305 km	49.305 km
6	Carriageway	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	Shoulders	1 m earthen for MCW	1 m earthen for MCW
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	Service Roads	Nil	Nil
10	Major Bridge	4 No.	4 No.
11	Minor Bridge	16 Nos.	16 Nos.
12	Pipe, Box & Slab Culverts	71 Nos.	71 Nos.
13	Major/Minor Junctions	4 Major & 19 Minor	4 Major & 19 Minor
14	Underpass	6 VUP & 1 PUP	6 VUP & 1 PUP
15	Grade Separator	Nil	Nil
15	ROB/RUB	1 No	1 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	Nil	Nil
18	Bus Shelter	10 Nos.	8 Nos.

6.3.1 Cross Sectional Elements

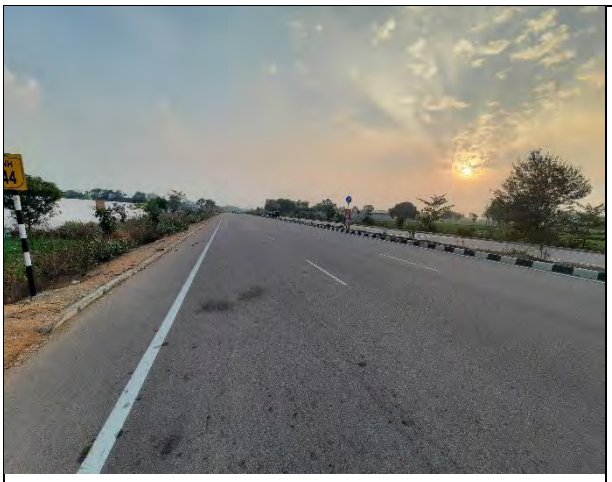
Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td>  </td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.3.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	49+700	85+100	BT	BT	35.400
2	85+250	85+500	CC	CC	0.400
3	85+500	99+005	BT	BT	13.505



Flexible Pavement

Rigid Pavement

6.3.3 Service Roads

As per Schedule A of CA no service road has been constructed. As per Schedule B new service road of 5.5 m width has been proposed for the length of 1200 m.

6.3.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 1.5 m wide median without MBCB and Antiglare	4.5 m wide Median with Shrubs

28 nos. of authorized and 7 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening without Solar Blinker	Unauthorized Median Opening

6.3.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. As per Schedule B lined drains are to be provided at the sides of the Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total 1.2 Km of covered line side drain is to be provided as per Schedule B. Shoulder drain of 3547m length and Median drain of 1750m length was observed in good condition.

Median Cut Drain at Project Road	Median Drain at Project Road

6.3.6 Major and Minor Junctions

As per the site inventory, 4 major and 19 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Major Junction at KM 0+000	Minor Junction

6.3.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road. Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	14.760
	Median	Nil
Pedestrian Guard Rail	Carriageway Edge	Nil
Concrete Barrier	Carriageway Edge & Median	1.294

MBCB and RCC Crash Barrier present on the project road

6.3.8 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 85+280 at Vigakhet with the configuration 2 x (3+1). This has 8 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Since new toll plaza is to be constructed as per IRC SP – 84: 2014, existing toll plaza is to be dismantled completely and new toll plaza with complete facility is to be provided.

Concessionaire has mobilized Toll Collection team with new system at Toll Plaza.

Vigakhet Toll Plaza at Km 85+280

6.3.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at built-up area, approach of grade separated structures. All lights were provided with LED bulbs for better quality and low operation cost.

High Mast and Highway Light along project Highway

6.3.10 Bus Bays and Bus Shelter

There are 8 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter along Project Highway

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	56+750	BHS	Steel shelter RCC seats	BT
2	77+350	BHS	Steel shelter RCC seats	BT
3	84+410	BHS	Steel shelter RCC seats	BT
4	87+410	BHS	Steel shelter RCC seats	BT
5	92+660	BHS	Steel shelter RCC seats	BT

6.3.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	Nil				

6.3.12 Signage and Marking

Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.

Road marking along the carriageway

6.3.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road	Plantation at 4.5 m Median

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they need maintenance to extend their design life.

As per site inspection it has been observed that

- 4 nos. of Major Bridges having total length varies from 60 m to 96 m are generally found in good condition.
- 16 nos. of Minor bridges having total length varies from 7 m to 40.6 m are generally found in good condition.
- 7 nos. of Underpass having single span arrangement are found in good condition.
- 1 nos. of double Span Road under Bridge total of total length 40m is in good condition
- Not any Flyover is found at the site

71 (pipe/box) nos. of culverts found at the site

6.4.2 Detailed Description of Structures

Major bridge – CH. 51+440

It consists of new bridge on both the carriageways. Each bridge has a span arrangement of 3x20m. The super structure comprises of RCC Slab. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & solid wall pier. Slope pitching of the bridge needs to be repaired. As periodic maintenance, replacement of joint and wearing coat is required after appropriate time span. Parapet wall is not constructed between the median opening in the direction of the traffic.

Detailed condition summary of Major Bridge is presented in Annexure-2.2(A). A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of carriageway

Span Arrangement

Major Bridge at Ch. 51+400

Major bridge – CH. 66+158

It consists bridge structure on each carriageway. The LHS bridge has a span arrangement of 3x30m. The super structure is of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Circular Pier. Wearing coat and Expansion joint is in poor condition.

The RHS bridge has a span arrangement of 3x30m.The super structure is of Steel girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Circular Pier. Steel girder is affected by rusting so painting/ other remedies of the girder is to be done immediately. The other conditions of the bridge are good. As periodic maintenance, replacement of joint and wearing coat is required for both the bridge structures. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span arrangement

Major Bridge at Ch. 66+158

Major bridge – CH. 74+108

It consists a bridge on both the carriageway. For both bridge structures, Span arrangement of 3x20.0m has provided, the super structure comprises of RCC Girder and POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment and wall type pier. Repairing of wearing coat of the RHS bridge is to be done. Other condition of the both bridge structures are Satisfactory. General repairs work such as painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc., as well as periodic maintenance works like replacement of joints and wearing coat is to be done in fixed interval. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span arrangement

Major Bridge at Ch. 74+108

Major bridge – CH. 96+425

It consists two bridge structures for each carriageway. The LHS bridge has a span arrangement of 3x32m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Circular Pier.

The RHS bridge has a span arrangement of 3x32m. The super structure comprises of PSC girder.POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment & circular Pier. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. W-Beam crash barrier at carriage way end has been provided along with steel railing at edge of deck, which is not recommended. Parapet wall is not constructed between the median opening in the direction of the traffic. The general condition of the bridge is good. Maintenance work like replacement of joint and wearing coat is to be done periodically.

A few pictures showing conditions of Major Bridge are presented as follows:

Span arrangement (LHS)

Span arragement (RHS)

Major Bridge at Ch. 96+425

Minor Bridge

Salient features along with condition of 16 Minor bridges are discussed here and detailed condition summary of Minor Bridge is presented in Annexure-2.2(B).

Minor Bridge – CH.54+022

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x13.50m, super structure comprises of RCC solid slab, the Foundation is not visible, and the Superstructure is resting on RCC Wall type abutment.

Minor Bridge – CH.54+712

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x15m, super structure comprises of RCC Girder, and the Superstructure is resting on RCC Wall type abutment. Wearing Coat of both the bridge is in good condition. Parapet wall is not constructed between the median opening in the direction of the traffic. The other condition of the bridge is also good. Only regular repair works such as fixing of drainage spouts, repair of slope pitching and periodic maintenance of joints etc. are required.

A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 54+712

Minor Bridge – CH.56+603

It consists of bridge on both the carriageways. Both the bridge has a span arrangement of 1x20.7m, Super structure comprises of RCC Girder and the superstructure is resting on RCC Wall type abutment. MS railing of the bridge had been damaged and needs to be replaced. Parapet wall is not constructed between the median opening in the direction of the traffic. The general condition of the bridge is good. It requires regular repair works such painting and repairing of Cross barrier and MS railing, repairing of drainage spouts, repairing of slope pitching etc. As periodic maintenance, replacement of joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of carriageway

Span arrangement

Minor Bridge at Ch. 56+603

Minor Bridge – CH.61+088

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x15m, super structure comprises of RCC Girder, Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. The general condition of the bridge is good. only requires regular repair works such painting and fixing of crash barrier & MS railing, fixing of drainage spouts, slope pitching and periodic maintenance of expansion joints etc.

A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway with Expansion Joint

Span Arrangement

Minor Bridge at Ch.61+088

Minor Bridge – CH.66+950

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x7.10m, super structure comprises of RCC solid slab and the superstructure is resting on Brick masonry Wall type abutment. It requires repairing of brick masonry parapet wall. The wearing coat and other general conditions of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

Span Arrangement

View of the carriageway

Minor Bridge at Ch. 66+950

Minor Bridge – CH.68+636

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x7.5m, super structure comprises of RCC solid slab, the superstructure is resting on Brick masonry Wall type abutment. Vegetation's growing in the abutment and wing walls needs to be removed completely. The wearing coat and other general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 68+636

Minor Bridge – CH.68+789

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x7.0m, super structure comprises of RCC solid slab and the superstructure is resting on Brick masonry Wall type abutment. Slope Pitching is in poor condition while the wearing coat and other general conditions of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 68+789

Minor Bridge – CH.72+307

It consists of bridge on Both Side of the carriage way. The LHS bridge has a span arrangement of 3x3.5m. The super structure comprises of RCC Slab, Superstructure is resting on Brick Masonry Wall type abutment & Pier.

The RHS bridge has a span arrangement of 1x10m. The super structure comprises of RCC Slab. The Superstructure is resting on RCC Wall type abutment. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat in each bridge is in good condition, and other general conditions of the bridge are also good. All the necessary periodical maintenance work needs to be done within the time frame.

A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span Arrangement

Span arrangement

Minor Bridge at Ch. 72+307

Minor Bridge – CH.81+268

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x7.0m, super structure comprises of RCC solid slab, and the superstructure is resting on Brick masonry Wall type abutment. Wearing coat and other general conditions of the bridge are good. Parapet wall is not constructed between the median opening in the direction of the traffic. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 81+268

Minor Bridge – CH.83+928

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x13.50m, super structure comprises of RCC Girder, Elastomeric bearing are used for resting the Superstructure on RCC Wall type abutment. Scouring has been observed, Minor repair in abutment and pitching is required. Wearing coat is in fair condition. All other general condition of the bridge is good.

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 83+928

Minor Bridge – CH.85+714

It consists of bridge on LHS and RHS carriageway.

Minor Bridge – CH.86+601

It consists of bridge on Both side of the carriageway. The LHS Bridge has a span arrangement of 2x11.70+1x17.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. Slope Pitching, Wearing Coat and other general condition of the bridge is good. The RHS Bridge has a span arrangement of 7x5.8m. The super structure comprises of RCC Slab. Superstructure is resting on Brick Masonry Wall type abutment & Pier. Slope pitching is in poor condition and needs immediate repairs. There are minor Crack developed in RCC Slab of this bridge, these cracks need to be rectified immediately.

A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 86+601

Minor Bridge – CH.89+453

It consists of bridge on Both the carriageways. The LHS bridge has a span arrangement of 1x17.3+1x14.8+1x7m. The super structure comprises of RCC Girder. Superstructure is resting on RCC Wall type abutment & Pier. Cross Barrier is to be repaired at the start of the bridge in urgent basis. Wearing coat in the bridge carriageway is in fair condition. All other general condition of the bridge is good.

The RHS bridge has a span arrangement of 5x6.7m. The super structure comprises of RCC Slab. The superstructure is resting on Brick masonry Wall type abutment & Pier. There are minor repairs in RCC Railing, which needs to be repaired immediately. Other conditions of the bridge are good but periodic maintenance of the bridge is to be done with in the specified time frame.

A few pictures showing the conditions of Minor Bridge are presented as follows:

Pitching in fair condition

Span Arrangement

Minor Bridge at Ch. 89+453

Minor Bridge – CH.92+180

It consists of bridge on each carriageway. The LHS Bridge has a span arrangement of 1x7m and the super structure comprises of RCC Slab. Superstructure is resting on RCC Wall type abutment. Wearing coat is in fair condition. There is minor repairing of abutment wall. Pitching is in poor condition. All other conditions of bridge are good.

The RHS Bridge has a span arrangement of 1x7m. The super structure comprises of RCC Slab. The superstructure is resting on Brick Masonry Wall type abutment. Wearing coat and all other conditions of the bridge is in good condition. Parapet wall is not constructed between the median opening in the direction of the traffic.

Periodic maintenance of both the bridges is to be done within the time frame.

View of carriage way

Span Arrangement

Minor Bridge at Ch. 92+180

Minor Bridge – CH.95+813

It consists of bridge on each Carriageway. The LHS bridge has a span arrangement of 2x16.5+1x7.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC Wall type abutment & Pier. Wearing coat and slope pitching is in fair condition and the drainage spout had been blocked which needs to be cleaned immediately. Other conditions of the bridge are good. The RHS bridge has a span arrangement of 5x7.5m, the superstructure comprises of RCC Slab, the superstructure is resting on RCC wall type abutment and piers. The general condition of the bridge is good. Periodic maintenance for both the bridges is to be done within specific timespan. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span arrangement

Minor Bridge at Ch. 95+813

Minor Bridge – CH.97+848

It consists of bridge on both carriageways. Both the bridge has a span arrangement of 1x9m, super structure comprises of RCC solid slab and the Superstructure is resting on RCC Wall type abutment in RHS bridge while in LHS bridge superstructure is resting in Stone Masonry wall type abutment. Parapet wall of RHS bridge has been broken, maintenance work is to be done. Slope Pitching is in poor condition, wearing coat and all other general conditions of each bridge are good.

A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 97+848

Under-Passes (UPs)

There is a total of 07 UPs has been provided. All UPs are single span with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B. UPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

View of Carriageway

Span Arrangement

UP at Ch. 52+501

View of carriage way

Span Arrangement

UP at Ch.76+667

View of carriage way

Span Arrangement

UP at Ch. 82+978

View of carriage way

Span Arrangement

UP at Ch. 50+737

Road under Bridge (RUBs)

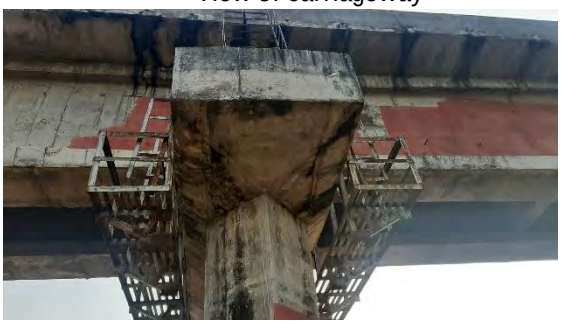
RUB at Ch. 92+235

It consists a bridge for railway under which road passes. The RUB has a span arrangement of 2x20.0m. The super structure comprises of RCC I-Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment. The general condition of the bridge is good.

Detailed condition summary of RUB's is presented in Annexure-2.2(D). A few pictures to ascertain the conditions of RUB are presented as follows: -

View of Carriageway

Span Arrangement



Super structure in fair condition

Super structure in fair condition

ROB at Ch. 92+235

Grade Separators (Flyover)

No grade separator

Culverts:

There are 71 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

6.4.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
1	51+440	LHS	3 x 20	2x 12.00	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	3 x 20	2x 12.00			●	●	●	●	●	●	●	●	●		●	Stable	
2	66+168	LHS	3 x 30	11.00	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	3 x 30	11.00			●	●	●	●	●	●	●	●	●		●	Stable	
					MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
3	74+108	LHS	3 x 20	2x 12.00															
		RHS	3 x 20	2x 12.00			●	●	●	●	●	●	●	●	●		●	Stable	
4	96+425	LHS	3 x 32	12.00	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	3 x 32	12.00			●	●	●	●	●	●	●	●	●		●	Stable	
5	54+022	LHS	1 x 13.50	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 13.50	2x9			●	●	●		●	●	●	●	●		●	Stable	
6	54+712	LHS	1 x 15	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 15	2x9			●	●	●		●	●	●	●	●		●	Stable	
7	56+603	LHS	1 x 20.7	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 20.7	2x9			●	●	●		●	●	●	●	●		●	Stable	
8	61+088	LHS	1 x 15	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 15	2x9			●	●	●		●	●	●	●	●		●	Stable	
9		LHS	1 x 7.10	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	66+950	RHS	1 x 7.10	2x9			●	●	●		●	●	●	●	●		●	Stable	
10	68+636	LHS	1 x 7.50	2x9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1 x 7.50	2x9			●	●	●		●	●	●	●	●			Stable	
11	68+789	LHS	1 x 7.00	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 7.00	2x9			●	●	●		●	●	●	●	●		●	Stable	
12	72+307	LHS	3 x 3.5	9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 10	9			●	●	●		●	●	●	●	●		●	Stable	
13	81+268	LHS	1 x 7	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1 x 7	9			●	●	●		●	●	●	●	●			Stable	
14	83+928	LHS	1 x 13.5	2x9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1 x 13.5	2x9			●	●	●		●	●	●	●	●			Stable	
15	85+714	LHS	3 x3.5	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
		RHS	1 x 10	9			●	●	●		●	●	●	●	●			Stable	
16	86+601	LHS	2 x11.70 +1 x 17.5	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	7 x 5.8	9			●	●	●		●	●	●	●	●			Stable	
17	89+453	LHS	1 x17.3+ 1 x14.8+ 1x 7	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	5 x 6.7	9			●	●	●		●	●	●	●	●			Stable	
18	92+180	LHS	1 x 7	9	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1 x 7	9			●	●	●		●	●	●	●	●			Stable	
19	95+813	LHS	2 x 16.5 +1x7.5	9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	5 x 7.5	9			●	●	●		●	●	●	●	●		●	Stable	
20	97+848	LHS	1 x 9	2x9	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1 x 9	2x9			●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
21	52+501	LHS	1x12	24	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x12	24			●	●	●		●	●	●	●	●		●	Stable	
22	53+820	LHS	1X11 (Sk), 1X10 (Sq)	24	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1X11 (Sk), 1X10 (Sq)	24			●	●	●			●	●	●	●		●	Stable	
23	56+280	LHS	1x10	24	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	24			●	●	●			●	●	●	●		●	Stable	
24	75+665	LHS	1X10.5 (Sk), 1x10 (Sq)	24	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1X10.5 (Sk), 1x10 (Sq)	24			●	●	●			●	●	●	●		●	Stable	
25	82+978	LHS	1x10.5 (Sk), 1x10 (Sq.)	24	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10.5 (Sk), 1x10 (Sq.)	24			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
26	76+677	LHS	1X11.5 (Sk), 1x10 (Sq.)	24	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1X11.5 (Sk), 1x10 (Sq.)	24			●	●	●			●	●	●	●		●	Stable	
27	50+737 (skew)	LHS	1x6 (Sk), 1x5.6 (Sq)	-	PUP	NA	●	●	●	●		●	●	●	●		●	Stable	
		RHS	1x6 (Sk), 1x5.6 (Sq)	-			●	●	●	●		●	●	●	●		●	Stable	
28	92+235 (Skew)		2 x 20	-	RUB	NA	●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Kanyakumari Etturavattam Tollway Limited

Report Number:

ACM-60657056-TDD-KETL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Kanyakumari Etturavattam Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Kanyakumari Etturavattam Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Kanyakumari Etturavattam Tollway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset 5B,
Aerocity Hospitality District, IGI Airport
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

Project Background 2
Project Salient Features 2
Project Principle Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 6

1. INTRODUCTION 7

1.1 Project Background 7
1.2 AECOM 9
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 10
1.5 Data Shared by the Company 11

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS 12

2.1 General 12
2.2 Estimation of Design Traffic 13
2.3 Test Pit 14
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 16
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 16
2.6 Roughness Survey using Network Survey Vehicle (NSV) 18
2.7 Determination of Pavement Major Maintenance 19
2.8 Base Year Pavement Rehabilitation Requirement 19
2.9 Future Maintenance Requirements 20

3. CAPEX REQUIREMENT 22

3.1 CAPEX needs 22
3.3 Unit Rate Analysis 25
3.4 Cost Estimate 26

4. MAJOR MAINTENANCE COST 28

4.1 Major Maintenance Cycle 28
4.2 Major Maintenance Quantity 28
4.3 Unit Rate Analysis 29
4.4 Cost Estimate 31

5. OPEATION AND MAINTEANCE COST - OPEX 33

5.1 O & M Requirement as per CA 33
5.2 O & M Strategy 36
5.3 Routine and Preventive Maintenance 36
5.4 Preventive Maintenance: 37
5.5 Highway Lighting 37
5.6 ATMS and TMS Cost 38
5.7 Incident Management 38
5.8 Manpower Cost 38
5.9 Office Expenses 38

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT 40

6.1 Reconnaissance Survey 40
6.2 Road Inventory and Condition Survey 40
6.3 Inventory and Condition Survey of Structures 52

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KETL	Kanyakumari Etturavattam Tollway Limited
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological

MIS	Management Information System
MJB	Major Bridge
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Kanyakumari Etturavattam Tollway Limited ("KETL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and KETL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Madurai – Kanyakumari Section from Km 52+300 to Km 116+500 of NH 44 (Old NH-7) in the State of Tamilnadu (Package-2) is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by the Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Madurai to Kanyakumari section from KM 52+300 to Km 116+500 Package-2 on NH-44 (Old NH-7) in the state of Tamilnadu.
Project Length	64.20 Km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Kanyakumari Etturavattam Tollway Limited
Signing of Agreement	27th December 2019
Appointed Date	20 Oct 2020
Concession Period	30 years
End of Concession Period	21 Oct 2050

Likely End of Concession Period	Oct 2050
Number of Toll Plaza	1 nos, Toll Plaza having 10 Hybrid lanes including Extra wide Lane

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Kanyakumari- Etturuvattam Tollway Limited
3	Independent Engineer	Bloom Companies LLC
4	Maintenance Contractor	1) Toll Operation (TBR Infra Pvt Ltd., Hyderabad), 2) Incident Management (Markolines Traffic Controls Private Limited) 3) G4S Security Solutions India Pvt Ltd., For Security 4) Routine Maintenance- M/s Racy Projects

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 12 months.

- Maintenance and rehabilitation of Pavement
- Construction of New Service Road & Structures
- Repair and Rehabilitation of Structures and Cross Drainage Works
- Minor Junction Improvement
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

- The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is **Rs. 29.24** crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2028/29	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**72.46**
2.	2035/36	30 mm BC in Main Carriageway for 100% Length and 50mm DBM in 20% Length. 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**117.56**
3.	2042/43	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**111.62**
4.	2049/50	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**171.38**

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs

As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement.

c) Operation and Maintenance (OpEX)

As per Schedule F, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	14,361,781
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	14,893,740
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	17,744,240
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	7,794,808
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	6,112,899
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	3,061,481
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	2,634,545
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	5,912,908
11	Community Development	Includes CSR related expenses.	1,097,727
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance	Includes project insurance expenses.	

Sl. No.	Description	Remarks	Amount (in INR)
	Expenses		13,611,818
15	IE Fees	Includes IE fees.	3,842,045
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	14,433,243
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	5,042,465
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	2618981
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	314800
		O & M Cost for Year 2022-23	**132,219,862**

A total of Rs. **13.22** crore is estimated to be incurred by the Concessionaire as OpEX as on FY 23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 5.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

1.1 Project Background

Kanyakumari Etturavattam Tollway Limited (hereinafter referred to as KETL or the Concessionaire), is a company to undertake Tolling, Operation, Maintenance & Transfer (**TOT Model**) of Madurai Kanyakumari Section of NH-44(Old NH-7) from Km 52+300 to Km 116+500 in the State of Tamil Nadu is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI)

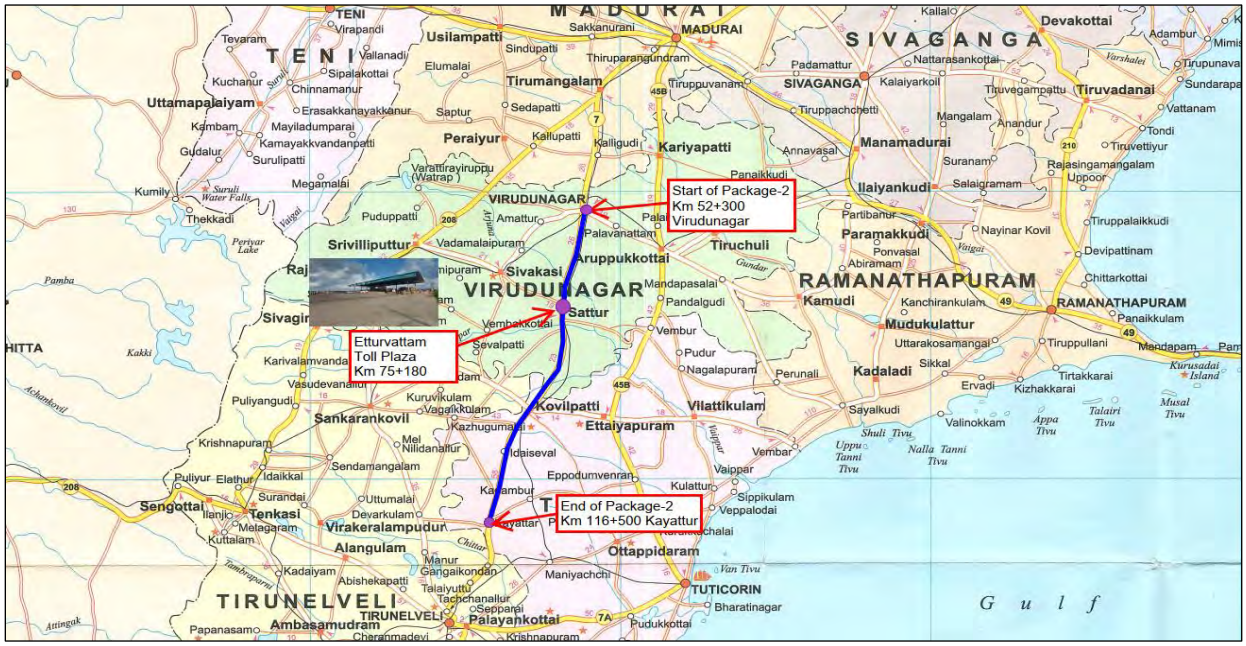
In this context, **M/s AECOM India Pvt. Ltd** is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 21 Oct 2050.
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 44 start from Km 52+300 and ends at Km 116+500. NH 44, National Highway 44 (NH 44) is a major north–south National Highway in India, the longest in the country. It passes through the Union Territory of Jammu and Kashmir, in addition to the states of Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.

It came into being by merging seven national highways, in full or part, starting with the Jammu-Srinagar National Highway (former NH 1A) from Srinagar in Jammu and Kashmir, former NH 1 in Punjab and Haryana ending at Delhi, part of former NH 2 starting from Delhi and ending at Agra, former NH 3 (popularly known as Agra-Bombay National Highway) from Agra to Gwalior, former NH 75 and former NH 26 to Jhansi, and former NH 7 via Lakhnadon, Seoni, Nagpur, Adilabad, Nirmal, Hyderabad, Kurnool, Anantapur,[2] Bangalore, Hosur, Krishnagiri, Dharmapuri, Salem, Namakkal, Karur, Dindigul, Madurai, Virudhunagar and Tirunelveli terminating at Kanyakumari. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	64.20 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1 m to 2 m earthen for MCW at Rural Area
Service Road / Slip Road	42.880 km one side length having width of varying from 5.5 m to 7.0 m
Major / Minor Junction	1 Major & 11 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 27.406 Km
Median Opening	35 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	Nil
Bus Bays with shelter	11 Bus Bay and 37 Bus Shelter
Highway Lighting	17 Nos. Single Arm

Description	Project Features
High Mast	7 nos
Highway Patrol	1 nos
Ambulance	1 nos
Crane	1 nos

b) Structure

Description	Project Features
Major Bridge	3 No
Minor Bridge	20 Nos
ROB and RUB	2 No ROB
VUP	10 VUP
Culverts	89 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With **approximately 1,00,000 employees** (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in **more than 150 countries** around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments**.**

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of **AECOM** based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering

- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) **Desk Study**: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) **Site Visit**: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) **CAPEX and OPEX:** calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface

- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

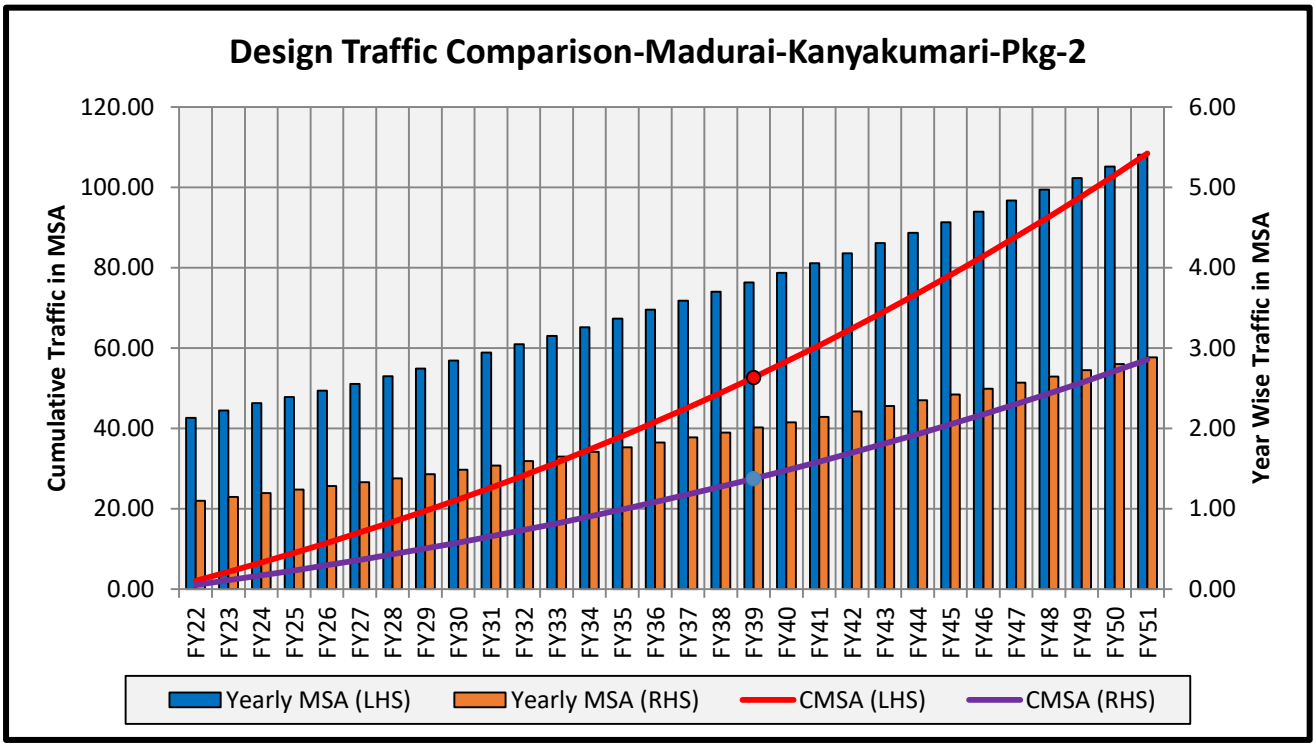
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till FY31 for 1st Cycle of MM design period for LHS (MK) 25.27 MSA and RHS (KM) 13.13 MSA whereas cumulative MSA upto FY51 is 108.46MSA for LHS (MK) and 57.13 MSA for RHS (KM). Year wise and cumulative MSA is presented in graph below:



MK – Madurai Kanyakumari (Virudha nagar Kayattur) direction

KM –Kanyakumari Madurai (Kayattur to Virudha nagar) direction

2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S. No	Existing Chainage (km)	Side	DCP-CBR	4 day soaked CBR in %
1	54+950	LHS	14.1	11.7
2	55+050	RHS	21.8	10.3
3	60+050	LHS	21.1	19.7
4	62+450	RHS	19.5	20.2
5	65+000	LHS	17.3	19.6
6	67+800	RHS	17.4	14.8
7	68+600	LHS	15.1	17.3
8	70+000	LHS	15.3	20.0
9	72+500	RHS	19.6	20.8
10	74+800	LHS	19.2	21.3
11	79+950	LHS	9.6	8.9
12	83+000	RHS	16.3	8.7
13	85+000	LHS	24.8	10.2
14	87+500	RHS	22.2	18.6
15	89+900	LHS	15.6	14.7
16	92+800	RHS	16.3	13.9
17	95+000	LHS	17.5	13.6
18	105+000	LHS	10.7	10.2
19	107+500	RHS	20.1	17.9
20	110+200	LHS	11.1	9.3
21	112+450	RHS	18.5	11.4
22	115+000	LHS	18.6	12.5
		Average DCP-Equivalent CBR	**17.3**	

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from **110 mm to 270 mm** and granular layer thickness varies from **380 mm to 520 mm**.

Samples were also collected for Natural ground and test results are as follows

S:No	Location (Km.)	Side (LHS/RHS)	Soil Classification as per IS: 1498	Gradation: Percent by weight passing through the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS :2720-Pt-V]			Modified Proctor Test (IS:2720-Pt-VIII)		4-Days Soaked CBR (%)	Free Swell Index (%)
				19.0 mm	10.0 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. dry density (gm/cc)	OMC (%)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	53+000	RHS	SC	100.0	95.5	88.5	76.0	65.0	44.9	44.9	29	21	8	1.94	9.5	9.7	15.0
2	53+800	RHS	CL	100.0	100.0	97.2	90.2	84.5	65.5	65.5	34	22	12	1.86	13.2	5.0	30.0
3	59+200	LHS	ML-CL	100.0	100.0	95.5	85.2	65.2	51.2	51.2	28	21	7	1.98	8.8	10.8	12.5
4	65+400	LHS	CL	100.0	99.1	88.5	72.5	68.0	61.1	61.1	32	21	11	1.85	12.2	5.2	30.0
5	65+400	RHS	ML-CL	100.0	100.0	85.1	5	70.2	68.2	58.2	28	21	7	1.95	9.3	8.7	15.0
6	83+000	LHS	SM	100.0	99.1	88.5	7	68.5	30.2	30.2	22	NP	NP	2.02	8.7	12.6	0.0
7	88+700	LHS	MI	100.0	100.0	100.0	6	88.2	78.5	78.5	38	28	10	1.82	12.9	5.1	22.2

GSB Materials samples were also collected and the test results are tabulated here

S.No	Chainage (km)	Side (LHS/RHS)	Type of Sample	Cumulative Percetage of Passing through IS Sieve (mm)												MoRTH 5th Revision	MoRTH 4th Revision	Atterberg Limits			Specific Gravity	W.A (%)	AIV (%)
				75	53.0	45.0	26.5	22.4	11.2	9.5	4.75	2.36	0.600	0.425	0.075			Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)			
1	54+950	LHS	WMM	100.0	100.0	100.0	64.8	55.9	31.0	26.7	22.7	18.4	13.0	10.5	0.5	22.4mm,11.2mm & 4.75mmIS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm,11.2mm & 4.75mmIS Sieve Material is Slightly Coarser Side in WMM Gradation	23	NP	NP	2.81	0.26	34.39
2	55+050	RHS	WMM	100.0	100.0	100.0	56.5	46.2	35.0	31.9	28.0	23.3	16.3	13.1	1.0	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	20	NP	NP	2.83	0.30	27.87
3	60+050	LHS	GSB	100.0	100.0	100.0	57.8	48.9	29.4	27.1	24.8	21.2	14.0	10.9	1.2	Conforming to GSB-III &IV	Conforming to GSB-IV & V	22	NP	NP	2.78	0.34	37.67
4	62+450	RHS	GSB	100.0	100.0	100.0	52.4	40.1	29.3	27.7	25.2	20.7	13.9	10.9	1.4	Confirming to GSB-IV	Confirming to GSB-V	20	NP	NP	2.81	0.29	35.16
5	65+000	LHS	WMM	100.0	100.0	100.0	65.9	56.0	27.9	21.2	15.7	12.0	8.5	7.0	1.1	Not Conforming to any Gradation	Not Conforming to any Gradation	22	NP	NP	2.80	0.35	30.25
6	67+800	RHS	WMM	100.0	100.0	100.0	91.9	78.6	41.0	32.7	24.6	20.7	11.8	9.4	1.0	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	20	NP	NP	2.83	0.29	31.33
7	68+600	LHS	GSB	100.0	97.0	95.7	69.3	62.7	40.1	35.6	29.9	23.6	14.1	11.1	1.0	Conforming to GSB-I	Conforming to GSB-I &IV	20	NP	NP	2.83	0.22	35.47
8	70+000	LHS	GSB	100.0	100.0	100.0	60.4	57.0	34.9	27.9	22.0	17.4	11.8	9.4	1.2	Conforming to GSB-III &IV	Conforming to GSB-IV & V	23	NP	NP	2.81	0.28	32.75
9	72+500	RHS	GSB	100.0	100.0	100.0	57.1	45.0	28.9	26.1	23.4	20.0	14.9	12.5	0.7	Conforming to GSB-III &IV	Conforming to GSB-IV & V	20	NP	NP	2.86	0.25	31.64
10	74+800	LHS	WMM	100.0	100.0	100.0	69.8	52.4	36.1	30.2	25.9	19.8	10.2	8.0	1.6	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	21	NP	NP	2.86	0.23	30.77
11	79+950	LHS	GSB	100.0	100.0	96.3	60.6	52.6	33.6	28.8	23.0	19.2	9.6	7.5	0.9	Confirming to GSB III & IV	Confirming to GSB IV & V	22	NP	NP	2.84	0.27	33.46
12	83+000	RHS	GSB	100.0	100.0	100.0	49.7	27.5	6.2	4.8	4.1	3.1	2.6	2.3	0.6	26.5mm &4.75mm IS Sieve Material is Slightly Coarser side in GSB III&IV	26.5mm &4.75mm IS Sieve Material is Slightly Coarser side in GSB IV&V	20	NP	NP	2.84	0.30	35.13
13	85+000	LHS	WMM	100.0	100.0	100.0	54.4	48.5	31.0	26.8	22.2	18.9	12.8	10.0	1.0	Not Conforming to any Gradation	Not Conforming to any Gradation	21	NP	NP	2.83	0.26	29.14
14	87+500	RHS	WMM	100.0	100.0	96.6	62.9	56.2	38.5	32.4	31.8	24.1	18.2	14.5	1.3	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	23	NP	NP	2.81	0.21	30.37
15	89+900	LHS	GSB	100.0	100.0	100.0	52.1	43.1	30.4	29.3	27.0	22.5	19.1	16.0	5.2	0.075mm IS Sieve Material is Slightly Finer Side in GSB- IV	Confirming to GSB-V	20	NP	NP	2.77	0.23	29.81
16	92+800	RHS	GSB	100.0	100.0	100.0	53.8	45.7	25.7	21.4	18.0	15.1	10.2	8.3	0.5	Conforming to GSB-IV	Conforming to GSB-V	20	NP	NP	2.74	0.16	31.33
17	95+000	LHS	WMM	100.0	100.0	100.0	67.5	65.0	32.2	27.4	22.7	19.4	10.6	8.4	0.9	11.2mm,4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	11.2mm,4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	23	NP	NP	2.76	0.24	30.73
18	105+000	LHS	WMM	100.0	100.0	100.0	86.1	78.8	45.0	37.1	28.2	20.7	9.2	6.9	2.0	Conforming to WMM gradation	Conforming to WMM gradation	23	NP	NP	2.78	0.29	29.64
19	107+500	RHS	WMM	100.0	100.0	100.0	72.7	60.7	36.9	31.9	26.9	23.0	11.7	9.2	1.0	11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	20	NP	NP	2.76	0.38	28.71
20	110+200	LHS	GSB	100.0	100.0	100.0	69.5	59.5	37.4	31.8	26.0	21.6	13.2	9.6	0.5	Conforming to GSB-IV	Conforming to GSB-IV & V	19	NP	NP	2.75	0.35	36.81
21	112+450	RHS	GSB	100.0	100.0	96.2	81.6	70.0	32.6	26.7	22.0	17.2	10.9	8.7	2.7	26.5mm IS Sieve Material is Slightly Coarser side in GSB-III&IV	26.5mm IS Sieve Material is Slightly Coarser side in GSB-IV&V	20	NP	NP	2.80	0.32	35.47
22	115+000	LHS	WMM	100.0	100.0	100.0	54.3	32.6	6.2	5.4	4.6	4.2	3.1	2.8	1.0	Not Confirming to any Gradation	Not Confirming to any Gradation	22	NP	NP	2.81	0.37	34.32

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	Length in km	
	LHS	RHS
Length of Road where MSA is less than 10-year design MSA i.e. 25.27 MSA in LHS and 13.13 MSA in RHS. 30-year Design MSA is 108.46 for LHS and 57.13 for RHS.	-	-
Less than 109 MSA in LHS and Less than 58 MSA in RHS	29.50	5.00
From 109 MSA to 200 MSA in LHS and from 58MSA to 110 MSA in RHS	25	29.00
Greater than 200 MSA in LHS and 110 MSA in RHS	9.7	30.20
Total Length	64.2	64.2

*Total Length 64.20 Km

Based on remaining life of pavement, structural overlay is not required till end of concession period.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	**Cracks**	- **Type:** Longitudinal, Transverse, Block, Alligator - **Extent: %** of Pavement Area Influenced by distress - **Severity:** High (> 3mm wide), Low (<3mm wide)
2	**Pothole**	- **Extent: %** of Pavement Area Influenced by distress

Sn	Distress	Details Captured and Yard Stick adopted for Classification
		- **No. of Potholes** - **Depth Severity:** Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	**Raveling**	- **Extent: %** of Pavement Area Influenced by distress - **Severity:** Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	**Patching**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	**Shoving**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<15mm), High (>15mm)
6	**Flushing/Bleeding**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	**Depression**	- **Extent: %** of Pavement Area Influence by distress - **Severity**
8	**Delamination**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<1 sq.m area), High (>1 sq.m area)
9	**Edge Break**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	**Pavement Missing**	- **Extent: %** of Pavement Area Missing
11	**Rutting**	- **Rut Depth**

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

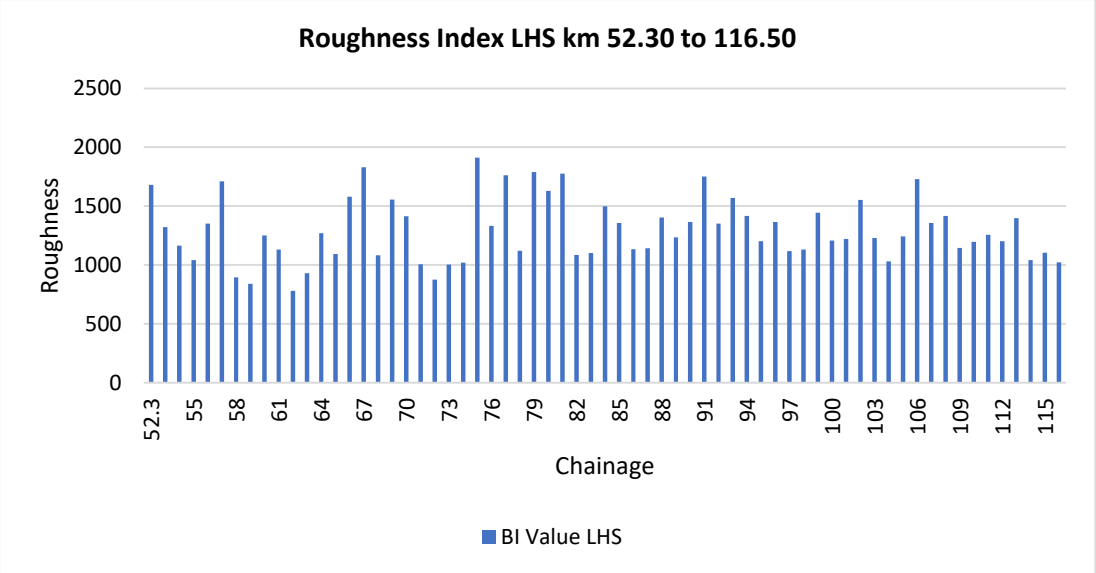
where, BI = Bump Integrator Roughness in mm/km

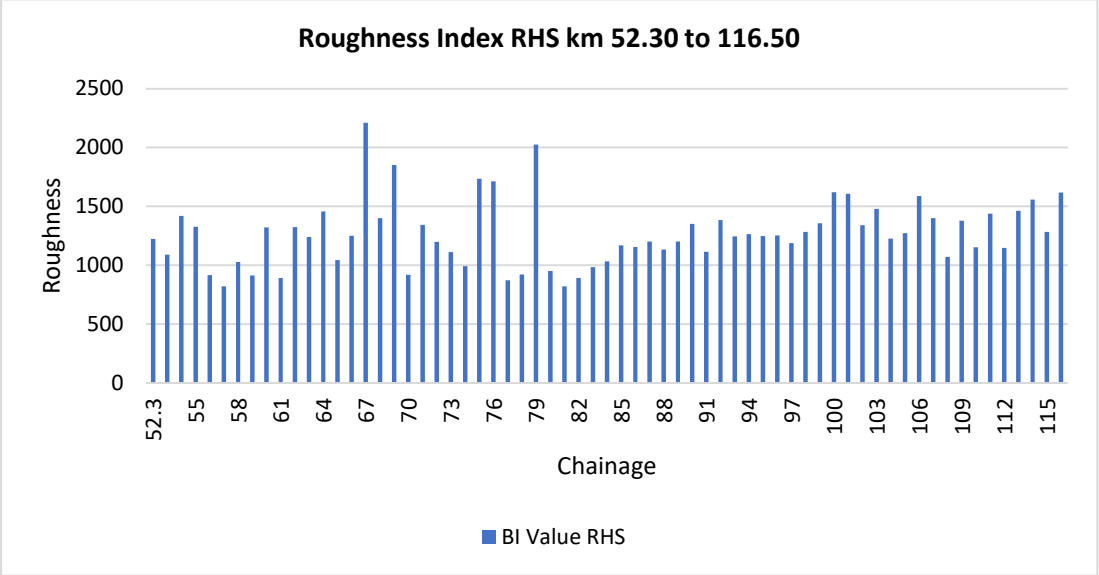
IRI = International Roughness Index

Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

Ratings	Roughness Value (mm/km)	LHS in km	RHS in km
Good	**<2000**	**64.2**	**62.2**
Fair	**2000 - 3000**	**0**	**2**
Poor	**>3000**	**0**	**0**

***- Source of Information**: Based on NSV Survey Carried out by M/s V R Techniche Private Limited in the month of **April 2022**.

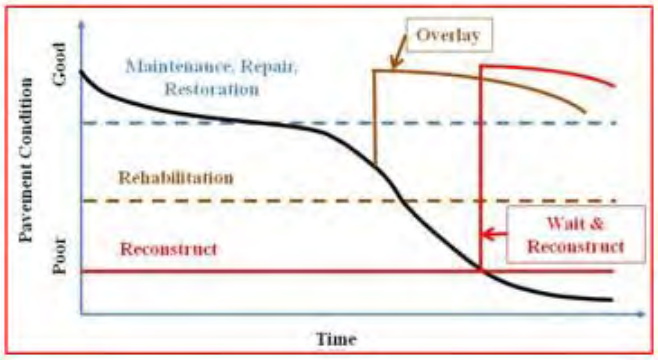




Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.

2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is not required however functional overlay is required to bring down roughness value less than 2000 mm / km and to maintain

performance requirement till next MM cycle. Also, as per Concession agreement, minimum overlay is to be provided at location as specified in Section 3.1 of Schedule B. The combined overlay location to be provide in FY 2021/22 based on pavement condition survey caried out and as specified in Schedule B is as below:

LHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	52+300	56+000	3.70	40	Full Width	BC Overlay
2	56+000	116+500	60.50	30	Full Width	BC Overlay

RHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	52+300	116+500	64.2	30	Full Width	BC Overlay

In addition to above, additional area for milling and overlay by BC also considered.

2.9 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. The Concession agreement do not clearly mention whether overlay on existing four lane shall be executed by the Authority during six laning under EPC or not. However, providing top layer in one go is required and providing one layer of overlay during six laning is considered to be executed by the Authority. In view of above major maintenance cycle is considered as follows:

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2027/28	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%
2	2035/36	Functional Overlay	30 mm BC in entire length+	30 mm BC in 50%, Micro

			DBM 50 mm in 20 % Length	surfacing in 50%
3	2042/43	Functional Overlay	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%
4	2049/50	Functional Overlay	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 1140 m having width of 5.50 m to 7.5m including tapering location
2. Widening of Pipe Culvert– 4 Nos
3. Rehabilitation of Pavement – 40 mm BC in 3.7 km 2 Lane and 62.4+60.5 Km=122.9Km 30mm BC 2 Lane.
4. Minor Repair of Structures – Major Bridge 3nos, Minor Bridge 20 nos, Culverts – 89 nos, ROB – 2 nos, VUP – 10 nos.
5. Junction Improvement – 1 Major Junction and 11 Minor Junctions
6. RCC Drain – 27.406 m along slip road
7. Road Furnitures – Solar Blinker 54 nos, Transverse Marking 64.2 km, W Beam 2.932 m, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
8. Toll Plaza Taper Portion as Rigid Pavement.
9. Landscaping and tree plantation
10. Way Side Amenities: to be constructed by NHAI
11. Incident Management – Highway Patrol, Ambulance, Crane
12. ATMS
13. Rainwater Harvesting
14. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from Appointed Date
4	Repair and Rehabilitation of Structure	12 months from Appointed Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from Appointed Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in **Schedule C**, Engineering and Safety Improvements along the Project Highways shall confirm to **IRC: SP: 84 -2014**, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. **Construction of new / widening of Service road /Slip road**
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. **Reconstruction of existing Service road /Slip road**
   No existing service roads in this package.
3. **Construction of new / widening of culverts / bridges / Grade separated structures**
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. **Repair / Rehabilitation of pavement (overlay)**
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.
5. **Repair / Rehabilitation of structures**
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
6. **Junction improvement**
   A list of improvements to be carried out at Major / Minor junction has provided in Schedule B. Consultant has prepared Typical Layout Plan for junction development based on IRC SP 84-2014 and quantity calculation arrived accordingly. Pavement thickness for Junction is as follows:
   a) Junction having Flexible Pavement
      Area adjoining to MCW: BC – 40 mm, DBM -60 mm, WMM – 250 mm, GSB – 200 mm.
      Area adjoining to Cross Road - BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm.
   b) Junction having Rigid Pavement: PQC – Not appliable
7. **Construction of new drain**
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. **Road furniture**
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
   i) Road marking – quantity considered along entire length of project road

j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. **Construction of new Toll plaza**

Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is having flexible pavement on tapper as well as central portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.

10. **Landscaping and tree plantation**

The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.

11. **Highway Patrol vehicles, Ambulance, Cranes**

Two numbers at each toll location has been considered.

12. **ATMS / TMS**

Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.

13. **Slope protection**

As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 16th March 2022	IOCL Chennai		
Bitumen	**Base Price**	**Discount**	**Ex MI price**
VG30	51752	5100	46652
VG40	55232	3800	51432

ii) Aggregates rates as per local market rates
iii) Equipment hire cost as per Standard Data Books published by MORTH
iv) Labour rates as per minimum wages applicable.
v) ATMS, TMS cost is based on offer from vendor.
vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.
vii) Items has breakdown in such a way that cost estimate can be easily established
viii) Computation of quantities for all items covering all the works to be carried out
ix) Calculation of repair and rehabilitation required for structure based on site condition.
x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.
xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	441
2	Granular Subbase	Cum	1,208
3	Wet mix macadam	Cum	1,644
4	Dense Bituminous Macadam – CAPEX	Cum	10,084
5	Bituminous Concrete	Cum	11,870
6	Pavement Quality Concrete (PQC)	Cum	6,188
7	RCC M 20 for Drain	Cum	6,156
8	Reinforcement Steel	MT	1,07,079
9	Metal "W" Beam crash barrier	Rm	4,302

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs
1	Cost of Strengthening of existing carriageway	0
2	Cost of new construction of LVUP approaches	40,506,477
3	Cost of Service/Slip road	20,945,605
4	Cost of Road Furniture	75,398,593
5	Cost of Drain	
6	Cost of Miscellaneous works	0
7	Cost of LVUP including RE Wall	55,958,131
8	Cost of Structure (BOX Culvert and Pipe culvert)	2,406,500
9	Cost of repairs of existing structures	0
10	Cost of Toll plaza Improvement	73,222,794
11	Cost of ATMS	94,384,500
12	Cost of Hybrid ETC	0
13	Additional Requirement as per Site condition	

S.no	Description	Cost in Rs
	Total	**261,074,217**
	Add 12% for GST	**31,328,906**
	Total including GST	**292,403,123**

Total CAPEX – Rs. 29.24 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2027/28	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%
2	2035/36	Functional Overlay	30 mm BC in entire length+ DBM 50 mm in 20 % Length	30 mm BC in 50%, Micro surfacing in 50%
3	2042/43	Functional Overlay	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%
4	2049/50	Functional Overlay	30 mm BC	30 mm BC in 50%, Micro surfacing in 50%

.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

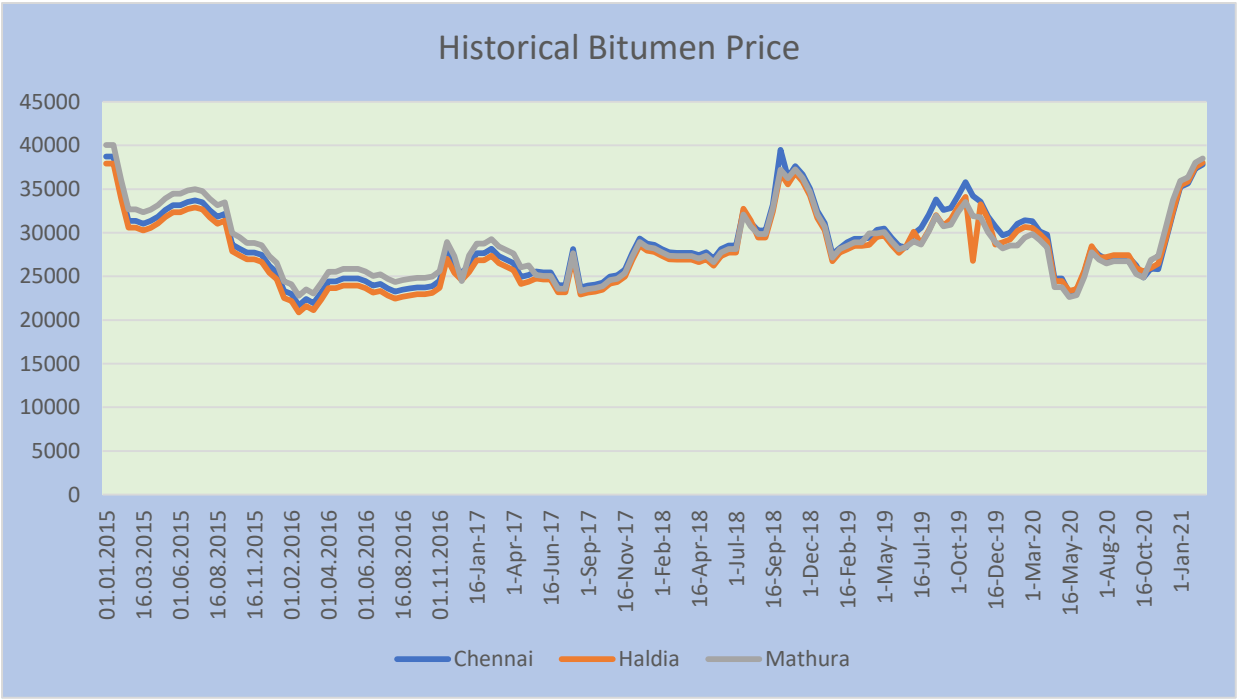
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company (Escalation factor applied only on Major Maintenance Cost).

Year	Growth Rate	Escalation Factor
FY - 22	2.83%	1.000
FY - 23	4.66%	1.047
FY - 24	5.65%	1.106
FY - 25	5.37%	1.165
FY - 26	5.52%	1.229
FY - 27	5.25%	1.294
FY - 28	4.86%	1.357
FY - 29	4.44%	1.417
FY - 30	4.24%	1.477
FY - 31	4.13%	1.538
FY - 32	4.08%	1.601

Year	Growth Rate	Escalation Factor
FY - 33	4.01%	1.665
FY - 34	4.00%	1.732
FY - 35	4.03%	1.801
FY - 36	4.01%	1.874
FY - 37	3.98%	1.948
FY - 38	3.98%	2.026
FY - 39	4.00%	2.107
FY - 40	3.99%	2.191
FY - 41	3.99%	2.278
FY - 42	3.99%	2.369
FY - 43	3.99%	2.464
FY - 44	3.99%	2.562
FY - 45	3.99%	2.664
FY - 46	3.99%	2.771
FY - 47	3.99%	2.881
FY - 48	3.99%	2.996
FY - 49	3.99%	3.116
FY - 50	3.99%	3.240

iv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

v) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as FY 23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	7,533
2	Bituminous Concrete	Cum	8,743
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220

Sn	Items Description	Unit	Rates (Rs.)
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented below:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Major Maintenance					
			Quantity				Unit Rate 2022#	
			2028-29	2035-36	2042-43	2049-50		2028-29
	Main Carriageway - Flexible Pavement							
1	Tack Coat	Sqm	1,260,308	1,512,369	1,260,308	1,260,308	13	15,779,050
2	Bituminous Concrete - VG 40 / CRMB	Cum	37,809	37,809	37,809	37,809	8743	330,578,909
3	Dense Bituminous Macadam - VG 30	Cum		12,603			7533	-
	Main Carriageway - Rigid							
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm						-
2	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum						-
3	Joint sealant replacement every 5th Year (5 %)	m	1,676	1,676	1,676	1,676	220	368,762
	Service Road							
1	Tack Coat	Sqm	198,476	198,476	198,476	198,476	13	2,484,916
2	DBM - VG 30	Cum						-
3	BC - VG 30	Cum	5,954	5,954	5,954	5,954	7993	47,591,601
4	Microsurfacing	Sqm	198,476	198,476	198,476	198,476	176	34,931,728
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)							
1	Tack Coat	Sqm	18137	18137	18137	18137	13	227,076
2	Bituminous Concrete - VG 40 / CRMB	Cum	544	544	544	544	8743	4,757,365
3	Dense Bituminous Macadam VG-40	Cum						-
4	Milling of existing Wearing Coat	Sqm	18137	18137	18137	18137	77	1,396,557
5	Painting of Crash Barrier	sqm	40498	40498	40498	40498	121	4,900,210
6	Microsurfacing	Sqm					176	-
	Other Works							-
1	Raising of Road Kerb	m		122,572		122,572	439	-
2	Replacement of Road Studs							-
	Road Studs	Nos	42,354	42,354	42,354	42,354	220	9,317,880
	Solar Studs	Nos	466	466	466	466	1647	767,502
3	Painting of Road Kerb	Sqm	45,965	45,965	45,965	45,965	121	5,561,705
4	Road Marking - MCW	Sqm	68658	68658	68658	68658	439	30,140,807
5	Shoulder Filling (40 to 50 mm)	Sqm	128400	128400	128400	128400	22	2,824,800
6	Median Filling	Cum		7704		7704	439	-
7	Cost for fixing Other CA Issue at Handback Time	LS						-
8	PMC Cost for Overlay @ 20 lakh per month	Month	8	8	8	8	2,000,000	16,000,000
	Major Maintenance Cost Per Year							507,628,867
	Major Maintenance Cost Per Year with GST							568,544,331
						Amount in Crore		56.85
	Escalation Factor							1.41
	Esclated Amount keping Bitumen Component w/o Escalation							72.46

5. OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the “Maintenance Requirements”). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimized staff requirement at

Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 16,727/ km / month excluding GST.

5.4 Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 12,218 / km / month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 10.89 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	1.97	104,284	205,440
2	Highway Lighting Electricity Charge	Kwh	1,606,949	10.89	17,503,234
3	Operation and Maintenance of DG Set	Nos	-	140,235	-
4	Solar Blinker	Nos	11	3,293	35,566
	Total				**17,744,240**

5.6 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is **1.63 crore** per year and additional cost of **40.57 crore** for replacement of equipment at every 7 (seven) years.

5.7 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is **Rs. 1.48 crore** per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as **Rs. 3.06 core (FY 23)** onwards.

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 2.81 crore (FY 22)** per year.

Year wise O & M Cost (OPEX) is presented in next pages.

Year in Nos	Year	OPEX									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	7,976,246	14,433,243	17,744,240	13,907,707	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	132,219,862
3	2023-24	11,210,174	14,433,243	17,744,240	17,575,447	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	139,121,530
4	2024-25	13,043,667	14,433,243	17,744,240	20,020,606	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	143,400,182
5	2025-26	14,855,915	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	147,657,590
6	2026-27	15,598,711	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	148,400,386
7	2027-28	16,066,672	14,433,243	17,744,240	109,216,927	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	235,619,509
8	2028-29	5,623,840	14,433,243	17,744,240	11,462,548	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	127,422,297
9	2029-30	7,976,246	14,433,243	17,744,240	13,907,707	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	132,219,862
10	2030-31	11,210,174	14,433,243	17,744,240	17,575,447	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	139,121,530
11	2031-32	13,043,667	14,433,243	17,744,240	20,020,606	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	143,400,182
12	2032-33	14,855,915	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	147,657,590
13	2033-34	15,598,711	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	148,400,386
14	2034-35	16,066,672	14,433,243	17,744,240	109,216,927	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	235,619,509
15	2035-36	5,623,840	14,433,243	17,744,240	11,462,548	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	127,422,297
16	2036-37	7,976,246	14,433,243	17,744,240	13,907,707	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	132,219,862
17	2037-38	11,210,174	14,433,243	17,744,240	17,575,447	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	139,121,530
18	2038-39	13,043,667	14,433,243	17,744,240	20,020,606	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	143,400,182
19	2039-40	14,855,915	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	147,657,590
20	2040-41	15,598,711	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	148,400,386
21	2041-42	16,066,672	14,433,243	17,744,240	109,216,927	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	235,619,509
22	2042-43	5,623,840	14,433,243	17,744,240	11,462,548	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	127,422,297
23	2043-44	7,976,246	14,433,243	17,744,240	13,907,707	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	132,219,862
24	2044-45	11,210,174	14,433,243	17,744,240	17,575,447	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	139,121,530
25	2045-46	13,043,667	14,433,243	17,744,240	20,020,606	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	143,400,182
26	2047-48	14,855,915	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	147,657,590
27	2048-49	15,598,711	14,433,243	17,744,240	22,465,766	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	148,400,386
28	2049-50	5,623,840	14,433,243	17,744,240	109,216,927	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	225,176,676
29	2050-51	7,976,246	14,433,243	17,744,240	11,462,548	14,893,740	1,778,318	30,694,650	2,634,545	28,157,173	129,774,702
	Total	**329,410,479**	**404,130,790**	**496,838,717**	**868,459,068**	**417,024,716**	**49,792,904**	**859,450,188**	**73,767,273**	**788,400,856**	**4,287,274,991**
Total Cost in Cr		**32.94**	**40.41**	**49.68**	**86.85**	**41.70**	**4.98**	**85.95**	**7.38**	**78.84**	**428.73**

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Kanyakumari Etturavattam section of NH 44 from Madurai to Kanyakumari. Project road starts from Km 52+300 at Near Virudha Nagar to Km 116+500 near Kayattur in the state of Tamilnadu. The total length of the project road is 64.20 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

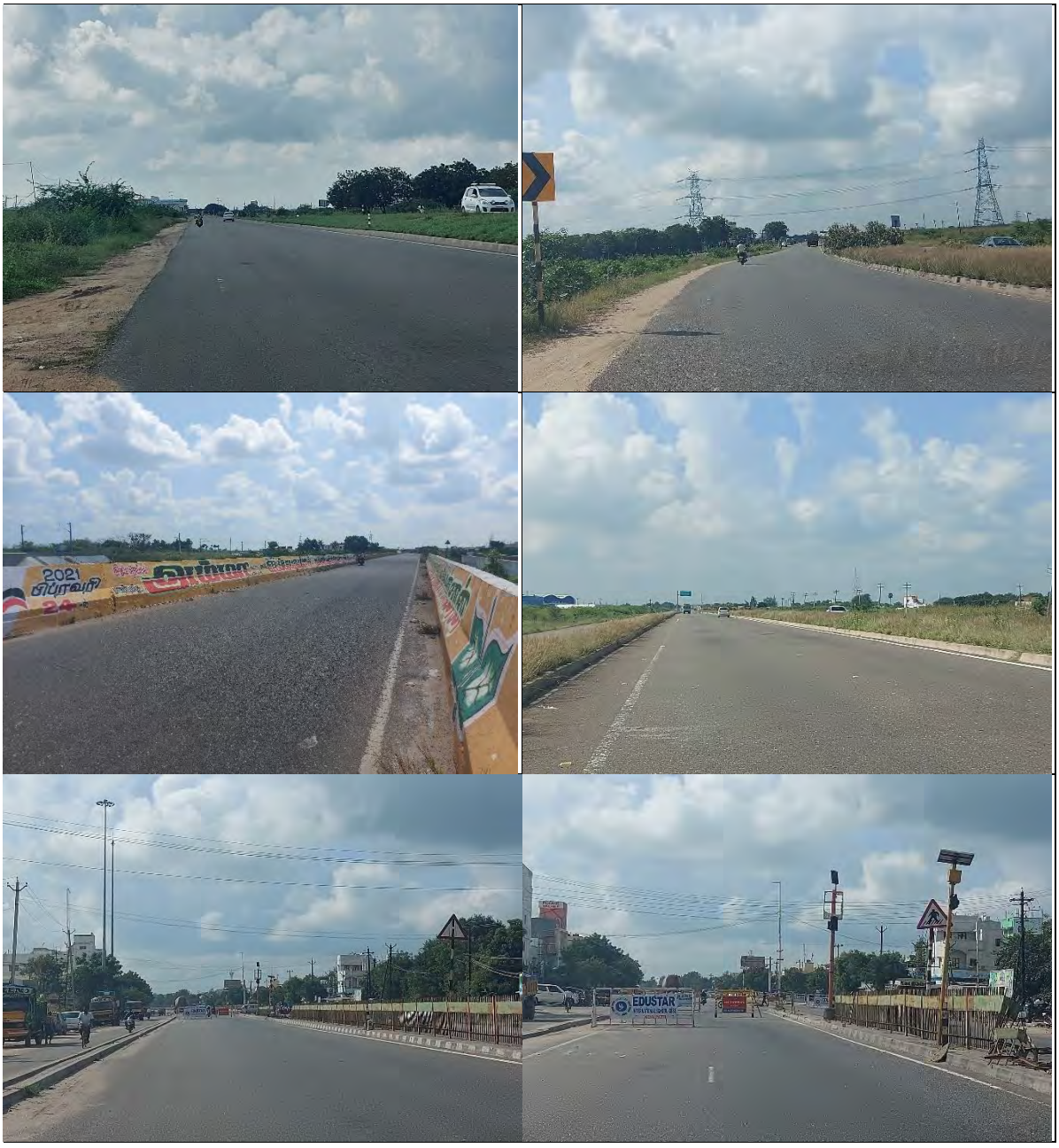
Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Madurai Kanyakumari Section of NH – 44 Package-2 on TOT Basis in the State of Tamilnadu	52+300	116+500	64.20	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.


2021
EDUSTAR

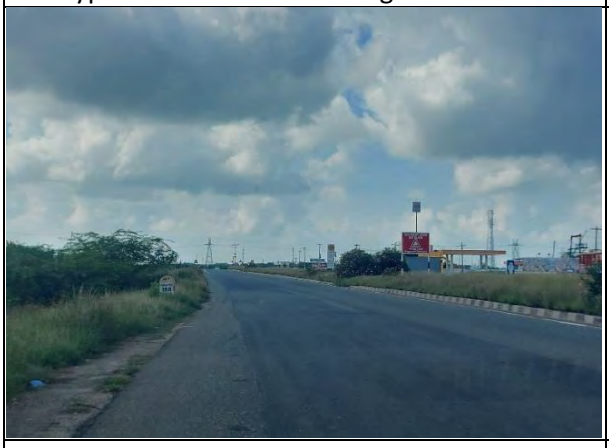
Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	**Project Road Start**	Km 52+300 at Virudha nagar of NH-44 (Old NH-7)	Km 52+300 at Virudha nagar of NH-44 (Old NH-7)
2	**Project Road End**	Km 116+500 at Kayattur of NH-44 (Old NH-7)	Km 116+500 at Kayattur of NH-44 (Old NH-7)
3	**Project Length**	64.20 Km	64.20 Km
6	**Carriageway**	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	**Shoulders**	1 m to 2 m earthen for MCW	1 m to 2 m earthen for MCW
8	**Median**	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	**Service Roads**	LHS: 29.65 km RHS: 27.030 km	LHS: 35.705 km RHS: 19.210 km
10	**Major Bridge**	3 No.	3 No.
11	**Minor Bridge**	20 Nos.	20 Nos.
12	**Pipe, Box & Slab Culverts**	89 Nos.	89 Nos.
13	**Major/Minor Junctions**	1Major & 11 Minor	1Major & 11 Minor
14	**Underpass**	10 VUP	10 VUP
15	**Grade Separator**	Nil	Nil
15	**ROB/RUB**	2 No	2 No
16	**Toll Plazas**	1 No	1 No
17	**Truck Lay-byes/Truck Parking**	Nil	Nil
18	**Bus Shelter**	11 Bus Bay and 37 Bus Shelter	11 Bus Bay and 37 Bus Shelter

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td>  </td><td> </td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length Km
	From	To	LHS	RHS	
1	52+300	75+180	BT	BT	22.80
2	75+180	75+230	CC	CC	0.05
3	75+230	116+500	BT	BT	41.27

Flexible Pavement	Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA 56.68 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 54.915 Km length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road vary from 5.5m to 7m width has been proposed for the length of 1140 m.

6.2.4 Median

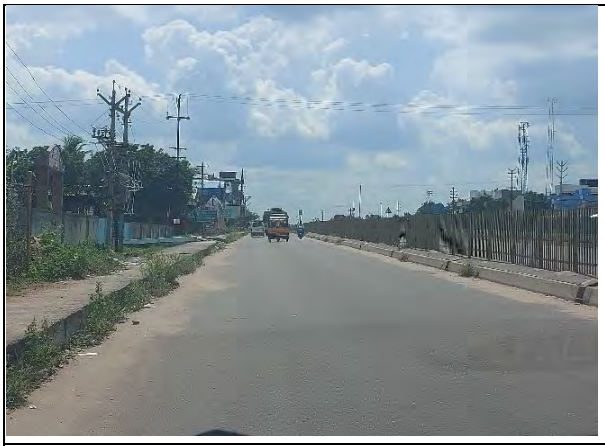
Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in fair to poor condition.

38 nos. of authorized and 2 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers and railing/safety barrier at narroe median near median opening throughout the project is not provided except at few locations.

Typical 1.5 m wide median	4.5m wide Median with Shrubs

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order, silt deposit need to be cleared through routine maintenance. Total 27.06 Km of covered/open line side drain is found on site. Median drain has observed in 0.588 Km at site. The condition of the same is good to fair.

	
RCC Covered Drain at Project Road	Median Cut Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 11 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	34.309
	Median	0.444
Pedestrian Guard Rail	Carriageway Edge	7.61

PGR and W-Beampresent on the project road

6.2.8 Toll Plaza and Other Facilities

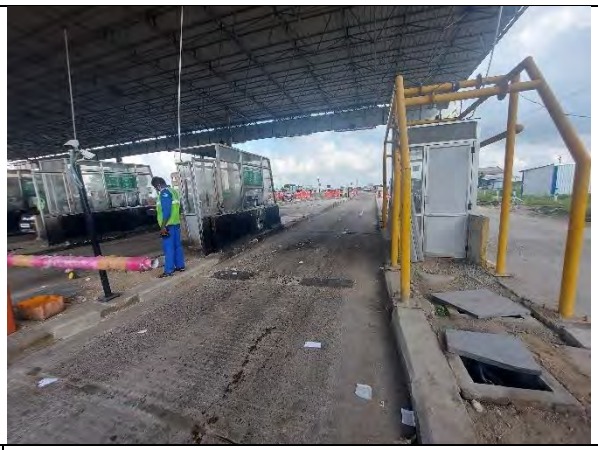
There is one existing toll plaza at KM 75+180 at Ettuvattum with the configuration 2 x (4+1). This has 9 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Sch-B states within 12 months these works to be completed. As per Sch-B toll plaza taper portion is to be constructed as rigid pavement as per IRC SP – 84: 2014.

The Details of Toll plaza are given below.

1. There is 01 Toll Plazas in the project road. Following are the details:
2. Centre of Toll Plaza : Km 75+180
3. Start of Taper : Km 75+030
4. Start of Straight : Km 75+160
5. End of Straight : Km 75+210
6. End of Taper : Km 75+360
7. Taper in Length : 130.0m
8. Taper Out Length :150.0m
9. Total Length of Toll Plaza :50m (Including Rigid Pavement)
10. Lanes at Toll Plaza : 1+4+4+1 (10 Lanes, 5 lanes in each carriageway)

The Concessionaire has running the operation at the toll plaza with temporary iron cabins as there is no admin building in the project highway.

Toll Plaza



Toll Plaza

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and urban section near Muzaffarpur city. Additionally, 7 High Mast has provided at Toll Plaza, major junction and flyover. 17 Nos. Single Arm poles has been provided at site.

Highway Lighting Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	60+430	Median	1	Single Arm	Working
2	66+368	Median	1	Single Arm	Working
3	69+557	Median	1	Single Arm	Working
4	70+790	Median	1	Single Arm	Working
5	74+390	Median	1	Single Arm	Working
6	75+286	Median	1	Single Arm	Working
7	85+310	Median	1	Single Arm	Working
8	90+155	Median	1	Single Arm	Working
9	92+800	Median	1	Single Arm	Working
10	95+000	Median	1	Single Arm	Working
11	101+050	RHS	1	Single Arm	Working
12	101+080	Median	1	Single Arm	Working
13	102+810	Median	1	Single Arm	Working
14	105+115	Median	1	Single Arm	Working
15	109+700	Median	1	Single Arm	Working
16	111+230	Median	1	Single Arm	Working
17	112+600	Median	1	Single Arm	Working

High Mast Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	55+704	Median	1	High mast	Working
2	62+640	LHS	1	High mast	Working
3	66+400	LHS	1	High mast	Working
4	76+475	LHS	1	High mast	Working
5	78+300	LHS	1	High mast	Working
6	78+320	LHS	1	High mast	Working
7	105+115	LHS	1	High mast	Working

High Mast Light	Highway Lighting

6.2.10 Bus Bays and Bus Shelter

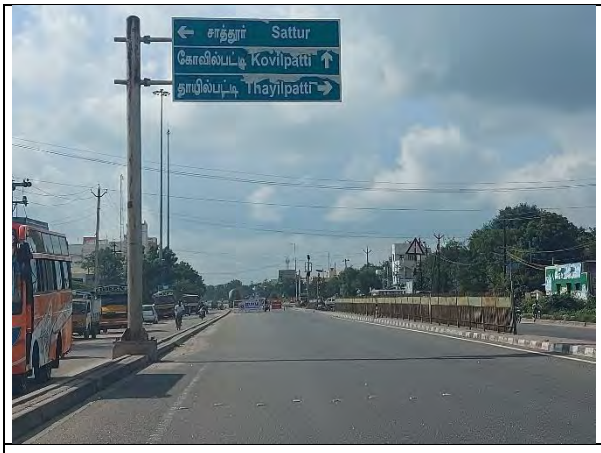
There are 11 Bus Bay and 37 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter	Bus Bay with Bus Shelter

6.2.11 Signage and Marking

Road Signs

917 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.



Route Marker Board on the Project Road

Sign Board fixed at Project Road

Sl. No.	Sign Type	Approx. Nos.	Condition	Remarks
1	90 cm equilateral triangle	214	Fair	Approx. 13 to be replaced
2	60 cm equilateral triangle		-	
3	60 cm circular	30	Good	
4	75 cm circular		-	
5	Route Marker	77	Fair	Approx. 19 to be replaced
6	60 cm x 45 cm rectangular	66	Fair	Approx. 2 to be replaced
7	60 cm x 60 cm square		-	
8	Chevron sign	509	Good	Approx. 21 to be replaced
9	Accident Zone sign		-	
10	90 cm high octagon (Stop)	4	Good	
11	60 cm high octagon (Go Slow)		-	
12	Overhead Gantry Sign	5	Fair	
13	Cantilever Gantry Sign	12	Fair	Approx. 2 to be replaced
Total		**917**		

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road marking along the carriageway

6.2.12 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is Not good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road | Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc**.** and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 3 nos. of Major Bridge of total length varies from 79.2 m to 219.6 m are generally found in good condition.
- 20 nos. of Minor bridges having total length varies from 6 m to 48.5 m are generally found in good condition.
- 10 nos. of Underpass having span minimum arrangement of 1 x 10 are found in good condition.
- 2 nos. of Single Span Railway over Bridge is in good condition
- Not any Flyover is found

6.3.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.69+350

It consists of bridge on both the carriageways. LHS bridge has span arrangement of 14x11.9m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier. It requires regular repair works such painting and repairing of Parapet wall and railing in urgent basis. Cross barrier needs to be provided before railing. Other condition of the bridge is fair.

RHS bridge has span arrangement of 7x23.8m. The super structure comprises of RCC T-Girder. Superstructure is resting on RCC wall type abutment and pier. The general condition of the bridge is good

A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriage way

Span Arrangement

Major Bridge at Ch. 69+350

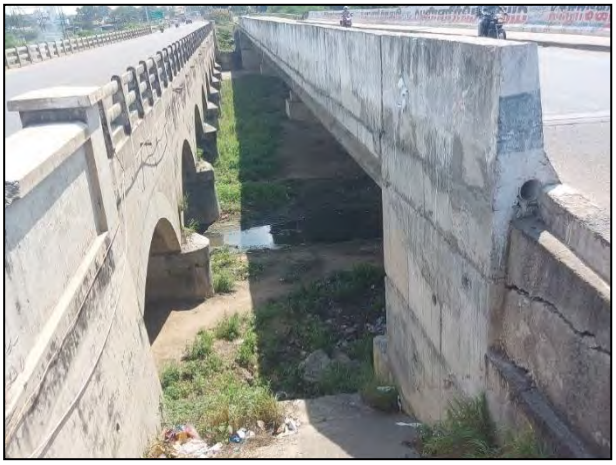
b) Major Bridge – CH.76+350

It consists of bridge on LHS and RHS Carriage way. LHS bridge has a Span arrangement of 9x8.8 m has provided. The super structure comprises of RCC Arch. Superstructure is resting on RCC Wall type abutment and pier. Wearing coat and Slope Pitching are in good condition. It only requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. Other conditions of the bridge are good.

RHS bridge has a Span arrangement of 3x26.4 m has provided. The super structure comprises of RCC T-Girder, POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment and pier. Parapet wall is not constructed between the median opening in the direction of the traffic. There is a minor repair in abutment wall and all other conditions of the bridge are good. As periodic maintenance, replacement of filler joint and wearing coat is required.

A few pictures to ascertain the conditions of Major Bridge are presented as follows:

Span arrangement



Span arrangement

c) Major Bridge – CH. 79+300

It consists of bridge on LHS and RHS of the carriage way. Both the bridges have Span arrangement of 12x18.3m. The super structure comprises of RCC T-Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC cross barrier, repairing of drainage spouts. As periodic maintenance, replacement of filler joint and wearing coat is required. **The existing bridge is using as underpass**. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Major Bridge at Ch. 79+300

Minor Bridges

Salient features along with condition of 20 Minor bridges are discussed here.

a) Minor Bridge – CH.52+720

It consists of bridge on LHS and on RHS carriage way. Span arrangement of both the bridges is 3x8.8m on both sides. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of parapet wall, repairing of drainage spouts, etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 52+720

b) Minor Bridge – CH.55+330

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x8.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Slope pitching is in poor condition, vegetation grown in the bridge needs to be removed immediately.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of parapet wall, repairing of slope pitching etc. As periodic maintenance, replacement of filler joint and replacement of wearing coat is required. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

c) Minor Bridge – CH.60+650

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x6.6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Cracks, that are developed in the wearing coat of the bridge should be rectified. Other general condition of the bridge is good.

A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

d) Minor Bridge – CH.60+920

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x6.9m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Parapet wall is not constructed between the median opening in the direction of the traffic. General condition of the bridge is good.
A few pictures showing the conditions of Minor Bridge are presented as follows:

Span arrangement

View of the Carriage Way

Minor Bridge at Ch. 60+920

e) Minor Bridge – CH.64+140

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 4x8.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Parapet wall is not constructed between the median opening in the direction of the traffic. Repair of cross barrier is to be done. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway **Span Arrangement**

Minor Bridge at Ch. 64+140

f) Minor Bridge – CH.64+260

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 3x6.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Repair of cross barrier is to be done. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

Span Arrangement **View of the carriage way**

Minor Bridge at Ch. 64+260

g) Minor Bridge – CH.69+680

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x8.6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Slope pitching is in poor condition. Wearing coat and other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway **Span Arrangement**

h) Minor Bridge – CH.70+200

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x8.6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Repair of cross barrier is to be done. Parapet wall is not constructed between the median opening in the direction of the traffic. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway **Span Arrangement**

Minor Bridge at Ch. 70+200

i) Minor Bridge – CH.75+650

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 3x3m. The bridge is of RCC Box. Wearing coat is in fair condition, Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway **Span Arrangement**

Minor Bridge at Ch. 75+650

j) Minor Bridge – CH.79+850

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x4.4m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Wearing coat is in fair condition. Vegetation grown in the bridge needs to be removed immediately. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 79+850

k) Minor Bridge – CH.80+150

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 3x5.3m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. In this bridge there is poor Slope Pitching and fair Wearing coat. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of carriage way

Span Arrangement

Minor Bridge at Ch. 80+150

l) Minor Bridge – CH.86+280

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of the carriage way

Span Arrangement

Minor Bridge at Ch. 86+280

m) Minor Bridge – CH.86+350

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x8m. The super structure comprises of RCC solid slab, Superstructure is resting on RCC Wall type abutment and pier. Vegetation grown in the bridge needs to be removed immediately. Painting and Repair of cross barrier is to be done. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

n) Minor Bridge – CH.92+110

It consists of bridge on LHS and on RHS carriage way. LHS bridge has a span arrangement of 2x5.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Slope pitching is in poor condition. Wearing coat and other general condition of the bridge is good. RHS bridge has a span arrangement of 3x3.35m. The super structure comprises of RCC solid slab. The Foundation is not visible. Superstructure is resting on RCC Wall type abutment and pier. The general condition of the bridge is good. As periodic maintenance, changing of wearing coat is required.
A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 92+110

o) Minor Bridge – CH.93+300

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 4x8.8m, the super structure comprises of RCC solid Slab, the super structure is resting on RCC wall type abutment. The drainage spout needs to be cleaned, wearing coat is in fair condition while slope pitching is in poor condition. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 93+300

p) Minor Bridge – CH. 94+985

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x8.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Wearing coat and Slope pitching is good, Vegetation grown in the bridge needs to be removed. Other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

Fair slope Pitching

Span Arrangement

Minor Bridge at Ch. 94+985

q) Minor Bridge – CH.97+780

it consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x5.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Slope pitching is in poor condition, minor repairing of wearing coat is required, other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 97+780

r) Minor Bridge – CH.98+700

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x5.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Minor repairing of wearing coat is required, other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway (LHS)

View of Carriageway (RHS)

Minor Bridge at Ch. 98+700

s) Minor Bridge – CH.101+250

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 2x6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Minor repairing of wearing coat is required, other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 101+250

t) Minor Bridge – CH.107+530

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment and pier. Slope pitching is in poor condition, minor repairing of wearing coat is required, other general condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 107+530

Under-Passes (UPs)

There is a total of 10 UPs has been provided. All UPs are minimum single span of 1 x 9.5 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages. A few pictures to ascertain the conditions of PUPs are presented as follows:

Super structure is in fair condition

Span Arrangement

UP at Ch. 52+450

Super structure in fair condition

Span Arrangement

UP at Ch. 67+540

Super structure in fair condition

Span Arrangement

UP at Ch. 75+850

Super structure in fair condition

Span Arrangement

UP at Ch. 77+670

Super structure in fair condition

Span Arrangement

UP at Ch. 80+560

Super structure in fair condition

Span Arrangement

UP at Ch. 81+795

Super structure in fair condition

Span Arrangement

UP at Ch. 96+380

Super structure in fair condition

Span Arrangement

UP at Ch. 100+150

Super structure in fair condition

Span Arrangement

UP at Ch. 102+200

Super structure in fair condition

Span Arrangement

UP at Ch. 106+700

Railway over Bridge (ROBs)

ROB at Ch. 54+460

It consists of bridge on LHS and on RHS carriage way. LHS bridge has a span arrangement of 1x5.3m. The super structure comprises of RCC Slab, Superstructure is resting on RCC Wall type abutment. Crack in Abutment, Crack in wing wall, Spalling of Concrete in slab Soffit, Expansion gap to be cleaned, metallic cross barrier needs to be repaired, are observed. The other condition of the bridge is good.

RHS bridge has a span arrangement of 1x28.3m. The super structure comprises of PSC I-Girder. The Foundation is not visible. POT-PTFE bearing is used for resting the Superstructure on RCC Wall type abutment. Potholes in Wearing coat, Drainage spout Blocked, Expansion joint to be cleaned, is observed.

Other conditions of the bridge are good.

A few pictures to ascertain the conditions of ROB are presented as follows: -

Span Arangement

Abutment RHS

Span Arrangrmrnt

Broken W-Beam Crash barrier

ROB at Ch. 54+460

ROB at Ch. 67+180

It consists of bridge on LHS and on RHS carriage way. Both the bridge has a span arrangement of 1x28.3m. The super structure comprises of PSC I-Girder. POT-PTFE bearing is used for resting the Superstructure on RCC Wall type abutment. Expansion Joint blocked and damaged, Runner Pipe damaged, Drainage Spout blocked, is observed in these bridges. The other conditions of the bridge are good. A few pictures to ascertain the conditions of ROB are presented as follows: -

Span Arrangement

Super structure in fair condition

Super structure in fair condition
ROB at Ch. 67+180

Culverts:

There are 89 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	**Good**	No immediate Repair / Maintenance Works Required
●	**Fair / Satisfactory**	Minor Repair Works Required
●	**Poor**	Major Repair Works or Replacement of components Required
N/A	**Not Applicable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	69+350	LHS	14x11.9	7.45	**MJB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	7x23.8	10.00			●	●	●	●	●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
2	76+350	LHS	9x8.8	7.60	**MJB**	Y	●	●	●		●	●	●	●	●			**Stable**	
		RHS	3x26.4	10.00			●	●	●	●	●	●	●	●	●			**Stable**	
3	79+300	LHS	12x18.3	6.90	**MJB**	Y	●	●	●	●	●	●	●	●	●			**Stable**	
		RHS	12x18.3	10.00			●	●	●	●	●	●	●	●	●			**Stable**	
4	52+720	SR+LHS	3x8.8	21.20	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS+SR	3x8.8	21.20			●	●	●		●	●	●	●	●		●	**Stable**	
5	55+330	LHS	1x8.8	9.25	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		RHS	1x8.8	9.25			●	●	●		●	●	●	●	●		●	Stable	
6	60+650	LHS	2x6.6	8.50	**MNB**	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x6.6	10.50			●	●	●		●	●	●	●	●		●	Stable	
7	60+920	LHS	2x6.9	8.50	**MNB**	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x6.9	10.00			●	●	●		●	●	●	●	●		●	Stable	
8	64+140	LHS	4x8.8	8.30	**MNB**	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	4x8.8	10.00			●	●	●		●	●	●	●	●		●	Stable	
9	64+260	LHS	3x6.8	9.50	**MNB**	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	3x6.8	10.00			●	●	●		●	●	●	●	●		●	Stable	
10	64+140	LHS	4x8.8	8.30	**MNB**	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	4x8.8	10.00			●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
11	70+200	LHS	1x8.6	8.50	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x8.6	10.00			●	●	●		●	●	●	●	●		●	**Stable**	
12	75+650	LHS	3x3	53.80	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	3x3	10.25			●	●	●		●	●	●	●	●		●	**Stable**	
13	79+850	SR+LHS	2x4.4	19.20	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS+SR	2x4.4	19.20			●	●	●		●	●	●	●	●		●	**Stable**	
14	80+150	LHS	3x5.3	19.20	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	3x5.3	19.20			●	●	●		●	●	●	●	●		●	**Stable**	
15	86+280	LHS	1x6	12.40	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x6	12.40			●	●	●		●	●	●	●	●		●	**Stable**	
		LHS	2x8	10.75	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
16	86+350	RHS	2x8	10.75			●	●	●		●	●	●	●	●		●	Stable	
17	92+110	LHS	2x5.5	13.50	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	3x3.35	11.60			●	●	●		●	●	●	●	●		●	Stable	
18	93+300	LHS		13.50	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS		8.50			●	●	●		●	●	●	●	●		●	Stable	
19	94+985	LHS	1x8.8	13.50	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x8.8	9.50			●	●	●		●	●	●	●	●		●	Stable	
20	97+780	SR+LHS	2x5.5	18.00	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS+SR	2x5.5	18.00			●	●	●		●	●	●	●	●		●	Stable	
		SR+LHS	2x5.5	18.00	MNB	Y	●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
21	98+700	RHS+SR	2x5.5	18.00			●	●	●		●	●	●	●	●		●	**Stable**	
22	101+250	SR+LHS	2x6	17.80	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS+SR	2x6	17.75			●	●	●		●	●	●	●	●		●	**Stable**	
23	107+530	LHS	1x8	13.50	**MNB**	Y	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x8	13.50			●	●	●		●	●	●	●	●		●	**Stable**	
24	52+450	LHS	2x10	27.50	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	2x10				●	●	●		●	●	●	●	●		●	**Stable**	
25	67+540	LHS	1x9.5	27.50	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x9.5				●	●	●		●	●	●	●	●		●	**Stable**	
26	75+850	LHS	2x10	27.60	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		RHS	2x10				●	●	●		●	●	●	●	●		●	Stable	
27	77+670	LHS	2x10	24.70	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10				●	●	●		●	●	●	●	●		●	Stable	
28	80+560	LHS	2x10	28.0	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10				●	●	●		●	●	●	●	●		●	Stable	
29	81+795	LHS	1x10	23.50	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x10				●	●	●		●	●	●	●	●		●	Stable	
30	96+380	LHS	2x10	12.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10				●	●	●		●	●	●	●	●		●	Stable	
31	100+150	LHS	2x10	27.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10				●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
32	102+200	LHS	2x10	24.70	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	2x10				●	●	●		●	●	●	●	●		●	**Stable**	
33	106+700	LHS	2x10	24.50	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	2x10				●	●	●		●	●	●	●	●		●	**Stable**	
34	182+050	LHS	1X36.0	12.5	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1X36.0	12.5			●	●	●	●	●	●	●	●	●		●	**Stable**	
35	178+049	LHS	1x17.1	11	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1x27.6	12.5			●	●	●	●	●	●	●	●	●		●	**Stable**	

TECHNICAL DUE DILIGENCE REPORT

Kotwa Muzzaffarpur Tollway Limited

Report Number:

ACM-60657056-TDD-KMTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Kotwa Muzzaffarpur Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Kotwa Muzzaffarpur Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
RP	PS	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Kotwa Muzaffarpur Tollway Limited

5th Floor, OSE Commercial Block, Hotel Aloft
Asset No. 5B, Aerocity Hospitality District
IGI Airport, New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **2**

Project Background 2
Project Salient Features 2
Project Principle Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 6

1. INTRODUCTION **8**

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Estimation of Design Traffic 14
2.2 Test Pit 14
2.3 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 16
2.4 Pavement Condition Survey using Network Survey Vehicle (NSV) 16
2.5 Roughness Survey using Network Survey Vehicle (NSV) 17
2.6 Determination of Pavement Major Maintenance 18
2.7 Base Year Pavement Rehabilitation Requirement 18
2.8 Future Maintenance Requirements 19

3 CAPEX REQUIREMENT **21**

3.2 CAPEX needs 21
3.4 Unit Rate Analysis 24
3.5 Cost Estimate 25

4 MAJOR MAINTENANCE COST **27**

4.1 Major Maintenance Cycle 27
4.2 Major Maintenance Quantity 27
4.3 Unit Rate Analysis 28
4.4 Cost Estimate 30

5 OPEATION AND MAINTEANCE COST - OPEX **32**

5.1 O & M Requirement as per CA 32
5.2 O & M Strategy 35
5.3 Routine and Preventive Maintenance 35
5.4 Highway Lighting 36
5.5 ATMS and TMS Cost 36
5.6 Incident Management 37
5.7 Manpower Cost 37

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **39**

6.1 Reconnaissance Survey 39
6.2 Road Inventory and Condition Survey 39
6.3 Inventory and Condition Survey of Structures 54

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KMTL	Kotwa Muzaffarpur Tollway Limited
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge

MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Kotwa Muzaffarpur Tollway Limited ("KMTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways and MKTL (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Kotwa Muzaffarpur Section from Km 440+000 to Km 520+000 of NH 28 in the State of Bihar is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI) which is being operated by Kotwa Muzaffarpur Tollway Limited (KMTL).

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Kotwa – Muzaffarpur Section from KM 440+000 to Km 520+000 of NH 28 in the State of Bihar
Project Length	80 km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Kotwa Muzaffarpur Tollway Limited
Signing of Agreement	27 Dec 2019
Appointed Date	20 Oct 2020
Concession Period	30 years
End of Concession Period	19 Oct 2020

Likely End of Concession Period	Mar 2045*
Six Lanning under EPC by NHAI	To be completed by FY 2037/38*
Number of Toll Plaza	1 nos, plaza having 10 lanes including extra width

* - as per information provided by the Company

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Kotwa Muzaffarpur Tollway Limited
3	Independent Engineer	
4	Maintenance Contractor	1) Toll Plaza (Markolines Traffic Controls Pvt Ltd.), 2) Incident Management (Markolines) 3) G4S India for Security
5	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 18 months.

- Maintenance and rehabilitation of Pavement
- Construction of New Service Road & Structures
- Repair and Rehabilitation of Structures and Cross Drainage Works
- Minor Junction Improvement
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 11.46 crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2028/29	30 mm BC in Main Carriageway 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	90.98
2.	2035/36	30 mm BC in Main Carriageway + 50 mm DBM in 20 % Length 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	152.15
3.	2037/38 to 2040/41	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA	NA
4	2044/45	30 mm BC in Main Carriageway (Six Lane) 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	207.24

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 5.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways is projected in Year 2037/38 to 2040/41

c) Operation and Maintenance (OpEX)

As per Schedule F, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2021/22 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	8,748,889
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	20,034,155
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	27,214,062
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	2,781,453
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	8,641,852
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	4,532,132
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	3,102,247
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	2,436,955

Sl. No.	Description	Remarks	Amount (in INR)
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	6,773,582
11	Community Development	Includes CSR related expenses.	1,620,245
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	17,014,773
15	IE Fees	Includes IE fees.	3,842,045
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	19,054,843
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	14,037,680
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	4,047,355
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	348,498
		O & M Cost for Year 2022-23	152,272,497

A total of Rs. 15.23 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and

authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 5.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

1.1 Project Background

Kotwa Muzaffarpur Tollway Limited (hereinafter referred to as KMTL or the Concessionaire), to undertake Tolling, Operation, Maintenance & Transfer (TOT Model) of Kotwa – Muzaffarpur Section from Km 440+000 to Km 520+000 of NH 28 in the State of Bihar is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI)

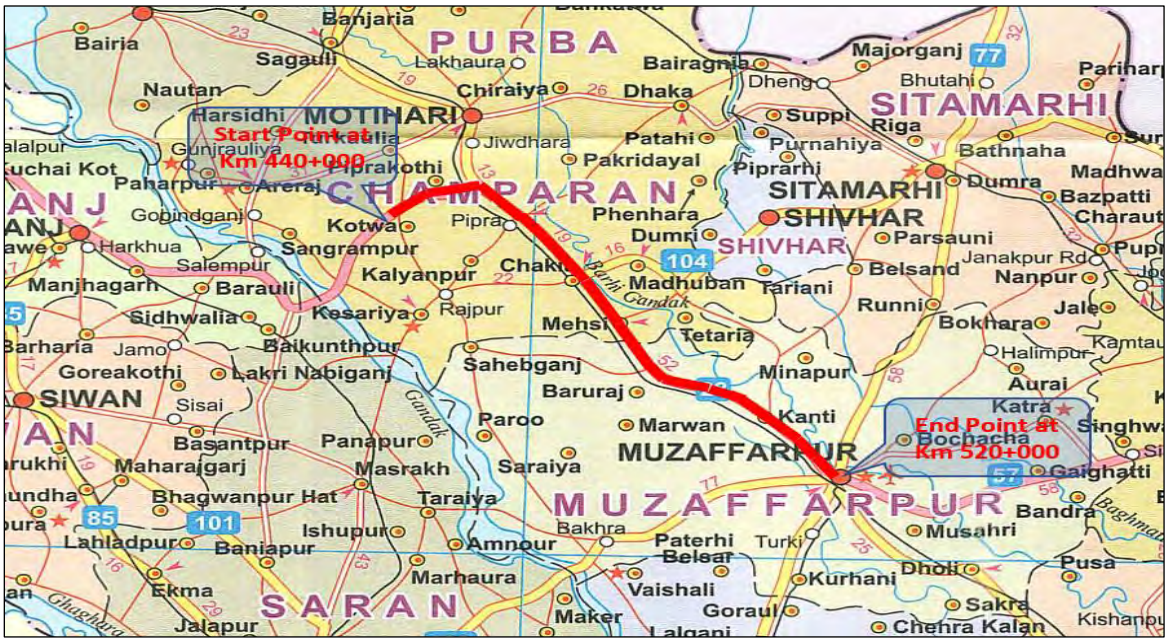
In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 28 start from Km 440+00 at Kotwa and ends at Km 520+000 at Muzaffarpur. NH 28, one of the major arterial roads of the country originates from Barauni in Bihar and ends at Lucknow in Uttar Pradesh. The total length of highway is 570 km. Major cities along NH 28 are Samastipur, Muzaffarpur, Gopalganj, Gorakhpur, Barabanki and Lucknow. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	80 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement – 133 km 2 Lane Rigid Pavement – 27 km 2 Lane
Shoulder	1 m to 2 m earthen for MCW at Rural Area
Service Road / Slip Road	50.2 km one side length having width of varying from 4.5 m to 5.5 m
Major / Minor Junction	3 Major & 58 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 24.041 Km
Median Opening	33 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	10 Nos
Bus Bays with shelter	18 Bus Shelter
Highway Lighting	176 Nos. Double Arm
High Mast	4 nos
Highway Patrol	2 nos
Ambulance	2 nos
Crane	2 nos

b) Structure

Description	Project Features
Major Bridge	1 No
Minor Bridge	7 Nos
Flyovers	2 No

Description	Project Features
ROB and RUB	2 No
VUP	8 VUP & 1 PUP
Culverts	100 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million

Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

The report is updated based on the latest documents, surveys and information provided by client.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

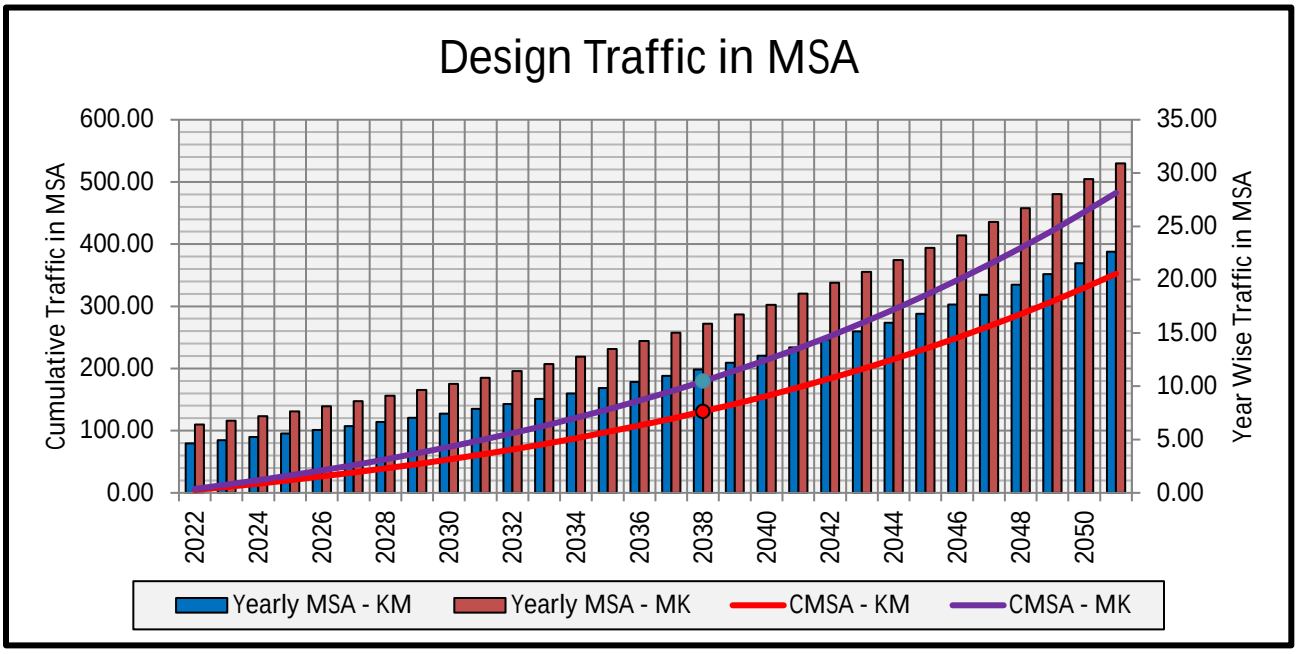
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Ravelling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till 2031 for 1st Cycle of MM design period for LHS (KM) 61.55 MSA and RHS (MK) 84.55 MSA whereas cumulative MSA upto 2051 is 252.77 MSA for LHS (KM) and 482.34 MSA for RHS (MK). Year wise and cumulative MSA is presented in graph below:



KM – Kotwa to Muzaffarpur direction

MK – Muzaffarpur to Kotwa direction

2.2 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

Sn	Location (km)	Side	CBR (%)
1	440+700	LHS	7.5
2	442+500	RHS	7.3
3	445+100	LHS	7.2
4	447+700	RHS	5.0

Sn	Location (km)	Side	CBR (%)
5	450+250	LHS	4.7
6	451+200	RHS	7.8
7	455+000	LHS	6.3
8	457+700	RHS	5.1

Sn	Location (km)	Side	CBR (%)
9	459+900	LHS	11.5
10	462+300	RHS	10.1
11	465+050	LHS	8.3
12	467+000	RHS	12.4
13	469+700	LHS	9.0
14	472+800	RHS	7.2
15	475+250	LHS	8.5
16	477+300	RHS	6.9
17	479+950	LHS	9.8
18	482+160	RHS	4.7
19	484+400	LHS	6.6
20	487+520	RHS	12.5
21	489+400	LHS	7.1
22	492+460	RHS	5.5
23	494+800	LHS	6.7
24	497+300	RHS	5.4
25	500+000	LHS	6.7
26	501+180	RHS	5.0
27	505+000	LHS	6.5
28	506+900	RHS	5.1
29	509+800	RHS	6.3
30	511+180	LHS	5.6
31	515+200	LHS	6.2
32	517+400	RHS	10.1
33	520+000	LHS	8.9
26	501+180	RHS	7.5

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from 150 mm to 270 mm and granular layer thickness varies from 430 mm to 500 mm.

2.3 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	Length in km	
	LHS	RHS
Length of Road where MSA is less than 10-year design MSA i.e. 61.55 MSA in LHS and 84.55 MSA in RHS	-	-
Less than 250 MSA	4	15
From 250 MSA to 750 MSA	37	42
Greater than 750 MSA	10	23
Total Length	51*	80

*-29 km on RHS is rigid pavement

Based on remaining life of pavement, structural overlay is not required till end of concession period.

2.4 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	Cracks	- Type: Longitudinal, Transverse, Block, Alligator - Extent: % of Pavement Area Influenced by distress - Severity: High (> 3mm wide), Low (<3mm wide)

Sn	Distress	Details Captured and Yard Stick adopted for Classification
2	Pothole	- Extent: % of Pavement Area Influenced by distress - No. of Potholes - Depth Severity: Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	Raveling	- Extent: % of Pavement Area Influenced by distress - Severity: Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	Patching	- Extent: % of Pavement Area Influence by distress - Severity: Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	Shoving	- Extent: % of Pavement Area Influence by distress - Severity: Low (<15mm), High (>15mm)
6	Flushing/Bleeding	- Extent: % of Pavement Area Influence by distress - Severity: Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	Depression	- Extent: % of Pavement Area Influence by distress - Severity
8	Delamination	- Extent: % of Pavement Area Influence by distress - Severity: Low (<1 sq.m area), High (>1 sq.m area)
9	Edge Break	- Extent: % of Pavement Area Influence by distress - Severity: Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	Pavement Missing	- Extent: % of Pavement Area Missing
11	Rutting	- Rut Depth

2.5 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

IRI = International Roughness Index

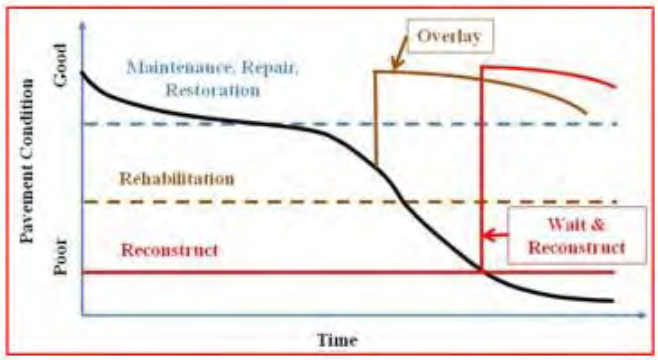
Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

Ratings	Roughness Value (mm/km)	LHS in km	RHS in km
Good	<2000	60	47
Fair	2000 - 3000	17	28
Poor	>3000	3	5

Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.

2.6 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.7 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is not required however functional overlay is required to bring down roughness value less than 2000 mm / km and to maintain performance requirement till next MM cycle. Also, as per Concession agreement, minimum overlay is to be provided at location as specified in Section 3.1 of Schedule B. The combined overlay location to be provide in FY 2021/22 based on pavement condition survey caried out and as specified in Schedule B is as below:

LHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	440+000	482+000	28	40	Full Width	BC Overlay

2	515+000	517+000	2	40	Full Width	BC Overlay

RHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	440+000	520+000	80	40	Full Width	BC Overlay

In addition to above, additional area for milling and overlay by BC also considered.

2.8 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times. Further, additional DBM of thickness 50 mm is considered in 20 % length at interval of 14 years to cater unprecedented distress in pavement.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Authority shall execute six laning under EPC from FY 2037/38 to 2040/41. The Concession agreement do not clearly mention whether overlay on existing four lane shall be executed by the Authority during six laning under EPC or not. However, providing top layer in one go is required and providing one layer of overlay during six laning is considered to be executed by the Authority. In view of above major maintenance cycle is considered as follows:

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %
2	2035/36	Functional Overlay with 20 % Structural Overlay	30 mm BC and 50 mm BC in 20 % Length	30 mm BC in 50 % and Microsurfacing in 50 %
3	2037/38 to 2040/41	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		
4	2044/45	Functional Overlay	30 mm BC	30 mm BC in 50 % and

				Microsurfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.2 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 900 m having width of 5.50 m
2. Widening of existing culvert for Slip Road – 2 x 1200 pipe culvert
3. Widening of Box Culvert for Slip Road– 1 Nos
4. Rehabilitation of Pavement – 40 mm BC in 110 km 2 Lane
5. Minor Repair of Structures – Major Bridge 1nos, Minor Bridge 7 nos, Culverts – 100 nos, Flyover – 3 nos, ROB – 2 nos, VUP – 8 nos, PUP – 1 nos
6. Junction Improvement – 1 Major Junction and 21 Minor Junctions
7. RCC Drain – 900 m along slip road
8. Road Furnitures – Solar Blinker 74 nos, Transverse Marking 80 km, W Beam 1940 m, Guard Posts – 900 m, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
9. Toll Plaza
10. Landscaping and tree plantation
11. Way Side Amenities: to be constructed by NHAI
12. Incident Management – Highway Patrol, Ambulance, Crane
13. ATMS
14. Rainwater Harvesting
15. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date

Sn	Description of Work	Date of Completion
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from Appointed Date
4	Repair and Rehabilitation of Structure	12 months from Appointed Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from Appointed Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in Schedule C, Engineering and Safety Improvements along the Project Highways shall confirm to IRC: SP: 84 -2014, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.3 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. Construction of new / widening of Service road /Slip road
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.

2. Reconstruction of existing Service road /Slip road
   No existing service roads in this package.
3. Construction of new / widening of culverts / bridges / Grade separated structures
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. Repair / Rehabilitation of pavement (overlay)
   Repair and Rehabilitation of Pavement has been carried out as per the initial overlay design confirming to schedule-B.
   Repair / Rehabilitation of structures
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
5. Junction improvement
   A list of improvements to be carried out at Major / Minor junction has provided in Schedule B. Consultant has prepared Typical Layout Plan for junction development based on IRC SP 84-2014 and quantity calculation arrived accordingly. Pavement thickness for Junction is as follows:
   a) Junction having Flexible Pavement
      Area adjoining to MCW: BC – 40 mm, DBM -60 mm, WMM – 250 mm, GSB – 200 mm.
      Area adjoining to Cross Road - BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm.
   b) Junction having Rigid Pavement: PQC – Not appliable
6. Construction of new drain
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
7. Road furniture
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
   i) Road marking – quantity considered along entire length of project road
   j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.
8. Construction of new Toll plaza
   Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is having PQC on tapper as well as central portion therefore additional PQC has not considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing

of TMS.

9. Landscaping and tree plantation
   The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.
10. Truck lay byes / toilet blocks
    Not applicable
11. Bus bays / bus shelters
    Not applicable
12. Highway Patrol vehicles, Ambulance, Cranes
    Two numbers at each toll location have been considered.
13. ATMS / TMS
    Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.
14. Rainwater harvesting systems
    Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.
15. Slope protection
    As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

Note: Most of the works of initial improvement works have been completed. Detailed cost estimate is provided in Section 3.5

3.4 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 1st March 2022	IOC Barauni		
Bitumen	Base Price	Discount	Ex MI price
VG30	52952	2650	50302
VG40	56432	2650	53782

ii) Aggregates rates as per local market rates
iii) Equipment hire cost as per Standard Data Books published by MoRTH
iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2022.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	423
2	Granular Subbase	Cum	2,853
3	Wet mix macadam	Cum	4,892
4	Dense Bituminous Macadam – CAPEX	Cum	10,631
5	Bituminous Concrete	Cum	12,718
6	Pavement Quality Concrete (PQC)	Cum	8,234
12	RCC M 20 for Drain	Cum	7,318
13	Reinforcement Steel	MT	1,06,301
14	Metal "W" Beam crash barrier	Rm	4,232

Note: above unit rates are excluding GST.

3.5 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs	Remarks
1	Cost of Strengthening of existing carriageway	0	Already completed
2	Cost of Service/Slip road	51,638,666	As per Invoice no. CSIPL/198/21-22 Dated 23-Mar-2022

S.no	Description	Cost in Rs	Remarks
3	Cost of Road Furniture	0	
4	Cost of Drain	0	
5	Cost of Miscellaneous works	0	
6	Cost of Structure (BOX Culvert and Pipe culvert)	0	
7	Cost of repairs of existing structures	0	
8	Cost of Toll plaza Improvement	50,684,639	Worked out based on data (Running bill & WO) provided
9	Cost of ATMS	0	Already completed
10	Cost of Hybrid ETC	0	
	Total	102,323,305	
	Add 12% for GST	12,278,797	
	Total including GST	114,602,102	

Total CAPEX – Rs. 11.46 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %
2	2035/36	Functional Overlay with 20 % Structural Overlay	30 mm BC and 50 mm BC in 20 % Length	30 mm BC in 50 % and Microsurfacing in 50 %
3	2037/38 to 2040/41	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		
4	2044/45	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking

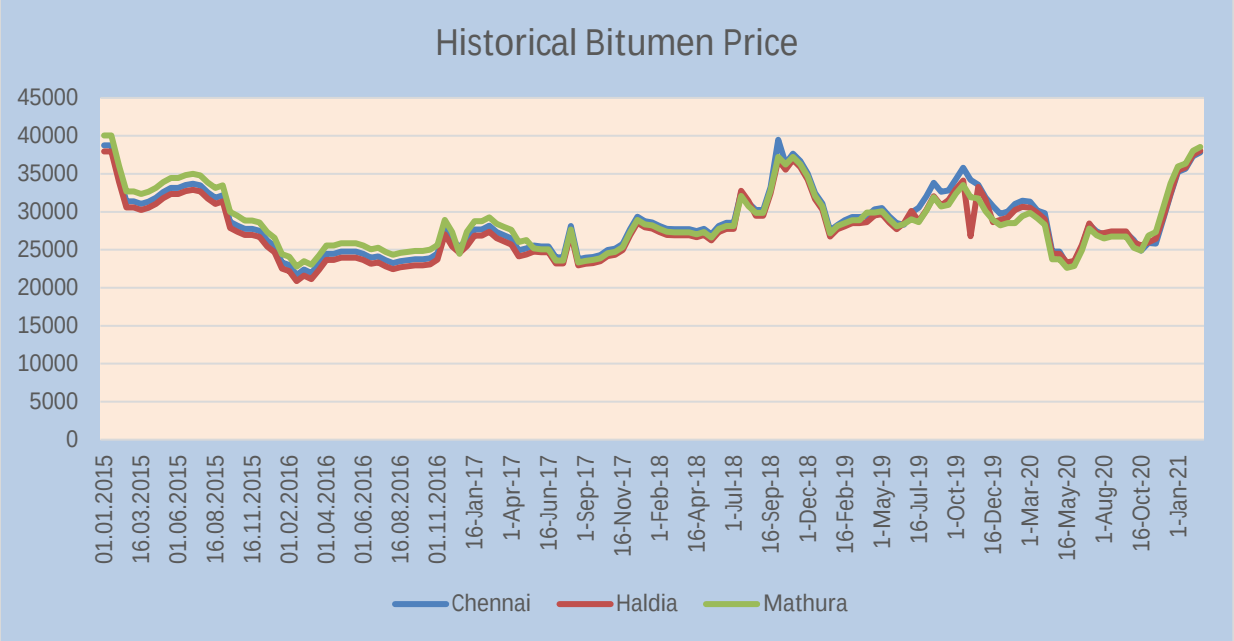
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024onwards is considered as below:

Bitumen	IOC Barauni		
	Base Price	Discount	Ex MI price
VG30	31,579	2650	28,929
VG40	35,059	2650	32,409

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 5.3. ii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY - 22	2.83%	1.000
FY - 23	4.66%	1.047
FY - 24	5.65%	1.106
FY - 25	5.37%	1.165
FY - 26	5.52%	1.229
FY - 27	5.25%	1.294
FY - 28	4.86%	1.357
FY - 29	4.44%	1.417
FY - 30	4.24%	1.477
FY - 31	4.13%	1.538
FY - 32	4.08%	1.601
FY - 33	4.01%	1.665
FY - 34	4.00%	1.732
FY - 35	4.03%	1.801
FY - 36	4.01%	1.874
FY - 37	3.98%	1.948
FY - 38	3.98%	2.026
FY - 39	4.00%	2.107
FY - 40	3.99%	2.191
FY - 41	3.99%	2.278
FY - 42	3.99%	2.369
FY - 43	3.99%	2.464
FY - 44	3.99%	2.562
FY - 45	3.99%	2.664

Year	Growth Rate	Escalation Factor
FY - 46	3.99%	2.771
FY - 47	3.99%	2.881
FY - 48	3.99%	2.996
FY - 49	3.99%	3.116
FY - 50	3.99%	3.240
FY - 22	2.83%	1.000
FY - 23	4.66%	1.047

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MoRTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – CAPEX	Cum	10,629
2	Bituminous Concrete	Cum	12,382
3	Microsurfacing	Sqm	160
4	Replacement of Joint Sealant in PQC	m	200
5	Raising of Road Kerb	m	400
6	Road Marking	sqm	400
7	Kerb and Crash Barrier Painting	sqm	110
8	Shoulder Filling	sqm	20
9	Road Studs - Normal	nos	200
10	Road Studs - Solar	nos	1500

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented below:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Quantity			Unit Rate 2022	Amount		
			2028-29	2035-36	2044-45		2028-29	2035-36	2044-45
	Main Carriageway - Flexible Pavement								
1	Tack Coat	Sqm	1,212,772	1,455,326	1,678,431	13	15,535,610	18,642,732	21,500,700
2	Bituminous Concrete - VG 40 / CRMB	Cum	36,383	36,383	50,353	12,382	450,487,583	450,487,583	623,457,859
3	Dense Bituminous Macadam - VG 40	Cum		12,128		10,629	-	128,908,576	-
							-	-	-
	Main Carriageway - Rigid								
1	Joint sealant replacement every 5th Year (50 %)	m	38,278	38,278	38,278	220	8,421,111	8,421,111	8,421,111
	Service Road								
1	Tack Coat	Sqm	147,633	147,633	147,633	13	1,891,172	1,891,172	1,891,172
2	DBM - VG 30	Cum				10,629	-	-	-
3	BC - VG 30	Cum	4,429	4,429	4,429	11,577	51,272,561	51,272,561	51,272,561
4	Microsurfacing	Sqm	147,633	147,633	147,633	176	25,983,320	25,983,320	25,983,320
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)								
1	Tack Coat	Sqm	13,136	13,136	13,136	13	168,269	168,269	168,269
2	Wearing Course	Cum	394	394	394	12,382	4,879,316	4,879,316	4,879,316
3	Dense Bituminous Macadam VG-40	Cum					-	-	-
4	Milling of existing Wearing Coat	Sqm	13,136	13,136	13,136	77	1,011,454	1,011,454	1,011,454
5	Painting of Crash Barrier	Sqm	8,524	8,524	8,524	121	1,031,379	1,031,379	1,031,379
	Other Works						-	-	-
1	Raising of Road Kerb	m		134,000		439	-	58,826,000	-
2	Replacement of Road Studs						-	-	-
	Road Studs	Nos	39,605	39,605	39,605	220	8,713,100	8,713,100	8,713,100
	Solar Studs	Nos	3,552	3,552	3,552	1647	5,850,144	5,850,144	5,850,144
3	Painting of Road Kerb	Sqm	-	-	-	121	-	-	-
4	Road Marking - MCW	Sqm	59,289	59,289	59,289	439	26,027,822	26,027,822	26,027,822
5	Shoulder Filling (40 to 50 mm)	sqm		268,000	-	22	-	5,896,000	-
6	Median Filling	Cum	-		-	439	-	-	-
7	Cost for fixing Other CA Issue at Handback Time	LS							
8	PMC Cost for Overlay @ 20 lakh per month	Month					16,000,000	16,000,000	16,000,000
	Major Maintenance Cost Per Year						617,272,842	814,010,539	796,208,207
	Major Maintenance Cost Per Year with GST						691,345,583	911,691,804	891,753,192
				Amount in Crore			69.13	91.17	89.18
	Escalation Factor						1.417	1.874	2.771
	Esclated Amount keping Bitumen Component w/o Escalation in Crores						90.98	152.15	207.24

5 OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organising itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimsed staff requirement at Toll

plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 17,722 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 20,982 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180 watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 11.74 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	KM	2.50	104,284	260,710
2	Highway Lighting Electricity Charge	Kwh	145,153	11.74	1,420,152
3	Operation and Maintenance of DG Set	Nos	2	174,873	349,745
4	Solar Blinker	Nos	28	3,293	92,209
5	Office Building Electricity Charge	LS	12	54,886	658,636
	Total				27,81,453

5.5 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is 1.49 crore per year and additional cost of 25.74 crore for replacement of equipment at every 7 (seven) years.

5.6 Incident Management

The following equipments along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 2 nos of route patrol vehicle as per Article 17
c) 2 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 1.89 crore per year including GST.

5.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as Rs. 3.44 core per year.

5.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 3.28 crore per year.

Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	18,433,533	19,054,843	2,781,453	13,173,983	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	152,272,497
3	2023-24	21,818,898	19,054,843	2,781,453	15,893,262	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	158,377,140
4	2024-25	23,598,772	19,054,843	2,781,453	17,706,115	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	161,969,867
5	2025-26	24,934,288	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	165,118,235
6	2026-27	26,264,468	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	166,448,416
7	2027-28	27,052,984	19,054,843	2,781,453	72,994,824	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	220,712,789
8	2028-29	15,818,212	19,054,843	2,781,453	11,361,130	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	147,844,323
9	2029-30	18,433,533	19,054,843	2,781,453	13,173,983	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	152,272,497
10	2030-31	21,818,898	19,054,843	2,781,453	15,893,262	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	158,377,140
11	2031-32	23,598,772	19,054,843	2,781,453	17,706,115	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	161,969,867
12	2032-33	24,934,288	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	165,118,235
13	2033-34	26,264,468	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	166,448,416
14	2034-35	27,052,984	19,054,843	2,781,453	72,994,824	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	220,712,789
15	2035-36	15,818,212	19,054,843	2,781,453	11,361,130	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	147,844,323
16	2036-37	18,433,533	19,054,843	2,781,453	13,173,983	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	152,272,497
17	2037-38	21,818,898	19,054,843	2,781,453	15,893,262	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	158,377,140
18	2038-39	23,598,772	19,054,843	2,781,453	17,706,115	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	161,969,867
19	2039-40	24,934,288	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	165,118,235
20	2040-41	26,264,468	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	166,448,416
21	2041-42	27,052,984	19,054,843	2,781,453	72,994,824	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	220,712,789
22	2042-43	15,818,212	19,054,843	2,781,453	11,361,130	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	147,844,323
23	2043-44	18,433,533	19,054,843	2,781,453	13,173,983	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	152,272,497
24	2044-45	21,818,898	19,054,843	2,781,453	15,893,262	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	158,377,140
25	2045-46	23,598,772	19,054,843	2,781,453	17,706,115	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	161,969,867
26	2047-48	24,934,288	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	165,118,235
27	2048-49	26,264,468	19,054,843	2,781,453	19,518,967	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	166,448,416
28	2049-50	27,052,984	19,054,843	2,781,453	72,994,824	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	220,712,789
29	2050-51	15,818,212	19,054,843	2,781,453	11,361,130	27,214,062	1,778,318	34,415,263	2,436,955	32,984,086	147,844,323
	Total	631,684,621	533,535,615	77,880,674	680,668,995	761,993,742	49,792,904	963,627,374	68,234,727	923,554,416	4,690,973,068
Total Cost in Crore		63.17	53.35	7.79	68.07	76.20	4.98	96.36	6.82	92.36	469.10

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Kotwa - Muzaffarpur section of NH 28. Project road starts from Km 440+000 at Kotwa to Km 520+000 at Muzaffarpur in the state of Bihar. The total length of the project road is 80 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Kotwa to Muzaffarpur Section of NH – 28 on TOT Basis in the State of Bihar	440+000	520+000	80.0	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.

Start Point of Project Road at Km 440+000	End Point of Project Road at Km 520+000

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 440+000 at Kotwa of NH-28	Km 440+000 at Kotwa of NH-28
2	Project Road End	Km 520+000 at Muzaffarpur of NH-28	Km 520+000 at Muzaffarpur of NH-28
3	Project Length	80 km	80 km
6	Carriageway	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	Shoulders	1 m to 2 m earthen for MCW	1 m to 2 m earthen for MCW
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	Service Roads	LHS: 23.345 km RHS: 26.855 km	LHS: 24.870 km RHS: 27.160 km
10	Major Bridge	1 No.	1 No.
11	Minor Bridge	7 Nos.	7 Nos.
12	Pipe, Box & Slab Culverts	100 Nos.	100 Nos.
13	Major/Minor Junctions	3 Major & 58 Minor	3 Major & 58 Minor
14	Underpass	8 VUP & 1 PUP	8 VUP & 1 PUP
15	Grade Separator	2 Flyover	2 Flyover
15	ROB/RUB	2 No	2 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	10 Nos.	10 Nos

Sn	Particulars	As per Schedule-A	As per Site Condition
18	Bus Shelter	18 Nos	17 Nos

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td>
</td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	440+000	467+600	BT	BT	27.6
2	467+600	468+050	CC	CC	0.45
3	468+050	482+000	BT	BT	13.95
4	482+000	507+800	CC	BT	25.8
5	507+800	520+000	BT	BT	12.2

Flexible Pavement

Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA 52.2 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 52.03 Km length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road of 5.5 m width has been proposed for the length of 900 m.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 1.5 m wide median without Antiglare	4.5 m wide Median with Shrubs

33 nos. of authorized and 22 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening with Solar Blinker	Unauthorized Median Opening

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total 24.041 Km of covered line side drain is found on site. Median drain has observed in 1.19 Km of length.

RCC Covered Drain at Project Road	Median Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 58 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Major Junction at KM 516+900	Minor Junction

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	10.37
	Median	1.518
Pedestrian Guard Rail	Carriageway Edge	16.168
Concrete Barrier	Carriageway Edge & Median	8.79

PGR and W-Beam present on the project road

6.2.8 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 467+700 near Pasoni Khem with the configuration 2 x (4+1). This has 9 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Since new toll plaza is to be constructed as per IRC SP – 84: 2014, existing toll plaza is to be dismantled completely and new toll plaza with complete facility is to be provided.

Concessionaire has mobilized Toll Collection team with new system at Toll Plaza.

Toll Plaza near Parsoni Khem at Km 467+700

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and urban section near Muzaffarpur city. Additionally, 8 High Mast has provided at Toll Plaza, major junction and flyover. As per schedule A, 89 Nos. has been provided at site.

High Mast and Highway Light along project Highway

6.2.10 Bus Bays and Bus Shelter

There are 20 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter along Project Highway

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	459+000	RHS	RCC	Bus Shelter Only
2	459+740	RHS	RCC	Bus Shelter Only
3	461+500	RHS	RCC	Bus Shelter Only
4	467+310	RHS	RCC	Bus Shelter Only
5	480+900	LHS	RCC	Bus Shelter Only
6	484+600	RHS	RCC	Bus Shelter Only
7	486+330	RHS	RCC	Bus Shelter Only
8	491+100	RHS	RCC	Bus Shelter Only
9	491+140	LHS	RCC	Bus Shelter Only
10	492+270	RHS	RCC	Bus Shelter Only
11	493+130	RHS	RCC	Bus Shelter Only
12	494+550	LHS	RCC	Bus Shelter Only
13	495+230	RHS	RCC	Bus Shelter Only
14	495+720	RHS	RCC	Bus Shelter Only
15	499+910	RHS	RCC	Bus Shelter Only
16	501+240	RHS	RCC	Bus Shelter Only
17	505+660	RHS	RCC	Bus Shelter Only
18	507+880	RHS	RCC	Bus Shelter Only
19	513+380	RHS	RCC	Bus Shelter Only
20	515+100	RHS	RCC	Bus Shelter Only

6.2.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	445+425	LHS	NA	Available	Available
2	445+545	RHS	NA	Available	Available
3	450+385	LHS	NA	Available	Available
4	450+400	RHS	NA	Available	Available
5	456+190	RHS	NA	Available	Available
6	456+225	LHS	NA	Available	Available
7	462+780	LHS	NA	Available	Available
8	462+880	RHS	NA	Available	Available
9	475+550	LHS	NA	Available	Available
10	475+680	RHS	NA	Available	Available

7

Truck Lay Bye

6.2.12 Signage and Marking

Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.

Road marking along the carriageway

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road	Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 1 no of Major Bridge having span arrangement of 1x26+1x24+1x26m in LHS and 6x12m in RHS is found in good condition
- 7 nos. of Minor bridges having total length varies from7 m to 45.5 m are generally found in good condition.
- 9 nos. of Underpass are found in good condition.
- 2 nos. of Railway over Bridge having span arrangement of 4x24.5+1x27.5 m and 6x21.7+1x37.5m is in good condition
- 2 no of Flyover having span arrangement of 1x35+4x24 and 4x24.0+1x35.0m is found in good condition
- 100 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

a) Major bridge – CH.442+820

It consists of bridge on LHS and RHS carriageways. LHS Bridge has span arrangement of 1x26+1x24+1x26m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. The general condition of the bridge is good.

RHS Bridge has span arrangement of 6X12.00m. The super structure comprises of RCC Girder. Superstructure is resting on Brick Masonry wall type Pier and RCC abutment. Wearing coats needs to be repaired, W Beam crash barrier needs to be repaired, expansion joint is in fair condition. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of the Carriageway

Span Arrangement

Major Bridge at Ch. 442+820

b) Minor Bridge

Salient features along with condition of 7 Minor bridges are discussed below:

Minor Bridge – CH.443+375

It consists of bridge on LHS and RHS Carriageway. Both the bridges have Span arrangement of 2x13.50 m and Service road bridges of span 2x13.50 have also provided on both sides. The super structure comprises of RCC Solid Slab. Tar Paper bearings are adopted for resting of superstructure on RCC Wall type abutment and pier.

It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of slope pitching etc. Expansion joint is in fair condition. Median wall Is to be provided. The other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 443+375

c) Minor Bridge – CH.457+430

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 1x7.0m. The super structure comprises of RCC Box.

It requires regular repair works such painting and repairing of RCC Crash Barrier, repairing of drainage spouts. Slope pitching is in poor condition. Other condition of the bridge is good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 457+430

d) Minor Bridge – CH.471+965

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 2x10.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

During inspection it was found that drainage spouts were blocked, Slope pitching was in poor condition. Wearing coat and expansion joint was in fair condition. Other conditions of the bridge were good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 471+965

e)

f) Minor Bridge – CH.472+555

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 1x10.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

During inspection it was found that drainage spouts were blocked, Slope pitching, wearing coat and expansion joint were in fair condition. Other conditions of the bridge were good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 472+555

g) Minor Bridge – CH.488+185

It consists of bridge on LHS and RHS carriageway. RHS bridge has Span arrangement of 1x44.5m. The super structure comprises of Box Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment. During inspection it was found that Slope pitching was good condition, wearing coat and expansion joint were in poor condition. Other conditions of the bridge were good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement (LHS)

Minor Bridge at Ch. 488+185

h) Minor Bridge – CH.490+558

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 1x13.56m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

During inspection it was found that wearing coat needs to be repaired, drainage spouts were blocked, expansion joint were in poor condition. Other conditions of the bridge were good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of the Carriage way

Superstructure is in fair condition

Minor Bridge at Ch. 490+558

i) Minor Bridge – CH.496+842

It consists of bridge on LHS and RHS carriageway. Both the bridge has Span arrangement of 2x13.5m. The super structure comprises of RCC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

During inspection it was found that drainage spouts, Slope pitching, wearing coat and expansion joint were in fair condition. Other conditions of the bridge were good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 496+842

j) Under-Passes (UPs)

There is a total of 09 UPs has been provided. All Ups have RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m.

UPs are generally in good condition with some minor damages. A few pictures to ascertain the conditions of PUPs are presented as follows:

Superstructure is in fair condition

Span Arrangement

UP at Ch. 443+800

Super structure in fair condition

Span Arrangement

k) Railway over Bridge (ROBs)

ROB at Ch. 451+986

It consists of bridge on LHS and RHS over railway tracks. Both the ROB has a span arrangement of 4x24.5+1x27.5m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment. Seismic stoppers are provided in both the bridges. Wearing coat, slope pitching and expansion joint is in fair condition. A few pictures to ascertain the conditions of ROB are presented as follows: -

Superstructure is in fair condition

Span Arrangement

Span Arrangement

Abutment

ROB at Ch. 451+986

ROB at Ch. 516+035

It consists of bridge on LHS and RHS over railway tracks. Both the ROB has a span arrangement of 6x21.7+1x37.5m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment. Expansion joints are completely filled, repairing in the wearing coat is required., Slope pitching Other conditions of the ROB are good.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Span Arrangement

View of Abutment

ROB at Ch. 516+035

I) Grade Separators (Flyover)

Grade Separator at Ch. 453+612

It consists of flyover on both carriageways. Flyovers has a span arrangement of 1x35+4x24m. The super structure comprises of PSC Girder. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after appropriate years from date of construction.

A few pictures showing conditions of Grade Separator are presented as follows: -

View of Carriageway

Superstructure is in fair condition

Flyover at Ch. 453+612

Grade Separator at Ch. 519+600

It consists of flyover on both carriageways. Flyovers has a span arrangement of 4x24+1x35m. The super structure comprises of PSC Girder. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment.

It requires repair works such repairing of drainage spouts, minor repairing of wearing coat etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after appropriate years from date of construction. Other conditions of the bridge are good. A few pictures showing conditions of Grade Separator are presented as follows: -

View of Carriageway

Span Arrangement

Span Arrangemnet

Superstructure is in fair condition

Flyover at Ch. 519+600

m) Culverts:

There are 100 numbers of culverts in entire project corridor. Detailed Condition summary of Culverts is presented in Annexure-2.2(F).

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		LHS	1x26+1x24+1 x26	10.25	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
1	442+280	RHS	6X12.00	8.5			●	●	●	●	●	●	●	●	●		●	Stable	
2	443+375	LHS	2 x 13.50	8.0	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2 x 13.50	10.25			●	●	●	●	●	●	●	●	●		●	Stable	
3	457+430	LHS	1 x 7	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 7	11.5			●	●	●	●	●	●	●	●	●		●	Stable	
4	471+965	LHS	2 x 10.5	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2 x 10.5	10.25			●	●	●	●	●	●	●	●	●		●	Stable	
5	472+555	LHS	1 x 10.5	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
		RHS	1 x 10.5	10.25			●	●	●	●	●	●	●	●	●		●	Stable	
6	488+185	LHS	1 x 44.5	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 44.5	8.45			●	●	●	●	●	●	●	●	●		●	Stable	
7	490+558	LHS	1 x 13.56	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1 x 13.5	8.45			●	●	●	●	●	●	●	●	●		●	Stable	
8	496+842	LHS	2 x 13.56	10.25	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	2 x 13.4	8.43			●	●	●	●	●	●	●	●	●		●	Stable	
9		LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
	443+800	RHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
10	461+678	LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
11	472+982	LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
12	481+255	LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
13		LHS	2x12.56	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
	493+937	RHS	2x12.56	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
14	501+800	LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		LHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
15	508+648	RHS	2x12.56	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		LHS	2x12.56	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
16	511+735	LHS	1x10	2x10.25	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x10	2x10.25			●	●	●		●	●	●	●	●		●	Stable	
17		LHS	1x3	32	PUP	NA	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
	515+600	RHS	1x3	32			●	●	●		●	●	●	●	●		●	Stable	
18	451+986	LHS	4x24.5+1x27.5	2 x10.25	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	4x24.5+1x27.5	2 x10.25			●	●	●	●	●	●	●	●	●		●	Stable	
19	516+035	LHS	6x21.7+1x37.5	2 x10.25	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	6x21.7+1x37.5	2 x10.25			●	●	●	●	●	●	●	●	●		●	Stable	
20	453+612	LHS	1x35+4x24	10.25	FO	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x35+4x24	10.25			●	●	●	●	●	●	●	●	●		●	Stable	
21		LHS	4x24.0+1x35.0	10.25	FO	NA	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Type of Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
	519+600	RHS	4x24.0+1x35.0	10.25			●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Lucknow Raebareli Tollway Limited

Report Number:

ACM-60657056-TDD-LRTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Lucknow Raebareli Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Lucknow Raebareli Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Lucknow Raebareli Tollway Limited

5th Floor, OSE Commercial Block, Hotel Aloft
Asset No. 5B, Aerocity Hospitality District
IGI Airport, New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **2**

Project Background 2
Project Salient Features 2
Project Principal Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 6

1. INTRODUCTION **8**

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Estimation of Design Traffic 14
2.3 Test Pit 14
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 14
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 14
2.6 Roughness Survey using Network Survey Vehicle (NSV) 14
3.5 Determination of Pavement Major Maintenance 15
3.6 Base Year Pavement Rehabilitation Requirement 15
3.7 Future Maintenance Requirements 15

2 CAPEX REQUIREMENT **17**

2.5 CAPEX needs 17
2.7 Unit Rate Analysis 20
2.8 Cost Estimate 21

3 MAJOR MAINTENANCE COST **22**

3.5 Major Maintenance Cycle 22
3.6 Major Maintenance Quantity 22
3.7 Unit Rate Analysis 23
3.8 Cost Estimate 24

4 OPEATION AND MAINTANANCE COST - OPEX **26**

4.5 O & M Requirement as per CA 26
4.6 O & M Strategy 29
4.7 Routine and Preventive Maintenance 30
4.8 Preventive Maintenance 30
4.9 Highway Lighting 30
4.10 ATMS and TMS Cost 31
4.11 Incident Management 31
4.12 Manpower Cost 31
4.13 Office Expenses 32

5 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **34**

5.5 Reconnaissance Survey 34
5.6 Road Inventory and Condition Survey 34
5.7 Inventory and Condition Survey of Structures 46

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
LRTL	Lucknow Raebareli Tollway Limited
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System

MJB	Major Bridge
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Lucknow Raebareli Tollway Limited ("LRTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways and LRTL (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Lucknow Raebareli Section from Km 12+700 to Km 82+700 of NH 30 in the State of Uttar Pradesh is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI) which is being operated by Lucknow Raebareli Tollway Limited (LRTL).

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client. This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer Lucknow – Raebareli Section from Km 12+700 to Km 82+700 of NH 30 in the State of Uttar Pradesh
Project Length	70 Km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Lucknow Raebareli Tollway Limited
Signing of Agreement	
Appointed Date	27 December 2019
O & M Handover Date	Mar 2029
Concession Period	30 years
End of Concession Period	19 Oct 2020
Likely End of Concession Period	Mar 2045*
Six Lanning under EPC by NHAI	NA
Number of Toll Plaza	1 nos, plaza having 10 lanes including extra width

* - as per information provided by the Company

Project Principal Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Lucknow Raebareli Tollway Limited
3	Annuity Concessionaire	Essel Infra Projects Ltd
4	Independent Engineer	
5	Maintenance Contractor	Markolines Traffic Controls Private Limited, G4S India for Security
6	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 18 months.

- Construction of Vehicular underpass and Approaches
- Construction of New Service Road & Structures
- Widening of Cross Drainage Works
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

- The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 87.46 crore including GST as on FY 2023.

b) Major Maintenance (MM) Cost

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2033-34	40 mm BC in 100% of length, 50 mm Milling + 50 mm DBM in 25% of length of Main Carriageway 30 mm BC in 50% of length, Micro surfacing in 50% of length of Service Road	139.84
2.	2035/36 to 2037/38	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA	NA
3.	2044/45	30 mm BC in 100% length of Six Lane 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	148.84

The above cost of MM is based on Cube Input for rate of bitumen and escalation factor. The bitumen rate is considered flat from 2024 onwards till end of concession period and escalation is applied only for other component of MM works i.e. except bitumen cost.
As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways is projected in 2035/36 to 2037/38.

c) Operation and Maintenance (OpEX)

The project road is currently maintained by Annuity Concessionaire and O & M handover will be on Mar 2029. The Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway from Mar 2029 to end of Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the

Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	15,565,088
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	-
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	3,480,000
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	8,377,838
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	3,389,127
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	2,711,386
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	3,161,455
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	6,601,246
11	Community Development	Includes CSR related expenses.	868,302

Sl. No.	Description	Remarks	Amount (in INR)
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	2,195,455
15	IE Fees	Includes IE fees.	5,532,545
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	-
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	
		O & M Cost for Year 2020-21	70,624,821

A total of Rs. 7.06 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2023.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over

the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs

1. INTRODUCTION

1.1 Project Background

Lucknow Raebareli Tollway Limited (hereinafter referred to as LRTL or the Concessionaire), is a company promoted by Cube Mobility Investments Pte. Ltd. (herein after refer as Cube Highways or the Company) to undertake Tolling, Operation, Maintenance & Transfer (TOT Model) of Lucknow-Raebareli Section from Km 12+700 to Km 82+700 of NH 30 in the State of Uttar Pradesh is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The construction of project road was completed under Annuity (BOT) basis and existing Concessionaire is maintaining highway till Mar 2029.

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.
This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The Project Stretch is section of NH 26 in the State of Uttar Pradesh, starts from km 0+000 (at T Junction, near Jhansi) on NH 26 and ends km 49+700 (near Khandi Village) and it is a part of North- South corridor. The 49.700 km long Project Stretch has 4-lane configuration and is currently tolled at one location – Babina toll plaza at km 32.100 for complete length. The total Length of Highway is 49.7 Km. The project corridor is shown in map below.

Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	70 km
Carriageway	Four Lane (2 x 9.0m Paved Width)
Type of Pavement	Flexible Pavement - MCW & Service Road Rigid Pavement -Toll Plaza
Shoulder	1.5 m earthen for MCW at Rural Area
Service Road / Slip Road	6.26 km total length having width of 5.5 m
Major / Minor Junction	5 Major & 29 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 59.750 Km
Median Opening	64 Nos
Toll Plaza	1 Nos –10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	2 Nos
Bus Bays with shelter	52 Bus Shelter
Highway Lighting	1068 Nos. Double Arm and 94 nos Single arm
High Mast	4 nos
Highway Patrol	1 nos (To be deployed after O&M handover)
Ambulance	1 nos (To be deployed after O&M handover)
Crane	1 nos (To be deployed after O&M handover)

b) Structure

Description	Project Features
Major Bridge	Nil
Minor Bridge	7 Nos
Flyovers	Nil
ROB and RUB	2 No
VUP	1 PUP
Culverts	89 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.
b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Ravelling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.3 Test Pit

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

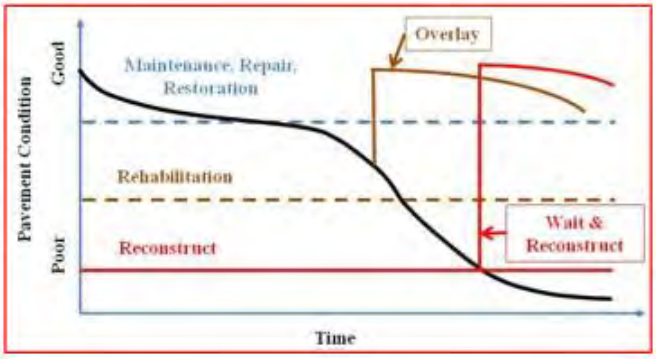
Since the project is being maintained by annuity concessionaire and shall be handed over to TOT concessionaire on 2027, hence the data is not relevant.

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Project is being maintained by Annuity Concessionaire. Data not available.

3.5 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

3.6 Base Year Pavement Rehabilitation Requirement

Not applicable as project road in under Annuity.

3.7 Future Maintenance Requirements

The project road is being maintained by the existing Annuity Concessionaire till Mar 2027 and he shall be responsible for providing required level of service as per Concession agreement signed between NHAI and Annuity Concessionaire. The Company shall only be responsible for Operation and maintenance from Mar 2027. Basis on the assumption that, the project road shall be provided at least 7 years of balance life of pavement with roughness value less than 2000 mm/km at the time of O & M handover. AECOM consider Structural Overlay required after 5 years from O & M handover date and functional Overlay is required at every 7 year

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is always required to satisfy Schedule F requirement .

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Six Lanning work is going beyond end of Concession Period therefore effect of six laning is considered while forecasting MM cycles.

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2031-32	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2.	2035/36 to 2037/38	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		
2	2044-45	Functional Overlay	30 mm BC in Entire Six lane	30 mm BC in 50 % and Micro surfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

2 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

2.5 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 3200 m having width of 5.50 m
2. Reconstruction of existing Box culvert for Service Road – 3 Nos
3. Reconstruction of Pipe Culvert for Service Road– 2 Nos
4. RCC Drain – 3200 m along service road
5. Road Furnitures – Transverse Marking 3.2 km, Rigid Barrier – 3200m, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
6. Toll Plaza
7. Landscaping and tree plantation
8. Way Side Amenities: to be constructed by NHAI
9. Incident Management – Highway Patrol, Ambulance, Crane
10. ATMS
11. Rainwater Harvesting
12. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from O & M Handover Date
4	Repair and Rehabilitation of Structure	12 months from O & M Handover Date

Sn	Description of Work	Date of Completion
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from O & M Handover Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

O & M Handover Date: Mar 2027.

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in Schedule C, Engineering and Safety Improvements along the Project Highways shall confirm to IRC: SP: 84 -2014, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

2.6 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. Construction of new / widening of Service road /Slip road
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. Reconstruction of existing Service road /Slip road
   No existing service roads in this package.
3. Construction of new / widening of culverts / bridges / Grade separated structures
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. Repair / Rehabilitation of pavement (overlay)
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.

5. Repair / Rehabilitation of structures

In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.

6. Junction improvement
   Not applicable
7. Construction of new drain
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. Road furniture
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
   i) Road marking – quantity considered along entire length of project road
   j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.
9. Construction of new Toll plaza
   Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is not having PQC on tapper portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.
10. Landscaping and tree plantation
    The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.
11. Truck lay byes / toilet blocks
    Not applicable
12. Bus bays / bus shelters
    Not applicable
13. Highway Patrol vehicles, Ambulance, Cranes
    One number at each toll location has been considered.
14. ATMS / TMS
    Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.
15. Rainwater harvesting systems

Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.

16. Slope protection

As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

2.7 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 1st March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	52, 452	2650	49, 802
VG40	55, 932	2650	53, 282

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	340
2	Granular Subbase	Cum	2,440
3	Wet mix macadam	Cum	3,255
4	Dense Bituminous Macadam VG -30	Cum	8,775
5	Bituminous Concrete – VG 30	Cum	9,621
6	Pavement Quality Concrete (PQC)	Cum	7,339

Sn	Items Description	Unit	Rates (Rs.)
12	RCC M 20 for Drain	Cum	6,973
13	Reinforcement Steel	MT	80,491
14	Metal "W" Beam crash barrier	Rm	3,420

Note: above unit rates are excluding GST.

2.8 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs
1	Cost of VUP Approaches	Concessionaire has requested for negative change of scope for amount 42,87,65,212 vide LRTL/NHAI/IE/NH-30/2022-23/437 dated 21 june 2022.
2	Cost of Service/Slip road	
3	Cost of Road Furniture	
4	Cost of Drain	
5	Cost of VUP	
6	RE Wall	
7	Cost of Structure (BOX Culvert and Pipe culvert)	
	Total	42,87,65,212

3 MAJOR MAINTENANCE COST

3.5 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2031-32	Functional Overlay	40 mm BC in 100%, 50 mm Milling + 50 mm DBM in 25%	30 mm BC in 50%, Micro surfacing in 50%
2.	2035/36 to 2037/38	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		
3	2044-45	Functional Overlay	30 mm BC in entire Six lane	30 mm BC in 50 % and Micro surfacing in 50 %

3.6 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

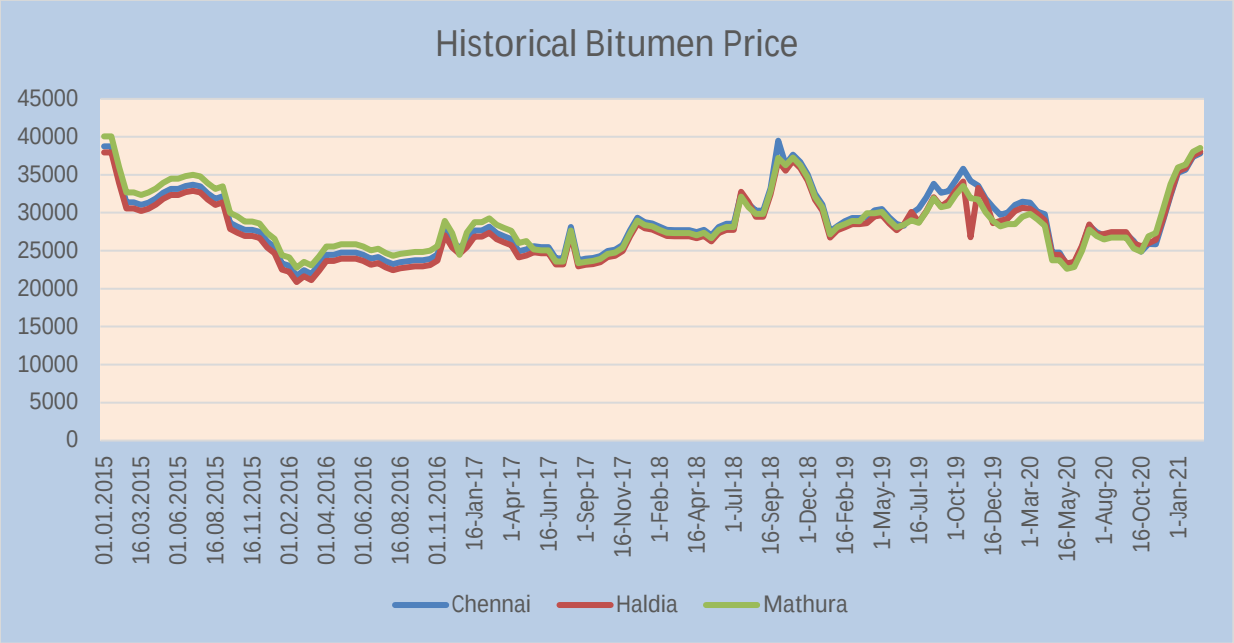
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

3.7 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 2024 onwards	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	52,452	2650	49,802
VG40	55,932	2650	53,282

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874

Year	Growth Rate	Escalation Factor
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of FY 2023 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam – VG 40	Cum	8,775
2	Bituminous Concrete – VG 40	Cum	9,911
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

3.8 Cost Estimate

Cost estimates of each cycle wise is presented in table below.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

S.N.	Activity	Unit	Quantity		Unit Rate 2022	Amount	
			2033/34	2044/45		2033/34	2044/45
	Main Carriageway - Flexible Pavement						
1	Tack Coat	Sqm	1,607,814	1,522,854	13	21,351,770	20,223,501
2	Bituminous Concrete - VG 40	Cum	51,313	52,886	9911	508,558,353	524,144,406
3	Dense Bituminous Macadam - VG 40	Cum	16,250		8775	142,584,076	-
4	Milling	Sqm	324,990		77	25,024,230	-
	Main Carriageway - Rigid						
1	Joint sealant replacement every 5th Year (5 %)	m	8,916	8,916	220	1,961,562	1,961,562
	Service Road						
1	Tack Coat	Sqm	21,065	21,065	13	279,743	279,743
2	BC - VG 30	Cum	632	632	9365	5,917,915	5,917,915
3	Microsurfacing	Sqm	21,065	21,065	176	3,707,440	3,707,440
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)						
1	Tack Coat	Sqm	20882	20882	13	277,306	277,306
2	Bituminous Concrete - VG 40 / CRMB	Cum	835	626	9911	8,278,190	6,208,643
3	Milling of existing Wearing Coat	Sqm	20882	20882	77	1,607,876	1,607,876
4	Painting of Crash Barrier	sqm	7952	7952	121	962,240	962,240
	Other Works						
1	Raising of Road Kerb	m	137,160		439	60,213,240	-
2	Road Studs	Nos	38,622	38,622	220	8,496,840	8,496,840
3	Solar Studs	Nos	1,876	1,876	1647	3,089,772	3,089,772
4	Painting of Road Kerb	Sqm	34,290	34,290	121	4,149,090	4,149,090
5	Road Marking - MCW	Sqm	51878	51878	439	22,774,344	22,774,344
6	Shoulder Filling (40 to 50 mm)	Sqm	89100	89100	22	1,960,200	1,960,200
7	Median Filling	Cum	3429		439	1,505,331	-
8	PMC Cost for Overlay @ 10 lakh per month	Month	8	8	2000000	16,000,000	16,000,000
	Major Maintenance Cost Per Year					838,699,519	621,760,878
	Major Maintenance Cost Per Year with GST					939,343,461	696,372,183
						93.93	69.64
	Escalation Factor					1.732	2.771
	Esclated Amount keping Bitumen Component w/o Escalation					139.84	148.84

4 OPEATION AND MAINTANANCE COST - OPEX

4.5 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall always procure that during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organising itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass, the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimized staff requirement at

Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

4.6 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

4.7 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 16,736 / km / month excluding GST.

4.8 Preventive Maintenance

The cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs.12,033 / km / month excluding GST.

4.9 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 12.35 Rs / Kwh based on monthly electricity bill.
c) Electricity cost considered till O & M Handing Over is Rs. 0.34 crore per Year up to FY 2028-29 and Rs.2.53 crore per year after O&M Handing Over i.e. FY 2029-30 onwards.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	34.85	104,284	3,634,301
2	Highway Lighting Electricity Charge	Kwh	1,663,670	12.35014	20,546,552
3	Operation and Maintenance of DG Set	Nos	2	140,235	2,80,469
4	Solar Blinker	Nos	48	3,293	158,073
5	Lighting at Toll Plaza	Kwh			
6	Office Building Electricity Charge	LS			7,20,000
	Total				25,339,394

4.10 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is Rs. 1.31 crore per year and additional cost of Rs. 24.63 crore for replacement of equipment at every 7 (seven) years for TMS/ATMS.

4.11 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 2 nos of route patrol vehicle as per Article 17
c) 2 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is Rs. 2.53 crore per year including GST.

4.12 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.
   As per Company, overloading shall not be collected from this asset therefore only Six Toll Collector is considered for 10 lane plaza from FY 2023 onwards. at this stage.

The cost of manpower is estimated as Rs. 3.72 core for FY 2022/23 and Rs. 3.16 crore per year from FY 2023/24 onwards.

4.13 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses based on data provided by the Company. The cost estimated is Rs. 1.88 crore per year for FY 2022/23.

Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2022-23			3,480,000	11,766,964		1,778,318	31,611,299	3,161,455	18,826,784	70,624,821
2	2023-24			3,480,000	13,800,440		1,778,318	31,611,299	3,161,455	18,826,784	72,658,297
3	2024-25			3,480,000	15,156,091		1,778,318	31,611,299	3,161,455	18,826,784	74,013,947
4	2025-26			3,480,000	16,511,742		1,778,318	31,611,299	3,161,455	18,826,784	75,369,598
5	2026-27			3,480,000	16,511,742		1,778,318	31,611,299	3,161,455	18,826,784	75,369,598
6	2027-28			3,480,000	69,952,344		1,778,318	31,611,299	3,161,455	18,826,784	128,810,200
7	2028-29			3,480,000	10,411,314		1,778,318	31,611,299	3,161,455	18,826,784	69,269,170
8	2029-30	6,700,890	15,744,799	22,670,697	11,766,964	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	139,740,126
9	2030-31	8,394,484	15,744,799	22,670,697	13,800,440	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	143,467,196
10	2031-32	10,432,245	15,744,799	22,670,697	15,156,091	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	146,860,607
11	2032-33	6,700,890	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	144,484,903
12	2033-34	8,394,484	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	146,178,497
13	2034-35	10,432,245	15,744,799	22,670,697	69,952,344	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	201,656,860
14	2035-36	11,910,788	15,744,799	22,670,697	10,411,314	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	143,594,373
15	2036-37	12,994,027	15,744,799	22,670,697	11,766,964	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	146,033,263
16	2037-38	14,076,635	15,744,799	22,670,697	13,800,440	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	149,149,346
17	2038-39	6,700,890	15,744,799	22,670,697	15,156,091	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	143,129,253
18	2039-40	8,394,484	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	146,178,497
19	2040-41	10,432,245	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	148,216,258
20	2041-42	11,910,788	15,744,799	22,670,697	69,952,344	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	203,135,403
21	2042-43	12,994,027	15,744,799	22,670,697	10,411,314	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	144,677,612
22	2043-44	14,076,635	15,744,799	22,670,697	11,766,964	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	147,115,871
23	2044-45	6,700,890	15,744,799	22,670,697	13,800,440	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	141,773,602
24	2045-46	8,394,484	15,744,799	22,670,697	15,156,091	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	144,822,846
25	2047-48	10,432,245	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	148,216,258
26	2048-49	11,910,788	15,744,799	22,670,697	16,511,742	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	149,694,801
27	2049-50	12,994,027	15,744,799	22,670,697	8,377,838	25,356,633	1,778,318	31,611,299	3,161,455	20,949,071	142,644,136
	Total	204,978,193	314,895,971	477,773,940	544,456,725	507,132,656	48,014,586	853,505,079	85,359,273	550,768,914	3,586,885,337
Total Cost in Cro		20.50	31.49	47.78	54.45	50.71	4.80	85.35	8.54	55.08	358.69

5 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

5.5 Reconnaissance Survey

This project road is a Lucknow Raebareli section of NH 30. Project road starts from Km 12+700 at Lucknow to Km 82+700 at Raebareli in the state of Uttar Pradesh. The total length of the project road is 70km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Lucknow Raebareli section of NH 30 on TOT Basis in the State of Uttar Pradesh	12+700	82+700	70.00	Four lane divided Carriageway

5.6 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor

Various key features along the project road such as slope protections, median openings,

Start Point of Project Road at Km 12+700

End Point of Project Road at Km 82+700

- Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 12+700 at Lucknow of NH-30	Km 12+700 at Lucknow of NH-30
2	Project Road End	Km 82+700 at Raebareli of NH 30	Km 82+700 at Raebareli of NH 30
3	Project Length	70 km	70 km
6	Carriageway	4 lane highway with paved width 9.0 m on either side	4 lane highway with paved width 9.0 m on either side
7	Shoulders	1.5 m earthen for MCW	1.5 m earthen for MCW
8	Median	2 m wide in rural areas and 2 m in Urban Stretches.	2 m wide in rural areas and 2 m in Urban Stretches.
9	Service Roads	LHS: 2.23 km RHS: 2.23 km	LHS: 3.35 km RHS: 2.73 km
10	Major Bridge	Nil	Nil
11	Minor Bridge	7 Nos.	7 Nos.
12	Pipe, Box & Slab Culverts	89 Nos.	89 Nos.
13	Major/Minor Junctions	5 Major & 29 Minor	5 Major & 29 Minor
14	Underpass	1 PUP	1 PUP
15	Grade Separator	Nil	Nil
15	ROB/RUB	2 No	2 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	1 Nos.	2 Nos.
18	Bus Shelter	45 Nos.	52 Nos.

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

Typical Cross Section	Typical Section of Approach
Typical Rural Section	Toll Plaza

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	12+700	42+450	BT	BT	29.750
2	42+450	42+850	CC	CC	0.400
3	42+850	82+700	BT	BT	30.850

Flexible Pavement

Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA no service road has been constructed. As per Schedule B new service road of 5.5 m width has been proposed for the length of 4870 m.

6.2.4 Median

Median width of 2 m was observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 2 m wide median with PGR	2 m wide Median with Shrubs

64 nos. of authorized and 6 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers.

Median Opening without Solar Blinker	

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. As per Schedule B lined drains are to be provided at the sides of the Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Total 59.750 Km of covered line side drain is to be provided. Drain found in good condition.

Road Side Drain at Project Road

6.2.6 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

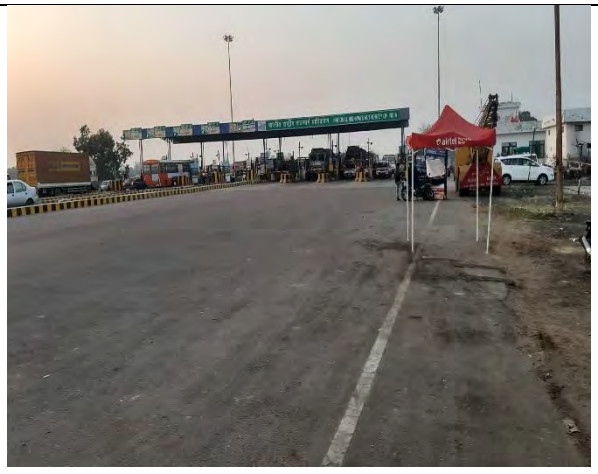
Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	3.390
	Median	Nil
Pedestrian Guard Rail	Carriageway Edge	51.37
Concrete Barrier	Carriageway Edge & Median	2.21

PGR on Median and RCC Crash Barrier present on the project road

6.2.7 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 42+650 near Dakshin Shekhpur with the configuration 2 x (4+1). This has 8 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Since new toll plaza is to be constructed as per IRC SP – 84: 2014, existing toll plaza is to be dismantled completely and new toll plaza with complete facility is to be provided.

Concessionaire has mobilized Toll Collection team with new system at Toll Plaza.



Toll Plaza at Km 42+650

6.2.8 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at built-up area, approach of grade separated structures. All lights were provided with LED bulbs for better quality and low operation cost.

High Mast and Highway Light along project Highway

6.2.9 Bus Bays and Bus Shelter

There are 4 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter along Project Highway

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N.	Chainage	Side	Shelter Type	Remarks
1	15+250	LHS	Steel Shelter with RCC Seats	BT
2	18+010	LHS	Steel Shelter with RCC Seats	BT
3	18+010	RHS	Steel Shelter with RCC Seats	BT
4	21+220	RHS	Steel Shelter with RCC Seats	BT
5	21+580	LHS	Steel Shelter with RCC Seats	BT
6	22+250	RHS	Steel Shelter with RCC Seats	BT
7	22+700	LHS	Steel Shelter with RCC Seats	BT
8	26+300	LHS	Steel Shelter with RCC Seats	BT
9	30+620	LHS	Steel Shelter with RCC Seats	BT
10	32+630	RHS	Steel Shelter with RCC Seats	BT
11	33+390	LHS	Steel Shelter with RCC Seats	BT
12	33+400	RHS	Steel Shelter with RCC Seats	BT
13	34+180	LHS	Steel Shelter with RCC Seats	BT
14	36+860	RHS	Steel Shelter with RCC Seats	BT
15	38+730	RHS	Steel Shelter with RCC Seats	BT
16	39+360	LHS	Steel Shelter with RCC Seats	BT
17	40+100	RHS	Steel Shelter with RCC Seats	BT
18	40+450	LHS	Steel Shelter with RCC Seats	BT
19	41+590	LHS	Steel Shelter with RCC Seats	BT
20	41+660	RHS	Steel Shelter with RCC Seats	BT
21	43+400	RHS	Steel Shelter with RCC Seats	BT
22	43+680	LHS	Steel Shelter with RCC Seats	BT
23	45+210	RHS	Steel Shelter with RCC Seats	BT
24	45+370	LHS	Steel Shelter with RCC Seats	BT
25	47+800	LHS	Steel Shelter with RCC Seats	BT
26	49+188	LHS	Steel Shelter with RCC Seats	BT
27	49+480	RHS	Steel Shelter with RCC Seats	BT
28	51+600	RHS	Steel Shelter with RCC Seats	BT
29	52+450	RHS	Steel Shelter with RCC Seats	BT
30	53+460	LHS	Steel Shelter with RCC Seats	BT
31	56+350	LHS	Steel Shelter with RCC Seats	BT
32	56+600	RHS	Steel Shelter with RCC Seats	BT
33	58+480	LHS	Steel Shelter with RCC Seats	BT
34	60+550	LHS	Steel Shelter with RCC Seats	BT
35	60+560	RHS	Steel Shelter with RCC Seats	BT
36	63+000	LHS	Steel Shelter with RCC Seats	BT
37	65+100	LHS	Steel Shelter with RCC Seats	BT
38	65+800	RHS	Steel Shelter with RCC Seats	BT
39	66+200	LHS	Steel Shelter with RCC Seats	BT
40	66+400	RHS	Steel Shelter with RCC Seats	BT
41	68+050	LHS	Steel Shelter with RCC Seats	BT
42	68+210	RHS	Steel Shelter with RCC Seats	BT
43	69+250	LHS	Steel Shelter with RCC Seats	BT

S.N.	Chainage	Side	Shelter Type	Remarks
44	69+250	RHS	Steel Shelter with RCC Seats	BT
45	71+680	LHS	Steel Shelter with RCC Seats	BT
46	71+500	RHS	Steel Shelter with RCC Seats	BT
47	73+200	LHS	Steel Shelter with RCC Seats	BT
48	73+650	RHS	Steel Shelter with RCC Seats	BT
49	76+900	LHS	Steel Shelter with RCC Seats	BT
50	77+100	RHS	Steel Shelter with RCC Seats	BT
51	78+050	RHS	Steel Shelter with RCC Seats	BT
52	80+300	LHS	Steel Shelter with RCC Seats	BT

6.2.10 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	30+400	RHS	NA	NA	Yes
2	52+555	RHS	NA	NA	Yes

Truck Lay Bye

6.2.11 Major and Minor Junctions

As per the site inventory, 5 major and 29 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas

Major Junction at KM 81+640	Minor Junction

6.2.12.1 Signage and Marking

Road Signs

Traffic Sign boards observed during the inventory of project road is in fair to poor condition. However, sign boards needed to be installed in many locations.

Sign Boards along the Project Road	

Road Marking

Road Marking along the project corridor was found to be in fair to Poor condition.

Road marking along the carriageway

6.2.12.2 Landscaping and Tree Plantation

Median plantation has provided at 2 m median and narrow median. Condition of median plantation is good in 2 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road

Plantation at Median

5.7 Inventory and Condition Survey of Structures

6.2.13 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they need maintenance to extend their design life.

As per site inspection it has been observed that

- There is no Major Bridge
- 7 nos. of Minor bridges having total length varies from 9 m to 43.50 m are generally found in good condition.
- 1 nos. of Underpass having span arrangement of 1 x 5 is found in good condition.
- There are 2 nos. of Railway over Bridge which are generally in good condition
- There is no of Flyover
- 89 (pipe/box) nos. of culverts found at site

6.2.14 Detailed Description of Structures

Minor Bridge

Salient features along with condition of 7 Minor bridges are discussed here.

a) Minor Bridge – CH.41+845

It consists bridge in both carriageways. Both the bridge have Span arrangement of 3x3 m, Super structure comprises of RCC Box. Superstructure is monolithically casted with RCC Walls of Box. Wearing coat and other general condition of the bridge is in good condition. Periodic maintenance of the bridge is to be done within definite time frame.

A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span arrangement

Superstructure is in fair condition

Minor Bridge at Ch. 41+845

b) Minor Bridge – CH.44+737

It consists of two bridge structures in each carriageway. Both the bridges Span arrangement of 2x6.0m, the super structure comprises of RCC Box and the. Superstructure is monolithically casted with RCC Walls of Box. Slope pitching is in poor condition. Wearing coat and other general conditions of the bridges are in good conditions. However, the periodic maintenance works should be done within definite timeframe.

A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 44+737

c) Minor Bridge – CH. 50+665

It consists of two bridges on each carriageway. The Bridges has Span arrangement of 3x3.0m, Super structure comprises of RCC Box and Superstructure is monolithically casted with RCC Walls of Box. There is

crack developed in parapet wall of the bridge which needs to be repair immediately. Wearing coat and other conditions of the bridge are good.

A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 50+665

d) Minor Bridge – CH.60+961

It consists of bridges on each carriageway. Both the bridge has a span arrangement of 2x10m, the super structure comprises of RCC Box, Superstructure is monolithically casted with RCC Walls of Box. Slope pitching is in fair condition. Minor repairing of wearing coat is required. MS barrier needs to be repair immediately. Other conditions of the bridges are good. As periodic maintenance, repairing of slope pitching and replacement of wearing coat is required.

A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 60+961

e)Minor Bridge – CH.61+726

It consists of bridge on each carriageway. Both the bridge has Span arrangement of 3x3.0m, the super structure comprises of RCC Box and the. Superstructure is monolithically casted with RCC Walls of Box. The

general condition of both the bridge is good. It requires regular repair works like repairing of drainage spouts, replacement of wearing coat etc. is required.

A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 61+726

f) Minor Bridge – CH.67+795

It consists of two bridges each on both the carriageway. LHS Bridge has a span arrangement of 2x10+1x20m. The super structure comprises of RCC Girder. The Foundation is open foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

RHS Bridge has a span arrangement of 1x43.50m. The super structure comprises of RCC Girder. The Foundation is pile foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment. Replacement of strip seal joint and wearing coat, minor repairing in the slope pitching is required. Other condition of the bridge is good.

A few pictures showing the conditions of Minor Bridge are presented as follows:

Span arrangement (RHS)

Span arrangement (LHS)

Minor Bridge at Ch. 67+795

g) Minor Bridge – CH.75+675

It consists of two bridges each on both the carriageway. LHS Bridge has a span arrangement of 2x10+1x20m. The super structure comprises of RCC Girder. The Foundation is open foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

RHS Bridge has a span arrangement of 1x43.50m. The super structure comprises of RCC Girder. The Foundation is pile foundation. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.

Slope pitching is in poor condition. The other condition of the bridge is good. As periodic maintenance, replacement of joint filler and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 75+675

h) Under-Passes (UPs)

There is only 01 PUPs with single span of 1 x 5 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs is generally in good condition with some minor damages. A few pictures to ascertain the conditions of PUPs are presented as follows:

View of Carriageway

Span Arrangement

Super structure in fair condition

UP at Ch.54+030

i) Railway over Bridge (ROBs)
ROB at Ch. 48+625

It consists of two bridges each on both the carriageway. LHS Bridge has a span arrangement of 2X11+12x24+6X12+1X32m.The super structure comprises of PSC Girder. The Foundation is Pile foundation. POT-PTFE bearings are adopted for resting of superstructure on RCC abutment & Circular Pier.

RHS Bridge has a span arrangement of 1X4+1x3+1x8+15x24+1X18+1X16+1X43m. The super structure comprises of PSC Girder and Steel Girder. The Foundation is pile foundation. POT-PTFE bearings are adopted for resting of superstructure on RCC abutment and Circular pier.

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Super structure in fair condition

Super structure in fair condition

ROB at Ch. 48+625

j) ROB at Ch. 81+230

It consists of a road over bridge over which both the carriageway passes. The bridges have Span arrangement of 15X24+1X18+1X46 m, the super structure comprises of PSC Girder and Steel Girder, and the Foundation is Pile foundation. POT-PTFE bearings are adopted for resting of superstructure on RCC abutment and circular pier.

The general condition of both the ROB is good. It requires regular repair works such painting and repairing of Cross Barrier, repairing of drainage spouts etc. A few pictures to ascertain the conditions of ROB are presented as follows: -

Span Arangement

Span Arrangement

Super structure in fair condition

Abutment

ROB at Ch. 81+230

k) Grade Separators (Flyover)

There aren't any flyovers on both carriageways.

2.3.2.6 Culverts:

There are 89 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone

6.2.15 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
1	41+845	LHS	3x3	12.5	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	3x3	12.5			●	●	●			●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
2	44+737	LHS	2x6.0	12.5	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x6.0	12.5			●	●	●			●	●	●	●			Stable	
3	50+665	LHS	3x3	12.5	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	3x3	12.5			●	●	●			●	●	●	●			Stable	
4	60+961	LHS	3x7	12.5	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	3x7	12.5			●	●	●			●	●	●	●			Stable	
5	61+726	LHS	6x6	12.5	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	6x6	12.5			●	●	●			●	●	●	●			Stable	
6	67+795	LHS	2x10+1x20	12	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super	Bearings	Expansion	Protection	Safety	Wearing Coat	Approaches		Drainage Spouts	
		RHS	1x43.50	12			●	●	●	●	●	●	●	●	●		●	Stable	
7	75+675	LHS	2x10+1x20	12	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x43.5	12			●	●	●	●	●	●	●	●	●		●	Stable	
8	154+030	LHS	1X5	22	UP	NA	●	●	●			●	●					Stable	
		RHS	1X5	22			●	●	●			●		●				Stable	
9	48+625	LHS	2X11+12x24+6X12 +1X32	12	ROB		●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1X4+1x3+1x8+15x 24+1X18+1X16+1X 43	12			●	●	●	●	●	●	●	●	●		●	Stable	
10	38+960	LHS	1X11.5(Sk)	28	VUP	NA	●	●	●		●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

Mahua Bharatpur Expressways Limited

Report Number:

ACM-60657056-TDD-LRTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Mahua Bharatpur Expressways Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("Trust"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Mahua Bharatpur Expressways Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Mahua Bharatpur Expressways Limited

5th Floor, OSE Commercial Block, Hotel Aloft
Asset No. 5B, Aerocity Hospitality District
IGI Airport, New Delhi 110 037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

LIST OF ABBREVIATION II

1. EXECUTIVE SUMMARY 3

1.1 Basis of Preparation 3
1.2 Overview of the Project 4
1.3 Key Findings 5
1.4 Asset Condition 8
1.5 Toll Plaza and TMS 11
1.6 Change of Scope (COS) 11
1.7 Balance Work 12
1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement 12
1.9 Insurance 13
1.10 Introduction of Asset 14
1.11 Review of Pavement 16
1.12 Major Maintenance 20
1.13 Operation & Maintenance Works 21
1.14 Major Maintenance Cost 23
1.15 List of Document Reviewed 23

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS 25

2.1 Background 25
2.2 Pavement Design 25
2.3 Survey and Investigations 26
2.4 Determination of Pavement Major Maintenance 39

3 MAJOR MAINTENANCE COST 41

3.1 Major Maintenance Cycle 41
3.2 Major Maintenance Quantity 41
3.3 Unit Rate Analysis 41
3.4 Cost Estimate 44

4 OPERATION AND MAINTENANCE COST 46

4.1 Introduction 46
4.2 Forecast Methodology 46
4.3 Requirement of CA (Schedule L and Concession Agreement) 47
4.4 Routine and Preventive Maintenance 47
4.5 Highway Lighting 48
4.6 TMS Cost and ATMS 48
4.7 Corridor Management 48
4.8 Manpower Cost 48
4.9 Office Expenses 49

5 PROJECT ROAD ANALYSIS 51

5.1 Reconnaissance Survey 51
5.2 Road Inventory and Condition Survey 51
6.3 Toll Plaza and Associated Facilities 67
6.4 Inventory and Condition Survey of Structures 76

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract	FWD	Falling Weight Deflectometer
ATMS	Advanced Traffic Management System	GAD	General Arrangement Drawing
BC	Bituminous Concrete	GSB	Granular Sub-base
BHS	Both Hand Side	GST	Goods and Services Tax
BI	Bump Integrator	HSYD	High Yielding Strength Deformed
BOQ	Bill of Quantity	INR	Indian Rupees
BT	Bituminous Top	IRC	Indian Road Congress
CA	Concession Agreement	ITM	Integrated Traffic Management
CAPEX	Capital Expenditures	KVA	Kilo-Volt-Ampere
CC	Control Centre	LCV	Light Commercial Vehicle
CCTV	Closed Circuit Television Systems	LED	Light Emitting Diode
CMSA	Cumulative Million Standard Axles	LHS	Left Hand Side
COS	Change of Scope	LIU	Light Interface Units
COD	Commercial Operation Date	LVUP	Light Vehicular Underpass
CUP	Cattle Underpass	MAV	Multi Axle Vehicle
DBM	Dense Bituminous Macadam	MBEL	Mahua Bharatpur Expressways Limited
DG	Diesel Generator	MCA	Model Concession Agreement
DLC	Dry Lean Concrete	MCW	Main Carriageway
ECB	Emergency Call Box	MDS	Metrological Data System
EPC	Engineering, Procurement, and Construction	MET	Metrological
ESAL	Equivalent Standard Axle Load	MIS	Management Information System
ETC	Electronic Toll Collection	MJB	Major Bridge
EW	East West	MNB	Minor Bridge
FO	Flyover	MoRTH	Ministry of Road Transport and Highways
FOB	Foot Over Bridge	MSA	Million Standard Axles

MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Mahua Bharatpur Expressway Limited ("MBEL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways and MBEL (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Bharatpur – Mahua Section of NH – 11 (New NH No 21) on BOT Basis in the State of Rajasthan (herein after refer as "the Project") which is being operated by "M/s Mahua Bharatpur Expressway Limited" (hereinafter refer as "the Concessionaire or Company or MBEL").

2.1.1 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.

In this report, AECOM provides an overview of the asset from technical perspective, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.

Further documents/test report received from Cube Highways and accordingly report is updated as March 2022.

2.1.2 Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

a) Project Document

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- O and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepared by IE
- Test Report
- Traffic Data

b) Test Report

- Axle Load Survey Data with VDF
- NSV Survey Data
- FWD Test Report with analysis
- Test Pit and Core Test Report

Apart from data room, information / data provided thorough email has also reviewed and included in this report.

2.1.3 Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.2 Overview of the Project

Agreement was signed between National Highways Authority of India (NHAI) and M/s Madhucon Agra- Jaipur Expressways") on 13 Oct 2005 for Improvement, Operation and Maintenance, Rehabilitation and Strengthening of the existing 2-lane and widening it to 4-lane divided highway of Bharatpur – Mahua Section of NH 11 (New NH No 21) from Km 63.00 to Km 120.00 in the state of Rajastan on BOT (hereinafter called "the Project") basis. We understand that Cube Highways Group acquired the SPV MAJEL in the year 2016 and has been operating the project road since year 2016.

Project Corridor	Four Laning of Bharatpur – Mahua Section of NH – 11 (New NH No 21) on BOT Basis in the State of Rajasthan
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways
Concessionaire	Mahua – Bharatpur Expressways Ltd.
Independent Engineer (During O & M)	M/s Theme Engineering Pvt. Ltd.

EPC Contractor	M/s Madhucon Projects Ltd.
Project Road Length	57.305 km
Project Cost	250 Crore (as per IE MPR Sep 2019)
Grant	96 crores
Date of Concession Agreement	13 Oct 2005
Appointed Date	10 Apr 2006
Concession Period	25 years including Construction Period
Construction Period	30 months
Schedule Date of COD	9 Oct 2008
Extended PCOD	6 Nov 2009
PCOD	8 May 2009
COD	13 Sep 2009
O & M Contractor	For Toll Collection, Incident Management: M/s Markolines Traffic Controls Pvt. Ltd
Number of Toll Plaza and Lanes	2 nos each plaza having 10 lanes including extra width
End of Concession Period	9 Apr 2031

Source: IE MPR Sep 2019, O & M Contracts, Concession Agreement

1.3 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (COD)	PCOD was issued on 8 May 2009 within extended completion date and Completion Project completion certificate issued on 13 Sep 2009. COD was issued 128 days from PCOD	🟢
Operation and Maintenance	As per Section XVIII of Concession Agreement, Concessionaire shall maintain project highway in conformity with Maintenance Requirements, the Maintenance Manual or Maintenance Program as the case may be. Concessionaire is fulfilling O & M obligations and there is no adverse comment from IE. As per O & M Inspection Report pursuant to Sub Clause 19.2 of Concession Agreement prepared by IE, Concessionaire is advised to carryout day to day routine maintenance activity no major defects has identified. Concessionaire has appointed various agencies for carrying out Operation and Maintenance of project. As per AECOM assessment average O & M cost per year 16.05 crore.	🟢
Major Maintenance (MM)	As per Schedule L, BC of 25 mm thickness as renewal coat, is required when surface roughness is exceeding 3000 mm / km to bring it to less than 2000 mm and structural overlay is required when characteristic deflection exceeds 0.80 mm.	🟠

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td></td><td>As per Sub Clause 4.3.2.3 of Schedule L, renewal / strengthening course to be provided on as required basis (once 5 years). Concessionaire has carried out Major Maintenance in year 2018 / 2019 through agency M/s Markolines . MM cycle along with escalation cost for balance concession period shall be:
1) Year 2023/24 - MM Cost 61.52 crores
2) Year 2028/29 – MM Cost 67.62 crores
3) Year 2031 – MM Cost 57.42 crores</td><td></td></tr>
<tr><td>Maintenance Manual and Yearly Program</td><td>As per Article 18.3 of Concession Agreement, Concessionaire required to submit proposed Programme not later than 45 days before beginning of each accounting year. Concessionaire has submitted Maintenance Program for Year 2012/23.</td><td>●</td></tr>
<tr><td>Pavement Design</td><td>Pavement design has done for 20 year of design traffic as per IRC 37 – 2001 considering 8 % CBR. Key fact of pavement design is as follows:
- Pavement design for 20 years
- Design Traffic 100 MSA till year 2027
- Total Traffic till year 2031 – 132 MSA
Adopted Pavement thickness: BC – 50 mm, DBM 140 mm, WMM -250 mm and GSB – 230 mm. Adopted pavement design for MCW is in line with the Sub Clause 5.0 Pavement Design of Schedule D.
Pavement design for Service Road is to be designed for 25 MSA as per Schedule D. Pavement design report for service road is not available for comment / review.</td><td>●</td></tr>
<tr><td>Pavement Condition</td><td>As per Roughness Survey carried out by M/s V R Techniche Consultants Private Limited in the month of Feb 2022, the project road is in Good to Fair condition. The summary of test is presented below:
<table>
<tr><th rowspan="2">Riding Condition</th><th rowspan="2">Roughness Index (mm/km)</th><th colspan="2">Length (in km)</th></tr>
<tr><th>LHS</th><th>RHS</th></tr>
<tr><td>Good</td><td><2000</td><td>44.4</td><td>52.6</td></tr>
<tr><td>Fair</td><td>2000-3000</td><td>13</td><td>4.8</td></tr>
<tr><td>Poor</td><td>>3000</td><td>0</td><td>0</td></tr>
</table></td><td>●</td></tr>
<tr><td>Pavement Condition Survey Test</td><td>As per Sub Clause 3.4.2.2 of Schedule L, roughness value to be measured at least twice in a year (before monsoon in the month of April and after monsoon in the month of Oct) and BBD survey is to be carried out every year as per IRC 81. Concessionaire has conducted FWD Survey in Dec 2020.</td><td>●</td></tr>
<tr><td>Penalty</td><td>Former Concessionaire was levied penalty due to non-compliance on O & M obligations (Major Maintenance). It is understood all penalty has settled by former Concessionaire before acquisition of project by the Client.

As per IE MPR Apr 2019 onwards, Penalty has issued vide letter No 626 dated 1 May 2019 due to failure of Concessionaire to remove encroachments. Penalty amount recommended by IE as of 1 May 2019 is 9.80 lakh.</td><td>●</td></tr>
<tr><td>Change of Scope</td><td>NHAI issued COS notices to the Company Pursuant to Article 17 of the CA for following Items:</td><td>●</td></tr>
</table>

Diligence Area	Findings	Risk
	1) COS of Rs. 1.38 crore towards installation of Hybrid ETC lane of all lanes of Toll Plaza 2) COS of Rs. 25.87 lakh towards construction of 2 nos Highway Nest at each Toll Plaza 3) COS of Rs. 35.18 lakh for Toilet Block 4) COS of Rs. 2.99 crore towards installation of WIM and SWB As per information provided by Project Site Team, all above COS has executed and payment received from NHAI. COS under Proposal: - Updating incident management as per NHAI Circular dated 20 Mar 2018 - Service road for Built Up area Halna	
Balance Work	COD was granted on 13 Sep 2009 stating project road has been completed successfully and tested as per Schedule J of Concession Agreement. All works as per Concession Agreement There is no balance work.	
Toll Plaza and TMS	There are two toll plazas along project corridor at Km 81+500 (TP 1) having 5 + 5 lanes and Km 98+500 (TPS 2) having 5 + 5 lanes. Flexible pavement has provided at tapper portion and center portion of toll lanes has provided with rigid pavement. Existing rigid pavement at Toll Plaza Km 98+500 is in poor condition, the same has been repaired by Microsurfacing. Plaza office at TP2 was under renovation at the time of site inspection. TMS at both toll plaza installed in year 2018 by M/s Bhari and tolling is continuing with current equipment. The existing system is in order and do not envisaged any issue. The replacement of system is expected in Year 2025 and Year 2031.	
Major Issue Identified by IE	As per IE MPR there is no major issues in the project. Current issue as per IE MPR is as follows: 1. Avenue Plantation: required proper maintenance to arrest the increasing Mortality Rate and fencing required around new avenue plantation 2. Encroachment – Penalty issued as per letter no. 626 dated 1 May 2019	
Road Safety	Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement. As noticed in IE MPR, there is no Black Spot in project road. and Concessionaire has not maintained properly (ref: IE letter dated 11 May 2018). As per AECOM site visit, following additional measures are recommended to enhance safety for road users: • Vertical drop between MCW and Bus bays to be removed • Provide blinkers at all median opening (13 nos out of 33 nos do not have blinkers) • Provide missing median plant to reduce glare affect during night • Wrong placement of Sign Board • Service Road at Built Up area (Halena, Tilchui etc.)	

Diligence Area	Findings	Risk
	• Hump at toll plaza (TP 2) to be rectified including rectification on island • Provide PGR between MCW and SR at all locations • Antiglare arrangement at narrow median (width less than 2 m) Safety Audit through independent agency (M/s VR Tech) has conducted in the month of Aug 2018. It is recommended to implement suggestion made by the Safety Consultant.	
Geometric Design	The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows: Design Speed – 100 kmph, Minimum Radius 400 m as ruling and 250 m as absolute minimum, K value for Summit Curves 70 and Valley Curves 42 for Stopping Sight Distance. Project road confirms requirement of Schedule D.	●
As-Built Drawing	As per provision of Contract Sub Clause 33.2 (iv), the Concessionaire is to deliver relevant records and reports pertaining to the Project Highway and its design, engineering, construction, operation and maintenance including all and all operation and maintenance records and programmes and manuals pertaining thereto and complete As-Built Drawing on the Date of Divestment. Soft copy has provided and found to be in order and site team confirms having of Signed As-Built Drawing at project office at TP 1.	●
Handback requirement	As specified in Schedule L, all defects and deficiencies specified in this Schedule –L shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date. Also following specific requirement has stated in Schedule L • Overlay to be carried out in the last year of Concession Period (Ref. Schedule L Sub Clause 3.3.7, Carriageway) • Characteristic deflection shall not be less than 0.50 mm (Ref: Schedule L Sub Clause 3.4.2.5, Structural Condition Survey) • Roughness value shall be less than 2500 mm / km (Ref: Sub Clause 33.2 of CA) As stated in Article 34.11, from the date which is 2 years prior to the expiry of the Concession Period a sum equal to the fess realisable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or a higher a sum estimated by the IE for renewal works, shall be retained in Escrow Account or a Bank Guarantee of equal amount to be furnished to NHAI.	●

1.4 Asset Condition

In general, the condition of asset is in Good condition at the time of survey as of Oct 2019. As per AECOM study, with existing arrangement for Operation and Maintenance and with every 5 years cycle of Major Maintenance (Overlay) cycle, project road will continue to fulfill Level of Service as set forth in Schedule L and requirement of Article 18 of Concession Agreement except following improvements are required:

- Removal of encroachments
- Enhance avenue plantation preservation system
- Safety enhancement
- Roughness Survey and BBD Survey to be conducted as per frequency stated in Schedule L

The summary of asset condition (as of Oct 2019) is tabled as follow:

Sn	Asset	Condition
1	Main Carriageway	Project road is four lane having paved width of 2 x 9 m along at grade section and 2 x 11 m at approach of grade separated structures. The pavement condition of existing pavement is in Good condition.
2	Service Road	5.50 m width of service road has provided at approach of Grade Separated Structures and at built up area. Total one side length of 14.410 km has provided as service road. The condition of service road is in fair condition except from Km 82+000 to Km 82+600 is in poor condition.
3	Median	4.5 m raised median along rural sections and 1.5 m raised median along Built Up area and approach of grade separated structures has provided. Median plantation in rural areas (4.5 m width) is in order however plantation at narrow median (1.5 m width) is required additional plant to reduce glare effect. It is suggested to provide metal beam crash barrier at narrow median to enhance safety.
4	Median Opening	33 nos of Median openings have provided out of which 19 median openings are with shelter lanes and remaining 14 nos of median opening are without shelter lanes. Solar blinkers has provided 20 nos of median opening and 13 nos of median openings are without blinkers. It is suggested to provide blinkers are all median opening as all median openings are safety hazard.
5	Drainage arrangement	Lined drain has provided between Main Carriageway and Service road at built up area and at outer edge of slip road at approach of grade separated structures (FO, PUP / CUP). Maintenance of existing at built up area is in poor condition which required cleaning for effective drainage system. Existing drainage system along rural area is in order.
6	Major and Minor Junctions	2 nos of major junctions and 36 nos of minor Junctions are found along project road.
7	Safety Barrier	17.46 km of Metal Beam Crash barrier and 4.21 km of RCC crash barrier has provided at site. Existing metal beam crash barriers are found in fair condition, except at 25 m length found to be damaged and 109 m gap has observed in between. Such damage accounts for 1% of the total length of barrier found in site.
8	Pedestrian Guard Rail	Pedestrian Guard Rail has provided in between MCW and SR at built up area to guide pedestrian safely to cross road at designated location. As per Inventory condition survey report 6905 m is found at site and 435 m is missing / damaged required rectification.
9	Toll Plaza	Km 64+570 at Ludhawali (TP 1): - (4+1) lanes in each direction Km 98+500 at Amoli (TP 2): - (4+1) lanes in each direction Existing toll plaza including administrative building, TMS are in order and complying project requirement. Existing rigid pavement at TP 2 is in poor condition which required repaired by Microsurfacing.

Sn	Asset	Condition
10	Highway Lighting	Highway lighting has provided at approach of Toll Plaza, approach of major Junction at median. 22 nos of High Mast has provide at Toll Plaza, ROBS, Major Junctions and Flyovers. Existing condition of highway lighting is in order.
11	Bus Bays and Bus Shelters	42 nos of bus bays with shelter has observed at site and conditions of bus bays and shelters are found to be in good condition.
12	Truck Laybys	4 nos of truck laybys has been provided with facility of toilets and drinking water facilities. The facilities as provided confirm requirement of Schedule C of CA.
13	Traffic Sign and Marking	649 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good except 20 nos of sign boards are required to be replaced with new. Road Marking along the project corridor was found to be in good condition.
14	Major Bridge	1 no of Major Bridge having span arrangement of 7 x 39.75 + 1 x 40.25 (total length of 318.5 m) has constructed and structural condition of bridge is "Good". Drainage Spout cover and elastomeric strip seal are found to be defective which are required to be provided.
15	Minor Bridge	4 numbers of Minor Bridge are in fair to good condition. Maintenance / cleaning of Expansion Joint, drainage spouts and protection work are required.
16	Flyover	1 No of ROB having span arrangement of 1x12+2x16+1x12 (total length 56 m) is found structurally sound condition. Cleaning of expansion joint / replacement elastomeric strip seal, replacement of drainage spout and 2 m length of railing are required to be replaced.
17	PUP	5 Nos of PUP are structurally in good condition. It is noted expansion joint of PUPs are covered by bituminous wearing coat which are required to be clean.
18	ROB	1 No of ROB having span arrangement of 1X14.56+1X23+1X14.56 is found in good condition. Cleaning of expansion joint and replacement of elastomeric strip seal, replacement of drainage spout is required.
19	Cross Drainage	Total 25 nos of cross drainage structures has found and condition of structure are found to be in order. It is noticed some of culverts are blocked and vent cleaning is required.

The project road has been visited by Consultant's team of engineers in the month of Dec 2020.

Note: The project road has a long operational history and we had forecasted the operations & maintenance costs/ strategies for the entire balance concession period primarily based on i) the original pavement design during construction phase, ii) the various investigations and surveys carried out to assess the technical performance and quality of the project road and iii) other information provided to us by the Client and we don't expect any material change in operations & maintenance costs/ strategies year on year.

1.5 Toll Plaza and TMS

Toll Plaza including collection and TMS is operated / maintained by MBEL. Existing TMS is installed by M/s Bhari Infra in Year 2018. Existing system is as per requirement of applicable Manual all equipment are found to be working condition.

NHAI issued circular on 30 Nov 2017 for installation of Hybrid ETC lane at all toll lane and NHAI shall borne all cost of equipment and O & M cost under COS. Concessionaire has installed Hybrid ETC system at all toll lanes and MSWIM under COS. Existing toll lane configuration with type of equipment is summarized as follows:

Item	TP 1	TP 2
Total Number of Lane	10	10
Total number of Regular Lane	8	8
Total Number of Extra Width Lane	2	2
Tolling Equipment		
Number of Dedicated ETC Lane	-	-
Number of Hybrid ETC Lane	10	10
Number of Reversible Lane	-	-

As per AECOM assessment total cost of TMS System is approximately 4.54 crore. The life TMS equipment is considered 7 years and 70 % of cost of TMS is forecasted as replacement cost which will occurred in every 7 year i.e. in Year 2025 and 2031 (at the end of Concession Period).

1.6 Change of Scope (COS)

As per Article XVIL, NHAI may, notwithstanding anything to the contrary contained in the Agreement, require provision of such addition / deletion to the works and services on or about the Project Highway which are beyond the scope of Project as contemplated by the Agreement. All such changes shall be made by NHAI by an order ("the Change of Scope Order"). The list of COS along with status of COS order is tabled below:

Sn	Description of Work	Status of COS Order	Amount	Work Status	Remarks
1	Implementation of Hybrid ETC Lane of all lanes of Toll Plaza	IE recommended to NHAI. COS order from NHAI pending	1.37 crore	Completed	
2	Development of Platform for highway Nest including filing of Concrete Paver Block	Concessionaire submitted cost estimate to PD, NHAI	25.85 lakh	Completed	
3	Construction of Toilet Block	COS order issued by NHAI	35.18 lakh	Completed	
4	Providing MSWIM and SWB	COS order issued by NHAI	2.99 crore	Completed	

As per information received from site management proposal for following work is initiated under COS:

1. Construction of Service Road at Built Up Area Halna
2. Updating incident management as per NHAI Circular dated 20 Mar 2018

Detail of COS is not available for further comment.

1.7 Balance Work

All work has completed as per Scope of Works under this Contract and there is NO balance work.

1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule L, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

i) Ensure the safety of personnel deployed on and users of the project facilities or part thereof
ii) Keep the Project Facilities from undue deterioration and wear
iii) Permit unimpaired performance of statutory duties and functions of any party in relation to

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule L elaborates requirement various service factor desirable level and acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (overlay) is required to be provided at least once in every 5th year (from COD) and in the last year of concession period. Also, overlay is required if Characteristic Deflection is more than 0.80 mm and roughness value exceeded more than 3000 mm / km.

Structural overlay is required if design MSA is less than anticipated MSA till end of Concession Period. As per Pavement design report, anticipated MSA till end of Concession Period (i.e. year 2031) is 132 MSA and pavement design adopted during construction for 100 MSA (till Year 2027) therefore structural overlay is required in year 2027 for 32 MSA.

1.8.1 Staff Requirement

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at Toll Plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.8.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	Out source
2	Preventive Maintenance	Out source
3	Operation cost of Toll Plaza and Administration Building	In house
4	Security of Toll Plaza and Cleaning	Out Source
5	Highway Lighting	Out Source / AMC
6	Maintenance of ATMS / TMS	Out Source AMC
7	Corridor Management	Out Source
8	Major Maintenance	Out Source

1.8.3 Handback Requirement

As per Clause 33.2 of Concession Agreement, all project assets including the road, pavement, structure and equipment shall have been renewed and cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in this Agreement. All sections of traffic lane shall have a roughness value not more than 2500 mm and characteristic deflection shall not be more than 0.50 mm. To satisfy above requirement, 40 mm BC overlay is required at end of Concession Period.

Also, NHAI shall hold a sum equal to the Fees realisable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or higher sum estimated by the IE for renewal works shall be retained in Escrow Account provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, no such retention shall be made.

1.9 Insurance

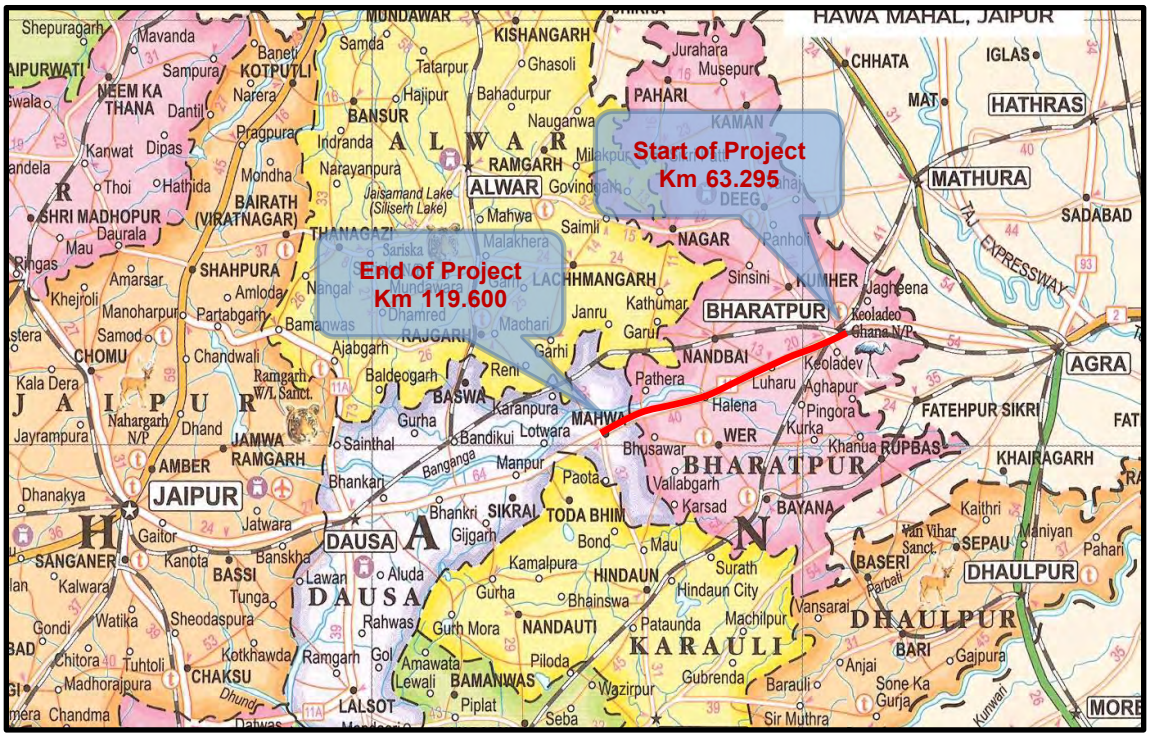
As per Sub Clause 27.2 of Concession Agreement, Concessionaire shall obtain and maintain at no cost to NHAI during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Industrial All Risk Insurance Policy Schedule
2	Burglary – Standard Policy Schedule
3	Electronic Equipment Insurance
4	Standard Fire & Special Perils Policy
5	Money Insurance Policy
6	Business Interruption (FIRE) Policy
7	Policy Schedule For Fidelity Guarantee
8	Policy Schedule for Public Liability
9	Policy Schedule for Package Insurance Policy

1.10 Introduction of Asset

1.10.1 Project Corridor

The project road is a section of National Highway No. 21 New (NH 11 Old) start from KM 63 at Bharatpur to KM 120 at Mahua. NH 21, one of the major arterial road of the country originates from Bareilly in Uttar Pradesh and ends at Jaipur in Rajasthan. The total length of highway is 465 km. Agra to Jaipur Section was known as NH 11 before MORTH new numbers of highway in year 2010. Major cities along NH 21 are Budaun, Agra, Bharatpur and Dausa. The project road starts Km 62.295 at Bharatpur and ends at Km 119.600 at Mahua. The total length of the project road is 57.305 km. The project corridor is shown in map below.



Location Map

Project Start KM 63+295

Project End KM 119+900

1.10.2 Salient Features of the Project:

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	57.305 km	57.305 km
Carriageway	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of VUP / PUPs and 2 x 13.50 Paved Width) FO Approach	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of VUP / PUPs and 2 x 13.50 Paved Width) FO Approach
Shoulder	2.0 m earthen for MCW at Rural Area	2.0 m earthen for MCW at Rural Area
Service Road / Slip Road	11.90 km one side length having width of 5.50 m	14.41 km one side length having width of 5.50 m Additional Service Road of 2.510 km found at site
ROW	45 m	45 m (approx.)
Major / Minor Junction	3 Nos Major	3 / 36 Nos
RCC Drain	Covered drain at Urban Section and open pucca drain between MCW and SR	RCC Drain 13.020 km as per Site Inventory
Median Opening		33 Nos
Toll Plaza	2 Nos	2 Nos
Truck Lay-bys	2 Nos at each sides (4 Nos Total)	2 Nos Lay Bys on both sides (4 Nos)
Bus Bays with shelter	21 Nos at each side (42 Nos Total)	21 Nos at each side (42 Nos Total)
Highway Lighting	Rest Area, Toll Plaza and Interchanges	Provided as per Schedule C (Total 43 nos of Double Arm lighting provided)
High Mast	At Major Junctions, ROB / Flyover	Provided as per Schedule C (22 nos of high mast provided)
Highway Patrol		2 Nos
Ambulance		1 Nos
Crane		1 Nos
Traffic Aid Post	At Toll Plaza 1	At Toll Plaza 1
Medical Aid Post	At Toll Plaza 1	At Toll Plaza 1
Vehicle Rescue Post	At Toll Plaza 1	At Toll Plaza 1

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	1 No	1 No
Minor Bridge	4 Nos	4 Nos
Flyovers	1 No	1 No
ROB and RUB	1 No	4 No
VUP	5 Nos	5 Nos
Culverts	23 Nos	25 Nos

1.11 Review of Pavement

Pavement Design

During construction of road, pavement deign was carried out for 100 MSA till year 2027 (20 years design traffic) whereas Concession Period ends at Year 2031. Summary of Report is presented as below:

Section	Design Traffic in MSA for Full Concession Period	Design Traffic MSA	CBR	Pavement Thickness (mm)			Remarks
				BC	DBM	WMM + GSB	
Entire Length	132	100	8 %	50	140	480	

The proposed design at the time of construction confirms requirement of Concession Agreement.

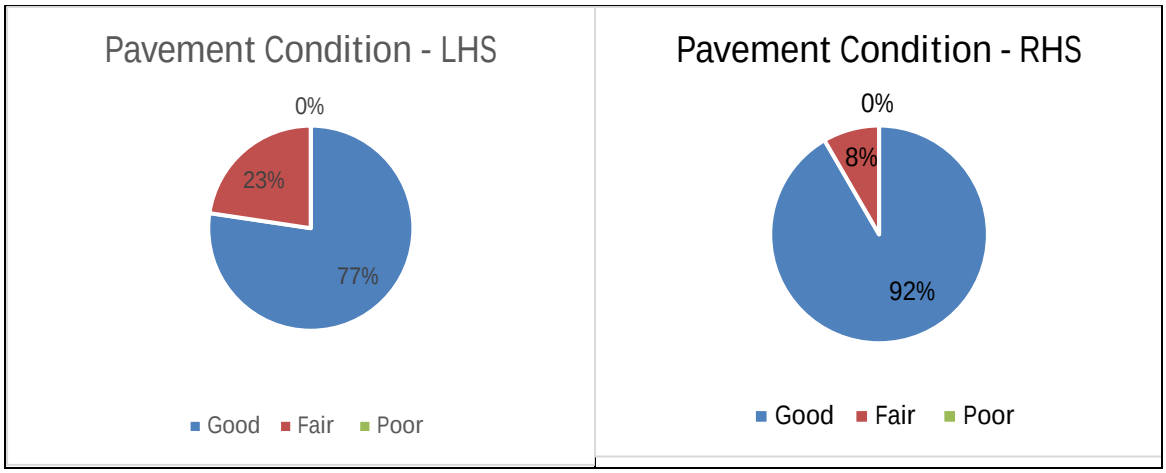
Analysis of Existing Pavement Condition

To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

a) Roughness Survey: Roughness Survey was carried in January 2022 before recently completed MM works. Pavement classification done as per following criteria:

Good - less than 2000 mm / km
Fair -2001 to 3000 mm / km
Poor – above 3000 mm / km

Graphical presentation of roughness survey report is appended below:



LHS – Bharatpur to Mahua *RHS - Mahua to Bharatpur*

b) Analysis of Existing Pavement – FWD Test

Evaluation of existing pavement using Falling Weight Deflectometer (FWD) survey was carried out in year dec 2020 before carrying out MM. FWD provides deflection of existing pavement under dynamic loads by simulating actual wheels in both response and duration. FWD survey has carried out along entire length of project road and remaining life of pavement found to be 5.1 MSA to above 200 MSA. Summary of FWD Survey report is presented as below:

Detail for Km 62 to Km 93

MSA	LHS	RHS
less than 10 MSA	1.0	.07
10 to 152 MSA	6.8	11.9
above 152 MSA	23.0	18.2
Total Tested Length	30.8	30.8

Details for km 93 to Km 119.6

MSA	LHS	RHS
less than 10 MSA	0.1	0.0
10 to 152 MSA	3.4	3.4
above 152 MSA	23.1	23.2
Total Tested Length	26.6	26.6

Note: Required remaining life of pavement till end of Concession Period for HS-1 is 84.69 MSA on LHS and 162.88 MSA on RHS and for HS-2 is 102 MSA on LHS & 146.4 MSA on RHS.

c) Test Pit

Ten (10) numbers of test pit results were provided to assess the existing pavement crust composition. Abstract of existing subgrade test result is as follows:

- Degree of compaction 86.8 % to 96.2 %
- Free Swell Index 0 to 11
- Four days Soaked CBR 8.6 to 15.2

Design CBR is 8 and existing subgrade CBR is more than 8 thus confirms requirement.

d) Core Test

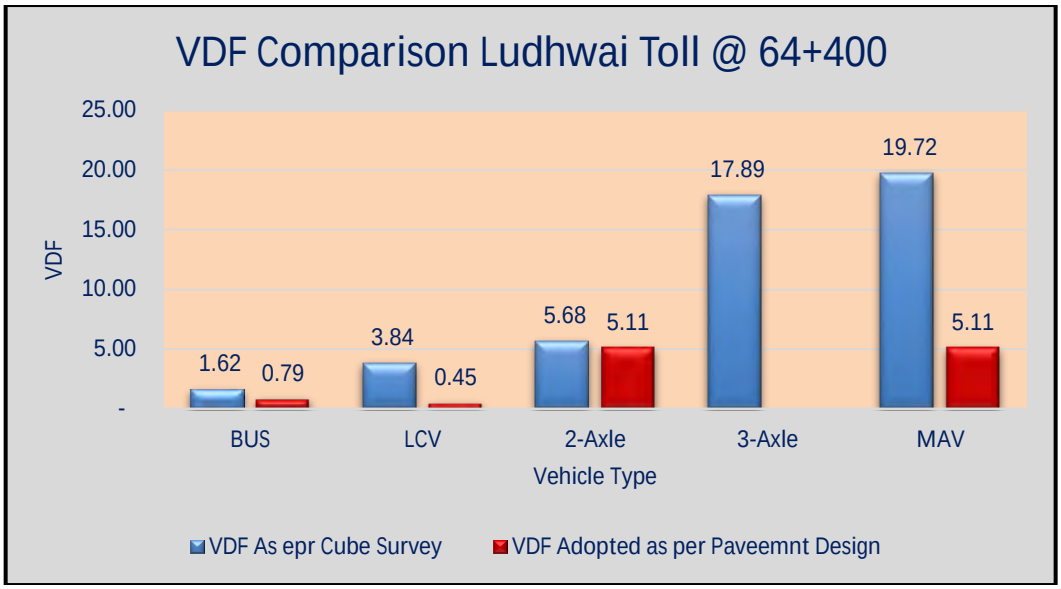
Thickness of existing pavement layers has provided based by conducting Core Test and test pit. Furthermore, the core samples and granular material (base and subbase layers) were also taken for laboratory test in order to determine various material properties such as bitumen content, aggregate properties of bituminous layers etc. The test result is summarized as below:

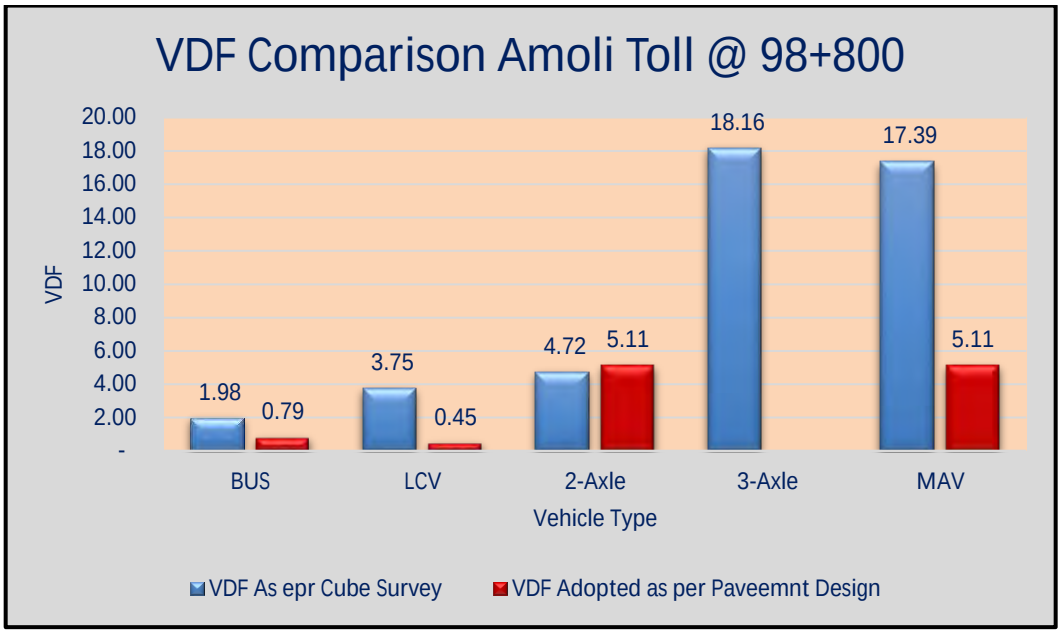
- Pavement Thickness –
  - based on Core Cutting bituminous layer thickness 140 mm to 290 mm. Thickness shown in imperfect core has not taken into account.
  - based on test Pit Bituminous layer thickness 220 mm to 310 mm
  Design thickness 190 mm.
- % of bitumen – 4.42 % to 4.81 % in DBM and 5.09 % to to 5.41 %
- Thickness of Granular Layer (GSB + WMM) – 380 mm to 460 mm (Design Thickness 480 mm)

From the test result, granular layer thickness is less than as designed.

e) Axle Load Survey

VDF as adopted during pavement design and VDF as per current Axle Load Survey data conducted in Year 2018 at Toll Plaza 1 (TP1 VDF) and Toll Plaza 2 (TP2 VDF) are presented as below:



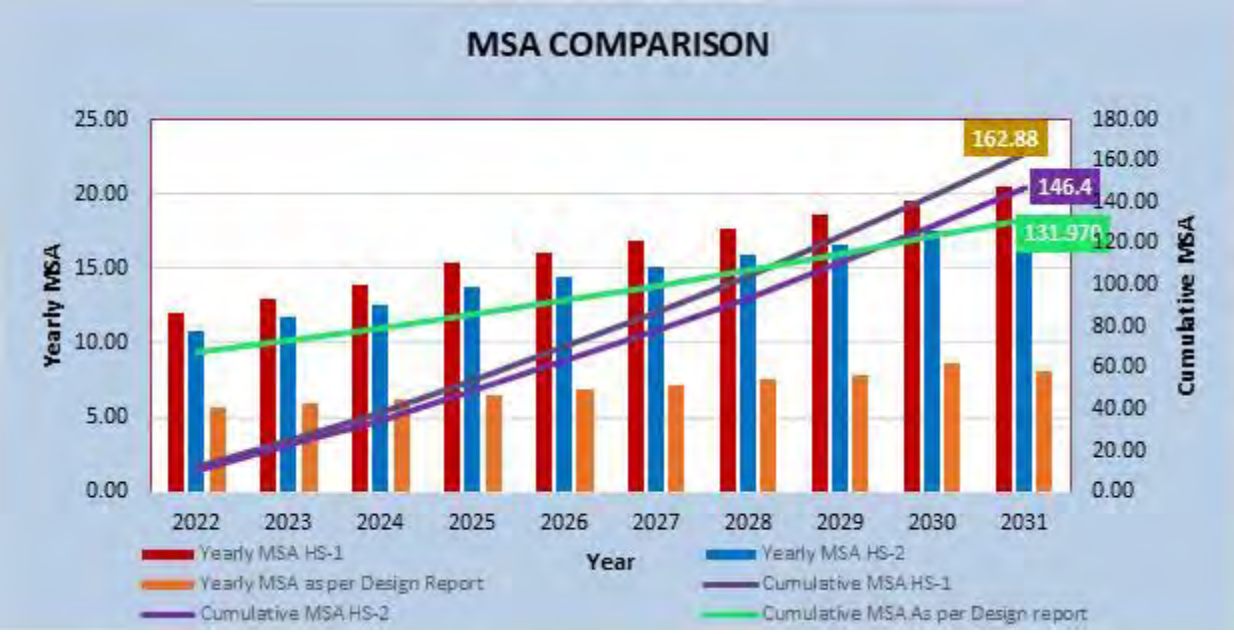


f) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from Year 2019 to Year 2031

Homogenous Section	Location		As per Pavement Design	Traffic	
	From	To		LHS	RHS
HS -1 (TP 1)	63+295	92+000	81	84.69	162.88
HS-2 (TP 2)	92+000	119+600	81	102.0	146.4



AECOM is in the opinion that considering existing pavement condition, year of construction and roughness index, immediate rehabilitation is required at distressed location and structural overlay is to be provided where remaining life of existing pavement is less than design life.

1.12 Major Maintenance

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. It is noted that Concessionaire has carried out MM in Year 2018 / 2019 which is summarized below:

MM Work in Year 2018 / 2019

Chainage		Length	LHS	RHS
From	To	(km)	Both Lane	Both Lane
62+295	68+000	5.705	30 mm BC (with rehabilitation where require) / Micro-surfacing (Profile correction does not warrant as well as do not required overlay	35 mm BC (with rehabilitation where required
68+000	79+000	11.000		CIP 140 + DBM 50 mm + 30 mm BC
79+000	90+800	11.800		35 mm BC (with rehabilitation where required
90+800	120+012	29.212		35 mm BC (with rehabilitation where required)

The above proposal is vetted by IE and consented for execution. AECOM also in the opinion based on existing condition survey carried out before MM, the proposed / executed MM works confirms requirement no further structural overlay is required in balance concession period. As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. MM Cycles for balance concession period is to be planned as follows:

Proposed MM Cycle for balance Concession Period

i) Main Carriageway

Sn	Year	Description
1	2023 / 24	40 mm BC overlay in 15%, 30 mm BC in 10 % and Microsurfacing in 75 % length DBM of 50 mm in 20 % of Length
2	2028 /29	40 mm BC overlay in 25%, 30 mm BC in 15 % and Microsurfacing in 60 % length DBM of 50 mm in 20 % of Length
3	2031	30 mm BC Overlay along entire length

ii) Service Road: 25 mm SDBC in 33 % length at each cycle

iii) Structure Major Maintenance
Replacement of Wearing Coat every fifth year at same time as above

1.13 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period. O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. TMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per current NHAI Policy, all toll lanes shall have compulsory Fast Tags at all lanes and payment to be collected through ETC system only. Due to which it is expected to reduce operation cost mainly for manpower cost. Implementation of Hybrid ETC is considered from Year 2022/23 considering overloading shall be collected.

As per AECOM calculation average yearly O & M Cost non-escalated is Rs. 17.52 crore per year. Year wise cost summary is appended in next page.

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost - Mahua Bharatpur Expressway Limited (MBEL)											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	11,254,922	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	175,243,320
3	2023-24	4,777,667	17,034,769	3,134,751	48,954,052	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	202,428,874
4	2024-25	6,762,892	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	171,057,640
5	2025-26	8,890,355	17,034,769	3,134,751d	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	173,185,103
6	2026-27	10,200,878	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	174,495,626
7	2027-28	11,254,922	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	175,549,670
8	2028-29	4,777,667	17,034,769	3,134,751	48,954,052	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	202,428,874
9	2029-30	6,762,892	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	171,057,640
10	2030-31	8,890,355	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	173,185,103
11	2031-32	4,777,667	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	169,072,415
	Total	78,350,217	170,347,695	31,347,505	222,688,854	194,177,408	17,783,180	726,168,825	59,277,273	284,806,155	1,788,010,617
	Total Cost in Crore	7.84	17.04	3.14	22.27	19.42	1.78	72.62	5.93	28.48	178.50
Note: Head office Expense to be discussed with Client (Cube Highways Team)											

1.14 Major Maintenance Cost

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Major Maintenance cost for each cycle for balance Concession Period is as below:

Sn	Year	Cost with Escalation and GST
1	2023/2024	60.25 crore
2	2028/2029	66.31 crore
3	2030/2031	56.56 crore

1.15 List of Document Reviewed

The Following documents were reviewed during our study and for preparation of DD Report:

Sn	List of Document	Status	Remarks
1	Concession Agreement – all Vols.	Available	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	Available	
3	Detail Highway Inventory and Condition Survey Report	Available	Inventory list of 12 Mar 2012 available
4	Detail Structure Inventory and Condition Survey Report	Available	Inventory list of 12 Mar 2012 available
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	Available	
6	Balance Work List with BOQ if any	Not Applicable	
7	Past Technical DD Report	Not Available	
8	Change of Scope Documents	Available	
9	Provisional COD Letter along with Punch List	Available	
10	Final COD Letter with Exclusion List if any	Available	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	Available	
12	NCR Status	Not Available	
13	Operation and Maintenance Manual, Yearly Maintenance Program	Manual Of 2009 And 2011	
14	Current Operation and Maintenance Arrangement / Strategy	Available	Maintenance program for 2019-2020

Sn	List of Document	Status	Remarks
15	Detail of TMS and ATMS / HTMS installed at site	Available	TMS Data
16	Pavement Design Report	Available	
17	Historical Major Maintenance and Strategy	Available	Methods for MM in Year 2018
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	Available	Axle Load, Core Cutting, Roughness, FWD, Pavement Composition and Investigation Report
19	As Built Drawing	Available	
20	MPR during Construction Stage (only last three months)	Not Available	
21	MPR of Independent Engineer during Maintenance stage	Available	6 Months
22	MPR Lender Report	Not Available	
23	Monthly Inspection Report during O and M	Available	
24	Historical O&M and MM Cot Cost	Available	O & M Contract with vendor
25	Major Maintenance Forecast	Not Available	
26	Traffic Data (Actual till now and projection till end of Concession Period)	Available	
27	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	Available	Safety Audit Report of Aug 2018
28	Other Documents		

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.2 Pavement Design

Pavement design was made for 20 years design period i.e. till year 2027 for 100 MSA.

a. Design Life and Design Traffic
   - Total Design Traffic upto end of Concession Period– 132 MSA (as per pavement design report)
   - Design CBR – 8 %
   - Design traffic – 100 MSA which is traffic upto Year 2027
   - Homogeneous Section - One
   - VDF adopted for calculation of design traffic by concessionaire is given below:

Vehicle Type	VDF Adopted
Standard Bus	0.79
LCV	0.45
2A Truck	5.11
MAV	5.11

a. Subgrade

As per the Pavement Design Note provided to the consultant, it is mentioned that the Subgrade CBR for all the subgrade samples along the project road was found to be more than 8%. Hence the CBR of 8% has been adopted for the design of pavement.

b. Design Thickness

Thickness of pavement as per Pavement Design Report is as under:

Bituminous Concrete (BC) - 50 mm
Dense Bituminous Macadam (DBM) - 145 mm
Wet Mixed Macadam (WMM) - 300 mm
Granular Sub-base (GSB) - 300 mm

2.3 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.3.1.1 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement in the month of January 2022by the Concessionaire. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km
IRI = International Roughness Index

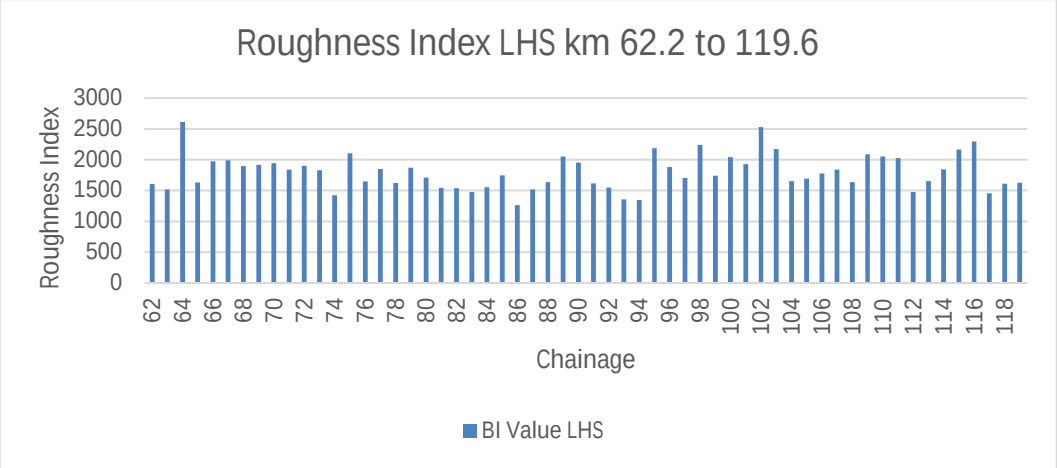
Based on the Roughness value, project road was classified into following three categories:

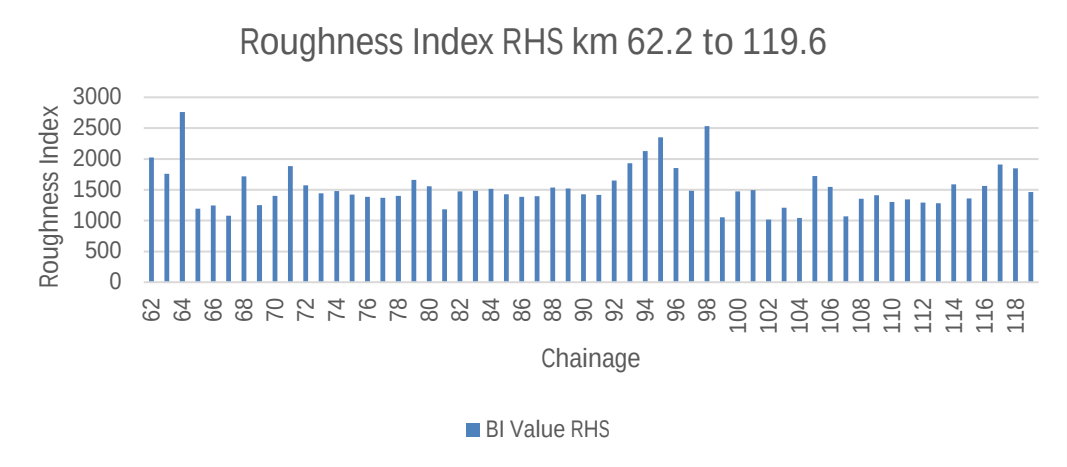
Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000 - 3000
Poor	>3000

The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:

Summary of Roughness Index

Riding Condition	Roughness Index (mm/KM)	Length (in km)			
		LHS		RHS	
		Inner	Outer	Inner	Outer
Good	< 2000	29.4	53.4	45.6	54.4
Fair	2000 - 3000	28	4.0	11.8	3.0
Poor	>3000	0	0	0	0





6.4.2 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade and embankment materials used in project road, test pits of size (approx.) 1m x 1m x 1m have been excavated alternatively on LHS and RHS carriageway at 10 locations and data provided by the Concessionaire.

Field Dry Density (FDD) and Field Moisture Content (FMC) tests were also conducted for subgrade soil at pit. The subgrade soil sample from each test pit was also collected and taken for laboratory examination.

Following tests were conducted on the samples:

- Gradation / Sieve Analysis
- Soil Classification
- Clay and Silt Content
- Atterberg's Limit (Liquid Limit, Plastic Limit)
- Compaction Test (Modified Proctor Test)
- 4-day soaked CBR

Similarly, from some of the test pits, samples of Granular Material were also collected and taken for laboratory testing. Following tests were performed for laboratory material.

- Gradation / Sieve Analysis
- Specific Gravity
- Water Absorption

As per test conducted by the Concessioanrie, CBR result is found from 8.6 % to15.2 %. Design CBR is 8 % thus confirm requirment of pavement design.

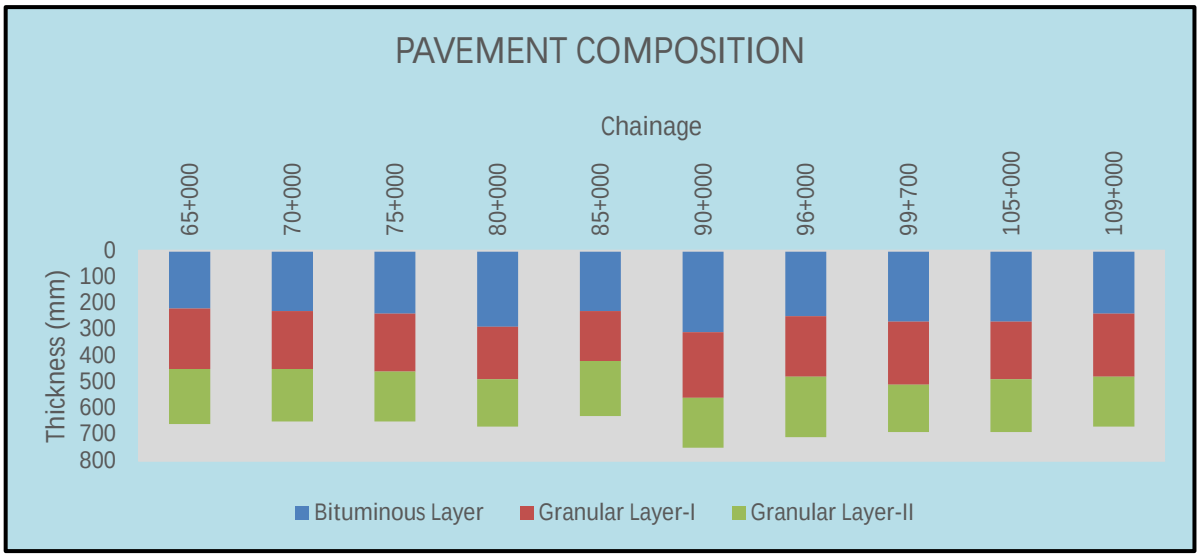
Crust Composition and Thickness:

From observation of test pits, it was found that the pavement crust along the project road composed of following three layers:

i) Bituminous Top (BT)
ii) Wet Mixed Macadam (WMM)
iii) Granular Sub-base (GSB)

Graphical illustration of pavment thickness and crust summary for the project road is given below:

Layer	Thickness (mm)		
	Minimum	Maximum	Average
Bituminous Top (BT)	310	220	265
Wet Mixed Macadam (WMM)	250	190	220
Granular Sub- base(GSB)	230	180	205



Existing average bituminous pavement thickness is more than pavement design thickness thus confirms requirement.

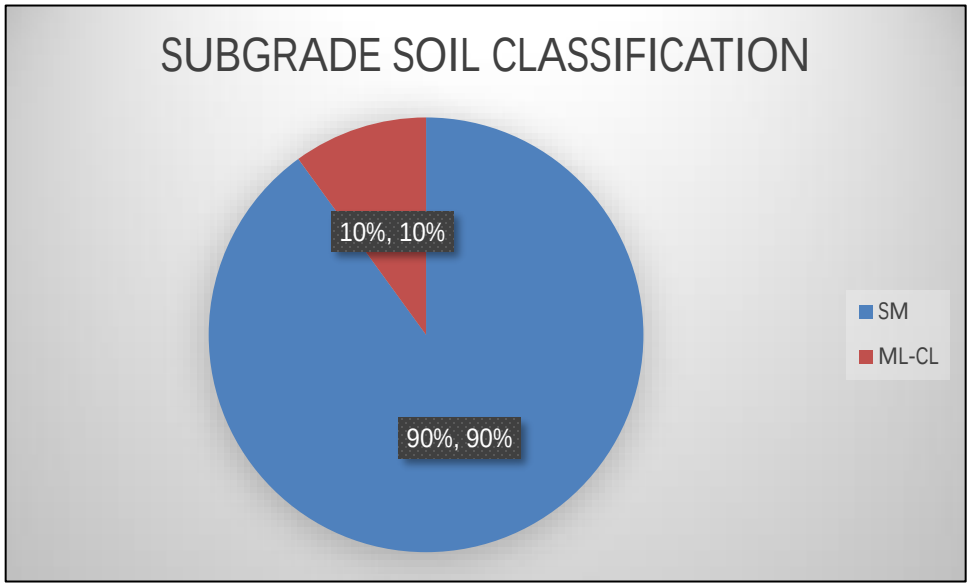
Subgrade Test:

As mentioned earlier, subgrade soil samples were collected from each test pit and taken for laboratory testing. Summary of laboratory test results for subgrade soil sample is given below.

Subgrade Test Results

Properties	Minimum	Maximum	Average
Liquid Limit (LL) %	19.00	25.00	22.00
Plastic Limit (PL) %	13.00	19.00	16.00

Properties	Minimum	Maximum	Average
Plasticity Index (PI)	6.00	6.00	6.00
Max. Dry density (gm/cc.)	1.85	2.02	1.94
OMC (%)	8.9	11.00	9.95
4-Days Soaked CBR (%)	8.6	15.2	11.9
Free Swell Index (%)	0.00	11.1	5.55



Granular Material Test:

Test report of 10 samples of Granular materials (6 nos. each of WMM and GSB) were provided and Summary of laboratory test results for subgrade soil sample is given.

Granular Test Results

Properties	Minimum	Maximum	Average
Liquid Limit (LL) %	19.00	26.00	22.6
Plastic Limit (PL) %	15.00	21.00	17.9
Plasticity Index (PI)	4.OO	5.00	4.66
Specific Gravity	2.39	2.53	2.46
Water Absorption (%)	0.34	0.69	0.52
Aggregate Impact Value (%)	17.3	19.5	18.41

6.4.3 Core Test

Core test result were provided along with test report of bitumen, aggregates used in pavement. Summary of core cutting report is summarized hereunder.

S:No	Chainage (Km)	Side	Height of the Core (mm)	Remarks
1	62+520	RHS	90	
2	64+000	LHS	220	De-bonding of Layer
3	66+000	RHS	150	
4	70+000	RHS	210	De-bonding of Layer
5	74+220	RHS	175	Segregation/ broken of DBM lower layer
6	78+260	RHS	120	Segregation/ broken of DBM lower layer
7	81+800	RHS	110	Segregation/ broken of DBM lower layer
8	86+000	RHS	170	
9	90+000	RHS	220	De-bonding of Layer
10	92+000	LHS	240	De-bonding of Layer
11	94+280	RHS	220	De-bonding of Layer
12	96+640	LHS	70	Segregation/ broken of DBM lower layer
13	99+900	LHS	175	
14	101+540	RHS	260	
15	106+100	LHS	290	
16	107+960	RHS	205	
17	113+100	LHS	240	
18	113+780	RHS	140	
19	117+450	RHS	110	Segregation/ broken of DBM lower layer
20	118+920	LHS	220	De-bonding of Layer

6.4.4 Pavement Evaluation By Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD survey in the month of Dec 2020 before carrying out major maintenance. FWD survey report along with analysis has provided. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented below and the detail data and calculations as provided by the Client.

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
62.2	62.4	309	308	671	115
62.4	62.6	309	308	602	27
62.6	62.8	302	318	33	27
62.8	63	300	313	689	418

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
63	63.2	307	235	18	56
63.2	63.4	304	235	689	37
63.4	63.6	219	318	664	37
63.6	63.8	308	315	687	129
63.8	64	306	318	499	600
64	64.2	301	312	95	606
64.2	64.4	309	312	101	595
64.4	64.6	309	312	101	595
64.6	64.8	309	312	101	595
64.8	65	235	25	317	221
65	65.2	235	238	424	606
65.2	65.4	226	303	101	599
65.4	65.6	229	318	689	258
65.6	65.8	224	67	666	143
65.8	66	94	236	263	44
66	66.2	94	236	263	44
66.2	66.4	94	236	263	44
66.4	66.6	94	236	263	44
66.6	66.8	131	232	119	43
66.8	67	235	231	35	131
67	67.2	233	314	666	610
67.2	67.4	231	237	54	7
67.4	67.6	234	317	53	48
67.6	67.8	229	231	670	78
67.8	68	233	317	13	446
68	68.2	235	35	84	177
68.2	68.4	234	150	36	47
68.4	68.6	234	235	446	63
68.6	68.8	222	233	18	70
68.8	69	228	233	47	14
69	69.2	234	233	11	12
69.2	69.4	234	234	28	8
69.4	69.6	231	24	30	12
69.6	69.8	232	228	28	7
69.8	70	226	228	18	10
70	70.2	231	240	21	3
70.2	70.4	233	242	53	16
70.4	70.6	229	231	17	28
70.6	70.8	236	231	45	157
70.8	71	238	319	9	15
71	71.2	235	320	15	16
71.2	71.4	238	321	12	60
71.4	71.6	237	233	20	140
71.6	71.8	234	212	28	16

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
71.8	72	214	233	29	40
72	72.2	235	317	11	29
72.2	72.4	231	140	166	15
72.4	72.6	37	317	30	610
72.6	72.8	27	317	674	25
72.8	73	234	23	182	558
73	73.2	16	55	85	601
73.2	73.4	234	55	667	51
73.4	73.6	55	12	26	119
73.6	73.8	174	37	668	222
73.8	74	228	318	34	611
74	74.2	230	318	265	215
74.2	74.4	236	45	101	583
74.4	74.6	234	45	663	62
74.6	74.8	234	45	15	322
74.8	75	237	233	410	567
75	75.2	328	103	75	19
75.2	75.4	324	123	71	12
75.4	75.6	312	123	31	12
75.6	75.8	328	319	443	73
75.8	76	314	319	670	35
76	76.2	327	313	141	119
76.2	76.4	321	320	51	7
76.4	76.6	11	310	552	22
76.6	76.8	47	89	267	24
76.8	77	150	89	315	63
77	77.2	322	321	22	455
77.2	77.4	325	412	150	71
77.4	77.6	324	416	368	13
77.6	77.8	320	416	39	576
77.8	78	480	363	234	12
78	78.2	329	195	92	43
78.2	78.4	319	195	46	41
78.4	78.6	474	86	677	186
78.6	78.8	466	126	28	374
78.8	79	480	126	20	559
79	79.2	480	315	666	569
79.2	79.4	329	416	628	564
79.4	79.6	480	321	339	559
79.6	79.8	319	412	624	565
79.8	80	482	412	629	566
80	80.2	319	221	1733	245
80.2	80.4	357	315	1725	1566
80.4	80.6	327	318	1642	1573

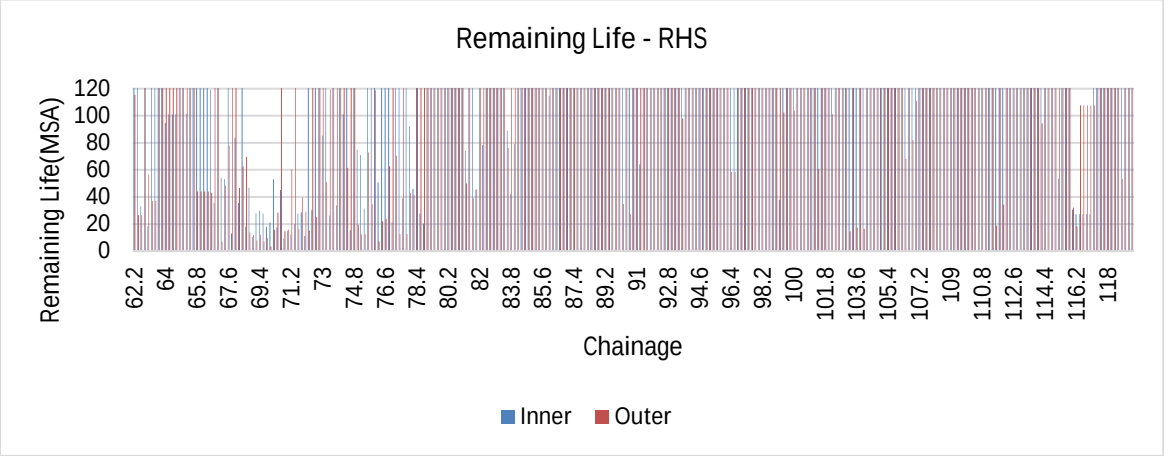
Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
80.6	80.8	327	325	991	1576
80.8	81	170	402	1786	928
81	81.2	476	402	1766	199
81.2	81.4	322	411	74	50
81.4	81.6	318	418	281	341
81.6	81.8	322	416	1700	39
81.8	82	327	416	45	46
82	82.2	480	412	695	341
82.2	82.4	323	319	78	1555
82.4	82.6	323	316	207	1229
82.6	82.8	167	36	1586	1593
82.8	83	167	36	1586	1593
83	83.2	167	36	1586	1593
83.2	83.4	167	206	1586	1593
83.4	83.6	20	84	365	1555
83.6	83.8	35	25	89	76
83.8	84	12	14	42	1073
84	84.2	12	10	79	235
84.2	84.4	102	8	140	174
84.4	84.6	14	26	1593	1115
84.6	84.8	151	26	227	1558
84.8	85	294	6	150	1553
85	85.2	7	33	637	1553
85.2	85.4	469	67	365	508
85.4	85.6	488	14	648	586
85.6	85.8	214	22	645	562
85.8	86	56	22	160	558
86	86.2	10	45	115	573
86.2	86.4	80	5	650	564
86.4	86.6	431	16	444	581
86.6	86.8	22	16	297	576
86.8	87	12	12	151	568
87	87.2	5	406	193	592
87.2	87.4	10	13	505	588
87.4	87.6	5	13	447	576
87.6	87.8	6	10	432	591
87.8	88	13	77	654	584
88	88.2	33	3	299	459
88.2	88.4	3	105	540	449
88.4	88.6	21	22	173	449
88.6	88.8	65	42	635	583
88.8	89	187	42	643	589
89	89.2	503	27	174	583
89.2	89.4	502	474	172	402

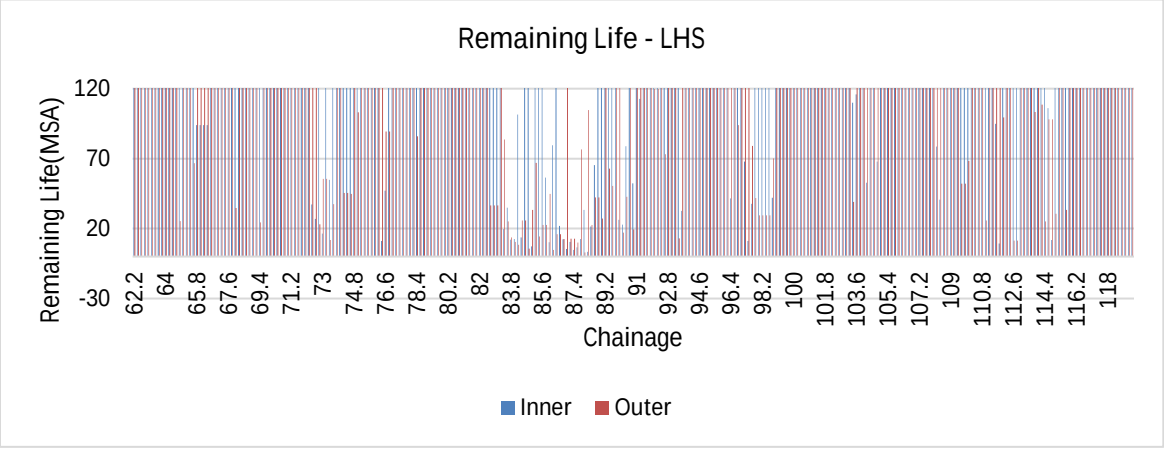
Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
89.4	89.6	132	63	715	216
89.6	89.8	421	50	300	665
89.8	90	341	446	166	319
90	90.2	26	1106	675	630
90.2	90.4	23	17	659	35
90.4	90.6	79	43	154	449
90.6	90.8	160	739	659	27
90.8	91	52	19	665	635
91	91.2	1726	1649	670	624
91.2	91.4	113	1649	64	624
91.4	91.6	370	1007	666	634
91.6	91.8	1179	1038	668	620
91.8	92	642	1038	658	621
92	92.2	1607	120	678	621
92.2	92.4	411	120	677	639
92.4	92.6	452	129	436	626
92.6	92.8	125	73	663	640
92.8	93	594	141	668	622
93	93.2	191	1032	657	625
93.2	93.4	225	1032	672	623
93.4	93.6	138	13	629	623
93.6	93.8	33	890	671	98
93.8	94	776	835	442	620
94	94.2	1748	1051	448	620
94.2	94.4	736	1716	664	629
94.4	94.6	1741	1049	436	625
94.6	94.8	1338	1052	273	623
94.8	95	1717	1108	658	623
95	95.2	661	688	658	623
95.2	95.4	1724	1048	662	591
95.4	95.6	1724	1048	662	591
95.6	95.8	940	1042	657	591
95.8	96	1526	1042	681	625
96	96.2	623	395	666	303
96.2	96.4	606	612	338	616
96.4	96.6	42	285	349	58
96.6	96.8	161	313	661	58
96.8	97	611	94	645	637
97	97.2	397	387	628	631
97.2	97.4	68	380	653	622
97.4	97.6	11	380	664	637
97.6	97.8	38	79	680	627
97.8	98	609	42	660	637
98	98.2	164	30	658	625

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
98.2	98.4	398	30	659	629
98.4	98.6	398	30	659	629
98.6	98.8	601	30	646	629
98.8	99	42	70	651	634
99	99.2	599	397	648	629
99.2	99.4	599	382	38	638
99.4	99.6	599	382	634	102
99.6	99.8	611	178	1272	1337
99.8	100	577	389	1364	1337
100	100.2	341	314	1305	104
100.2	100.4	341	314	1305	697
100.4	100.6	341	314	1305	697
100.6	100.8	394	397	869	697
100.8	101	597	397	869	336
101	101.2	595	397	744	1324
101.2	101.4	387	384	1429	215
101.4	101.6	394	259	1363	61
101.6	101.8	280	142	1402	1320
101.8	102	397	142	1422	1357
102	102.2	393	395	752	1357
102.2	102.4	395	398	970	101
102.4	102.6	394	398	1342	1323
102.6	102.8	394	398	1421	1365
102.8	103	388	383	1364	1346
103	103.2	538	391	490	1375
103.2	103.4	391	395	1373	15
103.4	103.6	110	39	1391	909
103.6	103.8	116	393	536	17
103.8	104	395	603	1417	1297
104	104.2	395	603	395	16
104.2	104.4	53	383	862	461
104.4	104.6	387	383	1411	859
104.6	104.8	393	397	1063	1338
104.8	105	68	386	587	148
105	105.2	542	544	1412	614
105.2	105.4	538	544	950	1323
105.4	105.6	538	544	950	1323
105.6	105.8	538	472	950	1323
105.8	106	150	472	354	1326
106	106.2	525	605	158	295
106.2	106.4	375	768	1368	860
106.4	106.6	531	472	1412	68
106.6	106.8	535	623	1170	845
106.8	107	524	517	1374	82

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
107	107.2	543	744	1422	111
107.2	107.4	819	756	1407	657
107.4	107.6	529	756	1418	1360
107.6	107.8	524	776	1417	1347
107.8	108	538	216	1413	1174
108	108.2	530	216	1389	1175
108.2	108.4	79	742	1414	1161
108.4	108.6	41	670	1246	1178
108.6	108.8	543	198	1238	1124
108.8	109	536	768	1231	967
109	109.2	406	765	724	698
109.2	109.4	788	765	722	702
109.4	109.6	811	436	703	698
109.6	109.8	836	52	726	696
109.8	110	808	52	729	513
110	110.2	829	68	730	203
110.2	110.4	388	695	729	207
110.4	110.6	803	349	722	696
110.6	110.8	799	139	726	597
110.8	111	800	139	719	700
111	111.2	138	26	733	704
111.2	111.4	552	658	500	677
111.4	111.6	572	156	723	599
111.6	111.8	95	436	715	19
111.8	112	9	436	720	503
112	112.2	485	99	735	34
112.2	112.4	405	699	730	682
112.4	112.6	824	384	711	702
112.6	112.8	486	11	710	677
112.8	113	387	11	710	512
113	113.2	839	697	733	691
113.2	113.4	811	697	729	691
113.4	113.6	823	697	721	681
113.6	113.8	373	713	478	692
113.8	114	813	103	703	696
114	114.2	447	491	624	686
114.2	114.4	399	109	727	94
114.4	114.6	838	25	725	686
114.6	114.8	106	98	726	686
114.8	115	12	98	689	690
115	115.2	354	31	657	249
115.2	115.4	185	186	53	253
115.4	115.6	804	186	705	131
115.6	115.8	233	33	561	697

Chainage		Remaining Life - LHS		Remaining Life - RHS	
From	To	Inner	Outer	Inner	Outer
115.8	116	492	683	330	146
116	116.2	829	126	31	32
116.2	116.4	819	126	27	18
116.4	116.6	819	707	27	108
116.6	116.8	819	707	27	108
116.8	117	819	707	27	108
117	117.2	819	707	27	108
117.2	117.4	457	696	735	108
117.4	117.6	541	696	229	703
117.6	117.8	542	697	716	327
117.8	118	803	701	391	327
118	118.2	803	686	728	304
118.2	118.4	825	644	716	172
118.4	118.6	818	681	199	701
118.6	118.8	837	266	713	699
118.8	119	520	266	726	53
119	119.2	826	677	715	695
119.2	119.4	833	692	685	694
119.4	119.6	833	692	685	690





6.4.5 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

Axle Load Survey was conducted in the Month Dec 2017 and analysis has been provided. Comparison between VDF based on traffic survey conducted in Dec 2017 and VDF adopted during Pavement Design is given below:

VDF Comparison at Ludhwai Toll Plaza (KM 64+570)

Vehicle Type	VDF Adopted for Pavement Design	As per Cube Survey for TP-1		
		LHS	RHS	Adopted VDF
Bus	0.79	1.62	1.33	1.62
LCV	0.45	1.59	3.84	3.84
2A Truck	5.11	1.94	5.68	5.68
3A Truck		5.45	17.89	17.89
MAV	5.11	10.77	19.72	19.72

VDF Comparison at Amoli Toll Plaza (KM 98+730)

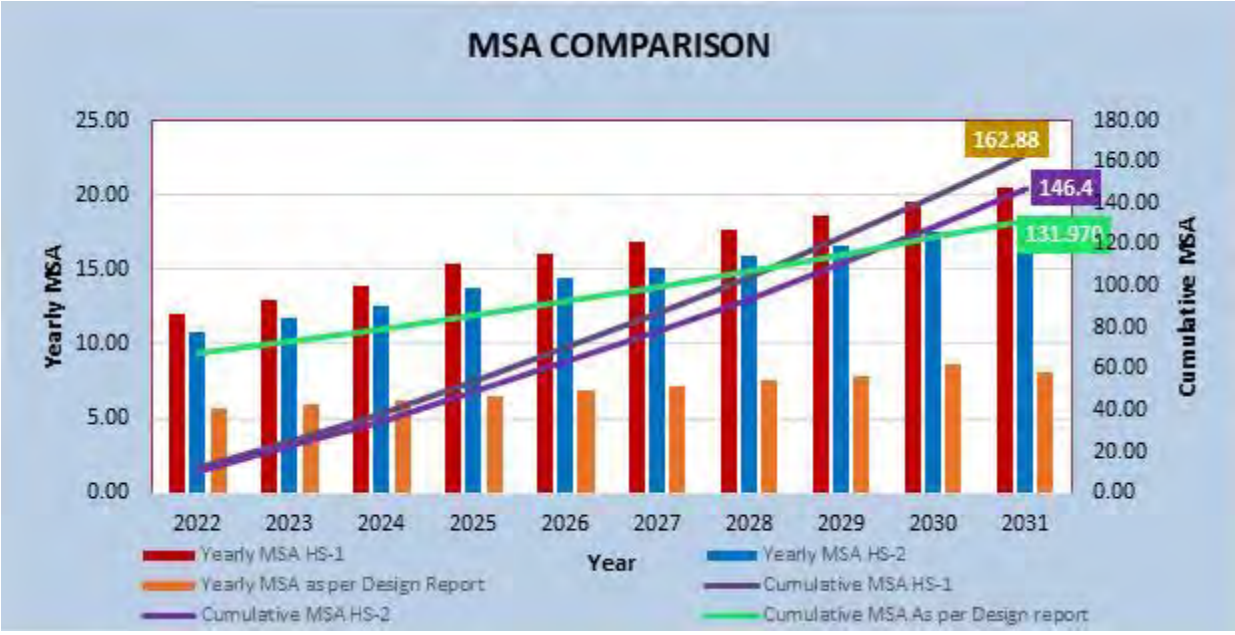
Vehicle Type	VDF Adopted for Pavement Design	As per Cube Survey		
		LHS	RHS	Adopted VDF
Bus	0.79	1.98	1.85	1.98
LCV	0.45	1.40	3.75	3.75
2A Truck	5.11	1.84	4.72	4.72
3A Truck		5.68	18.16	18.16
MAV	5.11	13.33	17.39	17.39

6.4.6 Homogeneous Section and Design MSA

As per current traffic pattern, two homogeneous sections considered for calculation Design MSA. However, during pavement design one homogeneous section was considered. MSA has calculated based on traffic data provided for balance Concession period and VDF as calculated above for balance Concession period. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided is tabled below.

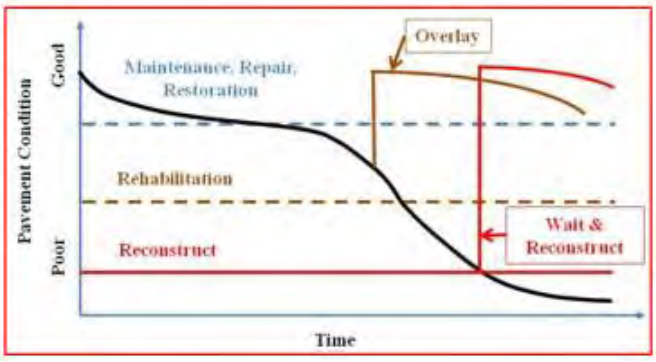
Homogeneous Section	Location - Km		As per Pavement design	Traffic	
	From	To		LHS	RHS
HS 1	63+295	92+000	81	84.69	102.0
HS 2	92+000	119+600	81	162.88	146.4

Year wise MSA graph is presented below:



2.4 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Concessionaire has conducted detail pavement investigation in April 2018 and Major Maintenance was carried out accordingly. KM wise major maintenance as proposed and executed in Year 2018 / 2019 is as below:

Last Major Maintenance executed on 2018 / 2019

Chainage		Length (km)	RHS	LHS
From	To		Both Lane	Both Lane
62+295	68+000	5.705	35 mm BC (with rehabilitation where required	30 mm BC (with rehabilitation where require) / Micro-surfacing (Profile correction does not
68+000	79+000	11.000	CIP 140 + DBM 50 mm + 30 mm BC	
79+000	90+800	11.800	35 mm BC (with rehabilitation where required	

Chainage		Length (km)	RHS	LHS
From	To		Both Lane	Both Lane
90+800	120+012	29.212	35 mm BC (with rehabilitation where required)	warrant as well as do not required overlay)

The above proposal is vetted by IE and consented for execution. AECOM also in the opinion based on existing condition survey carried out before MM, the proposed / executed MM works confirms requirement no further structural overlay is required in balance concession period.

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. Proposed MM cycles for balance concession period is as follows:

Proposed MM Cycle for balance Concession Period

Requirement of overlay is calculated considering 200 m lane as one section. The section length considered is executable at site as per Cube Highways. The detail lane wise 200 m interval calculation is provided in soft copy. The summary of MM cycle is presented below:

Sn	Year	Description
1	2023 / 24	40 mm BC overlay in 15%, 30 mm BC in 10 % and Microsurfacing in 75 % length DBM of 50 mm in 20 % of Length
2	2028 /29	40 mm BC overlay in 25%, 30 mm BC in 15 % and Microsurfacing in 60 % length DBM of 50 mm in 20 % of Length
3	2031	30 mm BC Overlay along entire length

i) Service Road: 25 mm SDBC in 33 % length at each cycle

ii) Structure Major Maintenance

Replacement of Wearing Coat every fifth year at same time as above.

3 MAJOR MAINTENANCE COST

3.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

Sn	Year	Description
1	2023 / 24	40 mm BC overlay in 15%, 30 mm BC in 10 % and Microsurfacing in 75 % length DBM of 50 mm in 20 % of Length
2	2028 /29	40 mm BC overlay in 25%, 30 mm BC in 15 % and Microsurfacing in 60 % length DBM of 50 mm in 20 % of Length
3	2031	30 mm BC Overlay along entire length

i) Service Road: 25 mm SDBC in 33 % length at each cycle

ii) Structure Major Maintenance

3.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provided by the Cube Highways as follows applicable for 2021/22:

Bitumen Price @ 1st March 2021	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG10	37160	2650	34510
VG30	37960	2650	35310
VG40	39350	2650	36700

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

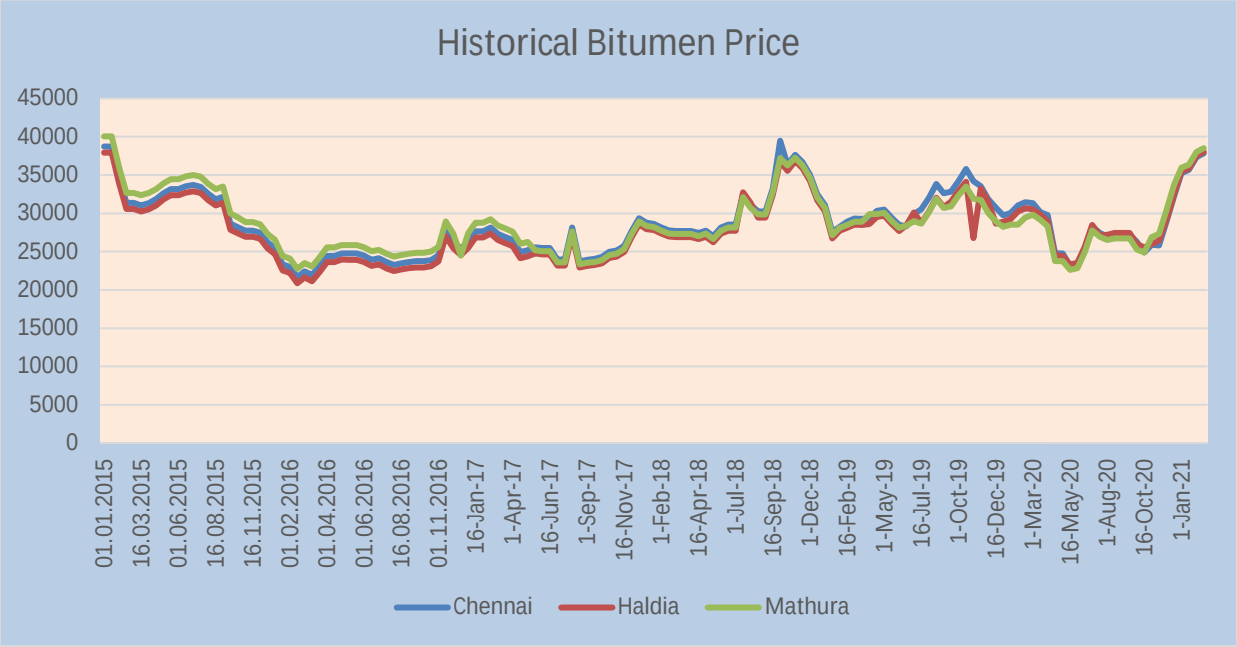
viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on FY 2021.

xii) The historical bitumen price from year 2015 to till date is present in below graph.



xiii) Cube Highway forecast Bitumen for upcoming year as follows:

a) FY 2024 onwards till end of Concession Period, Bitumen Price is considered same rate as below:

VG 40 – 27,614, VG 30 – 26,224 Rs / MT

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Year	Growth Rate	Cumulative Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165

Year	Growth Rate	Cumulative Factor
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:
Unit Rate as of 2021/22 with bitumen price as stated above

Sn	Items Description	Unit	Rate (Rs) for FY 25 onwards
1	Dense Bituminous Macadam – CAPEX	Cum	8,912
2	Bituminous Concrete	Cum	10,120
3	Microsurfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	cum	
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1,647

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Cost estimate each cycle wise is presented in next page.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)											
Sl. No.	Activity	Unit	Unit Rate 2022	Unit Rate 2025 Onwards	Treatment Cycles Quantity			Treatment Cycles Amount			
					MMR (2023/24)	MMR (2028/29	MMR (2030/31)	MMR (2023/24)	MMR (2028/29	MMR (2030/31)	
A	**Main Carriageway - Flexible Pavement**										
1	Tack Coat	Sqm	13	13	503,361	671,148	1,118,580	6,412,821	8,550,427	14,250,712	
2	Bituminous Concrete	Cum	13,398	10,120	10,067	16,219	33,557	134,880,240	164,138,842	339,597,605	
3	Milling of existing BC	Sqm	77	77	223,716	223,716		17,226,136	17,226,136	-	
4	Raising of Road Kerb	m	439	439	27,445	43,913	21,956	12,048,493	19,277,589	9,638,795	
5	Painting of Road Kerb	sqm	121	121	32,934	32,934	32,934	3,985,060	3,985,060	3,985,060	
6	DBM	Cum	11,585	8,912	11,186	11,186		129,592,554	99,683,508	-	
7	Microsurfacing	sqm	176	176	838,935	671,148	-	147,652,592	118,122,073	-	
									-	-	
B	**Structure(Including Flyover,Elevated,VUP,PUP and bridges)**								-	-	
1	Tack Coat	Sqm	13	13	12,510		12,510	159,380	-	159,380	
2	Bituminous Concrete	Cum	13,398	10,120	375		375	5,028,331	-	3,798,056	
3	Milling of existing BC	Sqm	77	77	12,510		12,510	963,285	-	963,285	
									-	-	
D	**Service Road**								-	-	
1	Tack Coat	Sqm	13	13	27,766	27,766	27,766	353,742	353,742	353,742	
2	BC - VG 30	Cum	12,852	9,574	694	694	694	8,920,999	6,645,515	6,645,515	
3	Road Marking - SR	Sqm	439	439	5,284	5,284	5,284	2,319,658	2,319,658	2,319,658	
									-	-	
E	**Other Works**								-	-	
1	Replacement of Road Studs							-	-	-	
	Road Studs	Nos	220	220	2804	2804	2804	616,880	616,880	616,880	
	Solar Studs	Nos	1,647	1,647				-	-	-	
									-	-	
2	Road Marking - MCW	Sqm	439	439	40,723	40,723	40,723	17,877,283	17,877,283	17,877,283	
3	Maintenance of Earthen Shoulder	cum	307	307	6,188	6,188	6,188	1,899,778	1,899,778	1,899,778	
F	**Contingency - 2 % above amount**							9,798,745	9,213,930	8,042,115	
	Major Maintenance Cost Per							499,735,975	469,910,422	410,147,863	
	GST							59,968,317	56,389,251	49,217,744	
	Major Maintenance Cost							559,704,292	526,299,672	459,365,606	
	Amount in Crores							55.97	52.63	45.94	
	Escalation Factor							1.11	1.42	1.54	
	Esclated Amount keping Bitumen Component w/o Escalation							60.25	66.31	56.56	

4 OPERATION AND MAINTENANCE COST

4.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 18 – Operation &Maintenance & Schedule – L Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 18 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)

NHAI has decided to implement 100 % Fast Tags at all lanes and toll collection only shall be through ETC. AECOM has forecast O & M in following two Scenarios:

1) O & M Cost without Fast Tags (as per Concession Agreement)
2) O & M Cost with 100 % Fast Tags

4.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2018, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	NSV Survey

Sn	Description of Data	Methodology adopted
3	Roughness Value (IRI), Rutting	NSV Survey
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	ATMS (ECB)	As per manufacturer's / suppliers recommendation
10	TMS	As per manufacturer's / suppliers recommendation

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each items.

4.3 Requirement of CA (Schedule L and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-L (the "Maintenance Requirements").

4.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 22,118 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 10,877 / km / month excluding GST.

4.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180 Watt LED light will be operated for 10 hours a day round the year
b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 8.90 Rs / Kwh.

The calculated electricity cost for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	km	0.89	1,37,216	1,22,122
2	Highway Lighting Electricity Charge	Kwh	1,98,764	9.77	19,41,795
3	Operation and Maintenance of DG Set	Nos	2	1,40,235	2,80,469
4	Solar Blinker	Nos	40	3,293	1,31,727
5	Office Building Electricity Charge	LS	12	54,886	6,58,636
	Total				3,134,751

4.6 TMS Cost and ATMS

Following consideration has made during calculation of O & M cost for TMS and ATMS:

a) AMC cost towards TMS is considered 1.5 lakh per lane per year
b) 70 % of equipment shall be replaced in every 7year interval.
c) However, NHAI has decided to implement 100 % HYBRID ETC lane at all toll lanes, it is expected increase in AMC (considered 12 % of Total Equipment Cost) and replacement of equipment in every five year as per NHAI Policy and accordingly same has considered.

Average O & M Cost as per AECOM calculation is 1.5 crore per year and additional cost of 6.18 crore for replacement of equipment at every 5 (five) years.

4.7 Corridor Management

The following equipments along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT
b) Traffic Aid Post with 2 nos of route patrol vehicle
c) 1 nos of Ambulance

O & M Cost estimated towards incident management with operation manpower is Rs. 1.94 crore per year including GST.

4.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1. Management, Administration / HR and Supervision Staff: in-house manpower
2. Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage.

Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as Rs. 7.26 core per year

4.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 2.84 crore per year. Year wise O & M Cost (OPEX) non-escalated is presented in next page.

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost - Mahua Bharatpur Expressway Limited (MBEL)											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	11,254,922	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	175,243,320
3	2023-24	4,777,667	17,034,769	3,134,751	48,954,052	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	202,428,874
4	2024-25	6,762,892	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	171,057,640
5	2025-26	8,890,355	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	173,185,103
6	2026-27	10,200,878	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	174,495,626
7	2027-28	11,254,922	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	175,549,670
8	2028-29	4,777,667	17,034,769	3,134,751	48,954,052	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	202,428,874
9	2029-30	6,762,892	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	171,057,640
10	2030-31	8,890,355	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	173,185,103
11	2031-32	4,777,667	17,034,769	3,134,751	15,597,594	19,417,741	1,778,318	72,616,883	5,927,727	28,480,615	169,072,415
	Total	78,350,217	170,347,695	31,347,505	222,688,854	194,177,408	17,783,180	726,168,825	59,277,273	284,806,155	1,788,010,617
	Total Cost in Crore	7.84	17.04	3.14	22.27	19.42	1.78	72.62	5.93	28.48	178.50
Note: Head office Expense to be discussed with Client (Cube Highways Team)											

5 PROJECT ROAD ANALYSIS

5.1 Reconnaissance Survey

This project road is a Bharatpur -Mahua section of Agra Jaipur Expressway of New NH 21. Project road starts from Km 62+295 at Sewar to Km 119+600 at Mahua in the state of Rajasthan. The total length of the project road is 57.305 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of October 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretch and length is given as below:

Detail of Project Stretch

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Improvement,Operation and Maintenance of Rehablitation and Strengthening of Existing 2-Lane Road and Widening to 4-lane Divided Highway	62+296	119+600	57.250	Four lane divided Carriageway

5.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and cross road details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

Start Point of Project Road at Km 62+350

End Point of Project Road at Km 119+600

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 62+295 of Agra Jaipur Expressway Section of NH-11 (New NH-21)	Km 62+295 of Agra Jaipur Expressway Section of NH-11 (New NH-21)	
2	Project Road End	Km 119+600 of Agra Jaipur Expressway Section of NH-11 (New NH-21)	Km 119+600 of Agra Jaipur Expressway Section of NH-11 (New NH-21)	
3	Project Length	57.305 km	57.305 km	
6	Carriageway	4 lane highway with paved width 9.0 m on either side in Rural Area, 11 m paved at approach of underpass and 13.5 m at approach of flyover	4 lane highway with paved width 9.0 m on either side in Rural Area, 11 m paved at approach of underpass and 13.5 m at approach of flyover	
7	Shoulders	2.0 m earthen shoulder for main carriageway & 1.5 m Raised Footpath for Service Roads.	12.0 m earthen shoulder for main carriageway & 1.5 m Drain cum Footpath for Service Roads.	
8	Median	4.50 m wide in rural areas and 2.0 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	
9	Service Roads	LHS: 5.95 km RHS: 5.95 km	LHS: 7.10 km RHS: 7.31 km	
10	Major Bridge	1 No.	1 No.	
11	Minor Bridge	4 Nos.	4 Nos.	
12	Pipe, Box & Slab Culverts	23 Nos	37 Nos	
13	Major/Minor Junctions	3 Major Junction	3 Major Junction + 36 Minor Junction	
14	Underpass	5 Nos	5 Nos	
15	Grade Separator	1 No.	1 No.	
15	ROB/RUB	1 No.	1 No.	
16	Toll Plazas	2 Nos.	2 Nos.	
17	Truck Lay-byes/Truck Parking	4 Nos.	4 Nos	
18	Bus bays/Bus Stops	42 Nos	8 os	

5.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

Six type of TCS has been proposed in Schedule-B of CA and same has adhered along project road.

5.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at two Toll Plazas where Rigid Pavement has been provided. Pavement condition is generally Good throughout the project corridor. Existing rigid pavement at Toll Plaza 2 is poor required repair and rehabilitation.

5.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

Comparison of Service Road Location between Schedule B and as per Site

Sn	As per Schedule B					As Per Site					
	Location		Side	Length (m)	Width (m)	Location		Length (m)	Width (m)	Pavement Type	Remarks
	From	To				From	To				
1	65+260	66+700	LHS	1440	5.5	65+160	66+680	1520	5.5	BT	
2	82+700	83+700	LHS	1000	5.5	82+620	83+820	1200	5.5	BT	
3	99+850	101+850	LHS	2000	5.5	99+800	101+860	2060	5.5	BT	
4	104+650	106+150	LHS	1500	5.5	105+040	106+140	1100	5.5	BT	
5			LHS		5.5	116+375	117+595	1220	5.5	BT	
6	65+260	66+700	RHS	1440	5.5	65+260	66+700	1440	5.5	BT	
7	82+700	83+700	RHS	1000	5.5	82+000	83+780	1780	5.5	BT	82+000 to 82+600 Damage Condition
8	99+850	101+850	RHS	2000	5.5	99+800	101+820	2020	5.5	BT	
9	104+650	106+150	RHS	1500	5.5	104+660	105+820	1160	5.5	BT	
10			RHS		5.5	116+375	117+285	910	5.5	BT	
Total				11880				14410			

5.2.4 Median

Median width of 4.5 m and 1.5-2 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

Typical 4.5 m wide median with Shurbs

1.5m wide Median with Shrubs

33 nos of Median Openings are found along project road. Most of median openings having shelter lane and blinkers. List of median openings is tabled below:

Sn	Location		Blinker	Length (m)	Storage Lanes
	From	To			
1	62.605	62.635	YES	30	LHS
2	67.945	67.975	YES	30	B/S
3	70.715	70.745	YES	30	B/S
4	71.440	71.470	NO	30	LHS
5	74.820	74.840	NO	20	LHS
6	77.020	77.050	YES	30	B/S
7	79.335	79.365	YES	30	B/S
8	81.095	81.125	YES	30	B/S
9	83.710	83.740	NO	30	NO
10	85.030	85.060	YES	30	B/S
11	87.290	87.320	YES	30	NO
12	89.135	89.155	NO	20	LHS
13	89.840	89.844	NO	4	NO
14	91.600	91.630	YES	30	B/S
15	92.390	92.410	YES	20	NO
16	93.655	93.675	YES	20	RHS
17	94.385	94.420	YES	35	B/S
18	96.890	96.910	YES	20	LHS
19	97.880	97.910	NO	30	NO
20	99.075	99.105	YES	30	B/S
21	100.810	100.840	YES	30	NO
22	101.030	101.040	NO	10	NO
23	103.890	103.930	YES	40	LHS
24	105.140	105.170	NO	30	NO
25	105.900	105.906	NO	6	NO
26	107.900	107.930	NO	30	LHS
27	108.460	108.490	NO	30	LHS
28	109.500	109.512	YES	12	NO
29	111.375	111.420	YES	45	RHS
30	112.180	112.186	NO	6	NO
31	114.335	114.370	YES	35	NO
32	115.735	115.765	NO	30	NO
33	118.640	118.670	YES	30	NO

Medain Opening with Solar Blinker

5.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road under Footpath and at some Locations covered lined Drains are Provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Location and type of drain as provided is presented below:

Location of RCC Drain

Sn	Location		Side	Length (m)	Type
	From	To			
1	65250	66690	LHS	1440	RCC Covered
2	65250	66690	RHS	1440	RCC Covered
3	82700	83700	LHS	1000	RCC Covered
4	82700	83700	RHS	1000	RCC Covered
5	90740	91140	LHS	400	RCC Covered
6	91200	91580	RHS	380	RCC Covered
7	99850	100840	LHS	990	RCC Covered
8	100870	101840	LHS	970	RCC Covered
9	99850	101850	RHS	2000	RCC Covered
10	105050	106150	LHS	1100	RCC Covered
11	104650	106150	RHS	1500	RCC Covered
12	113820	114220	RHS	400	RCC Covered
13	113820	114220	LHS	400	RCC Covered

Location of Median Cut Drain

Sn	Location		Side	Length (m)
	From	To		
1	62+480	62+580	Median Cut Drain	100

Sn	Location		Side	Length (m)
	From	To		
2	62+645	62+775	Median Cut Drain	130
3	63+235	63+440	Median Cut Drain	205
4	63+420	63+440	Median Cut Drain	20
5	63+445	63+590	Median Cut Drain	145
6	94+810	95+320	Median Cut Drain	510
7	95+315	95+355	Median Cut Drain	40
8	95+722	96+222	Median Cut Drain	500
9	95+727	95+737	Median Cut Drain	10
10	104+540	104+880	Median Cut Drain	340
11	108+220	108+960	Median Cut Drain	740
12	114+220	114+850	Median Cut Drain	630
13	116+940	117+020	Median Cut Drain	80
14	117+090	117+140	Median Cut Drain	50
15	118+340	118+900	Median Cut Drain	560

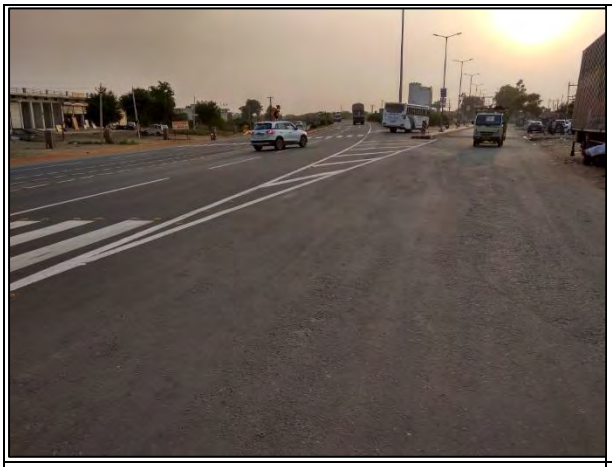
RCC Covered Drain at Project Road

Median Cut Drain at Project Road

5.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 36 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	3	3
Minor Junctions		36



Major Junction at KM 114+310

Minor Junction at KM 79+380

Details of Major and Minor Junctions along the project are presented in the table below:

Details of Major Junctions

Sn	Existing Chainage	Type of Junction	At-grade	Side	Cross Road Leading to	Width of Cross Road (m)	Surface Type
1	100+810	T	Yes	LHS	Bhusawal	5.5	BT
2	114+330	Y	Yes	RHS	Mahua	7.0	BT
3	118+680	Y	Yes	RHS	Mahua	7.0	BT

Details of Minor Junctions

Sn	Existing Chainage	Type of Junction	Side	Cross Road Leading to	Width of Cross Road (m)	Surface Type	Median Opening Provided (Y/N)
1	62+605	Y	RHS	Madoli	3.50	BT	Y
2	62+660	Y	LHS	Vamanpura	3.50	BT	Y
3	64+120	Y	LHS	Vamanpura	3.50	BT	N
4	67+950	X	LHS	Mahua	3.50	BT	Y
			RHS	Sinpini	3.50	BT	
5	71+100	T	LHS	Khedi	3.50	BT	N
6	71+445	T	RHS	Dhanlota	3.50	BT	Y
7	74+830	T	RHS	Lulhara	3.50	BT	Y
8	74+860	Y	LHS	Bagera	3.50	BT	Y
9	77+000	X	LHS	Lakhanpur	3.50	BT	Y
			RHS	Gadauli	3.50	BT	
10	79+380	X	LHS	Lakhanpur	3.50	BT	Y
			RHS	Nadbai	3.50	BT	
11	79+440	Y	LHS	Dehra	3.50	BT	Y

Sn	Existing Chainage	Type of Junction	Side	Cross Road Leading to	Width of Cross Road (m)	Surface Type	Median Opening Provided (Y/N)
12	84+425	Y	LHS	Moodiya	3.50	BT	N
13	85+020	T	RHS	Arauda	3.50	BT	Y
14	87+170	T	LHS	Moodiya	3.50	BT	N
15	87+660	T	LHS	Ramnagar	3.50	BT	N
16	89+120	T	RHS	Kheriya brahman	3.50	BT	Y
17	91+400	T	LHS	Halena	3.50	BT	N
18	91+600	X	LHS	Halena	3.50	BT	Y
			RHS	Nadbai	3.50	BT	
19	92+390	Y	RHS	Bhootauli	3.50	BT	Y
20	93+180	Y	RHS	Iraniya	3.50	BT	N
21	93+660	T	LHS	Iraniya	3.50	BT	Y
22	94+690	Y	LHS	Tilchivi	3.50	BT	N
23	96+520	Y	RHS	Bamera	3.50	BT	N
24	96+620	T	LHS	Tilchivi	3.50	BT	N
25	96+890	Y	LHS	Jhalatala	3.50	BT	Y
26	99+080	X	LHS	Amoli	3.50	BT	Y
			RHS	Moodiya Jat	3.50	BT	
27	100+690	T	RHS	chonkarwara khurd	3.50	BT	N
28	100+810	T	LHS	Bhusawal	7.00	BT	Y
29	102+120	T	RHS	chonkarwara khurd	3.50	BT	N
30	103+890	X	LHS	Malahera	3.50	BT	Y
			RHS	Kherli	7.50	BT	
31	105+130	T	LHS	Bachren	3.00	BT	Y
32	108+310	T	RHS	Jharonti	3.00	BT	N
33	109+500	X	LHS	kamalpura	3.50	BT	Y
			RHS	Haria	3.50	BT	
34	111+375	X	LHS	Tirhi Jalrah	3.50	BT	Y
			RHS	Naughariya	3.50	BT	
35	115+360	T	RHS	Rout	3.50	BT	N
36	116+810	X	LHS	Hindaun	7.00	BT	N
			RHS	Mandawar	7.00	BT	

5.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	13.704
	Median	3.76
Pedestrian Guard Rail	Carriageway Edge	6.905

PGR and W-Beam present on the project road

As per Inventory and condition survey it is found that 109 m Metal Beam Crash Barrier and 435 m of Pedestrian Guard Rail are required to repair / reinstall.

5.2.8 Toll Plaza and Other Facilities

As per Schedule-C; maximum number of two toll plazas are proposed at suitable locations in consultation with Independent Engineer/NHAI such that there is no possibility of traffic bypassing.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

The locations of two Toll Plaza are as mentioned below: -

1. Ludhawai Toll Plaza TP1 at km.64.570
2. Amoli Toll Plaza TP2 at km.98.730

Ludhwai Toll Plaza at Km 64+570	Amoli Toll Plaza at 98+500

5.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at flyover (interchange) as per Schedule C. Additionally, High Mast has provided at Toll Plaza, major junction, ROBs and flyover confirming Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

Sn	Existing Chainage		Length	Side	Nos.	Type	Condition
	From	To					
1	64+250	64+440	190	Median	10	Double Arm	Good
2	64+700	64+820	120	Median	8	Double Arm	Good
2	98+050	98+240	190	Median	7	Double Arm	Good
3	98+700	98+940	240	Median	8	Double Arm	Good
4	114+175	114+325	150	Median	5	Double Arm	Good
Solar Lights							
5	104+000	104+120	120	Median	4	Double Arm	Good
6	83+000			Median	1	Double Arm	Good

High Mast Location

S N	Chainage	Side	Nos
1	64+780	Toll Plaza	4
2	90+900	LHS	2
3	98+520	Toll Plaza	5
4	113+950	LHS	2
5	114+370	LHS	1
7	118+620	RHS	1
6	116+830	RHS	1
8	113+950	Median	2
9	114+370	RHS	1
10	90+900	RHS	2
12	100+800	Median	1
	Total		22

Highmast Light at 64+570 Toll Plaza

Highmast at Truck lay Bye

As per requirement of Schedule C, highway lighting is to be provided at approach of Grade Separated Structure, underpasses, toll plaza and its approaches, rest areas and bus stops.

5.2.10 Bus Bays and Bus Shelter

There are 42 Bus bays along the project road. All bus shelters present in the project road are in good condition

Bus Shelter at Km 64+020

Bus Shelter at Km 67+750

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S.N	Chainage	Side	Type	Detail			
				Pavement	Passenger Shelter	Lighting	Sign Boards
1	64+020	LHS	Steel shelter RCC seats	BT	Available	No	Yes
2	65+860	LHS	Steel shelter RCC seats	BT	Available	No	Yes
3	71+180	LHS	Steel shelter RCC seats	BT	Available	No	Yes
4	74+740	LHS	Steel shelter RCC seats	BT	Available	No	Yes
5	77+160	LHS	Steel shelter RCC seats	BT	Available	No	Yes

S.N	Chainage	Side	Type	Detail			
				Pavement	Passenger Shelter	Lighting	Sign Boards
6	79+500	LHS	Steel shelter RCC seats	BT	Available	No	Yes
7	83+630	LHS	Steel shelter RCC seats	BT	Available	No	Yes
8	85+250	LHS	Steel shelter RCC seats	BT	Available	No	Yes
9	91+850	LHS	Steel shelter RCC seats	BT	Available	No	Yes
10	93+820	LHS	Steel shelter RCC seats	BT	Available	No	Yes
11	94+600	LHS	Steel shelter RCC seats	BT	Available	No	Yes
12	97+050	LHS	Steel shelter RCC seats	BT	Available	No	Yes
13	97+850	LHS	Steel shelter RCC seats	BT	Available	No	Yes
14	99+240	LHS	Steel shelter RCC seats	BT	Available	No	Yes
15	101+000	LHS	Steel shelter RCC seats	BT	Available	No	Yes
16	104+060	LHS	Steel shelter RCC seats	BT	Available	No	Yes
17	106+020	LHS	Steel shelter RCC seats	BT	Available	No	Yes
18	109+700	LHS	Steel shelter RCC seats	BT	Available	No	Yes
19	111+540	LHS	Steel shelter RCC seats	BT	Available	No	Yes
20	112+320	LHS	Steel shelter RCC seats	BT	Available	No	Yes
21	118+810	LHS	Steel shelter RCC seats	BT	Available	No	Yes
22	64+000	RHS	Steel shelter RCC seats	BT	Available	No	Yes
23	65+860	RHS	Steel shelter RCC seats	BT	Available	No	Yes
24	70+600	RHS	Steel shelter RCC seats	BT	Available	No	Yes
25	74+600	RHS	Steel shelter RCC seats	BT	Available	No	Yes
26	76+880	RHS	Steel shelter RCC seats	BT	Available	No	Yes
27	79+200	RHS	Steel shelter RCC seats	BT	Available	No	Yes
28	83+630	RHS	Steel shelter RCC seats	BT	Available	No	Yes
29	84+900	RHS	Steel shelter RCC seats	BT	Available	No	Yes
30	91+707	RHS	Steel shelter RCC seats	BT	Available	No	Yes
31	93+500	RHS	Steel shelter RCC seats	BT	Available	No	Yes
32	94+500	RHS	Steel shelter RCC seats	BT	Available	No	Yes
33	96+800	RHS	Steel shelter RCC seats	BT	Available	No	Yes
34	97+900	RHS	Steel shelter RCC seats	BT	Available	No	Yes
35	98+940	RHS	Steel shelter RCC seats	BT	Available	No	Yes
36	100+760	RHS	Steel shelter RCC seats	BT	Available	No	Yes
37	103+600	RHS	Steel shelter RCC seats	BT	Available	No	Yes
38	106+020	RHS	Steel shelter RCC seats	BT	Available	No	Yes
39	109+340	RHS	Steel shelter RCC seats	BT	Available	No	Yes
40	111+240	RHS	Steel shelter RCC seats	BT	Available	No	Yes
41	112+050	RHS	Steel shelter RCC seats	BT	Available	No	Yes
42	118+760	RHS	Steel shelter RCC seats	BT	Available	No	Yes

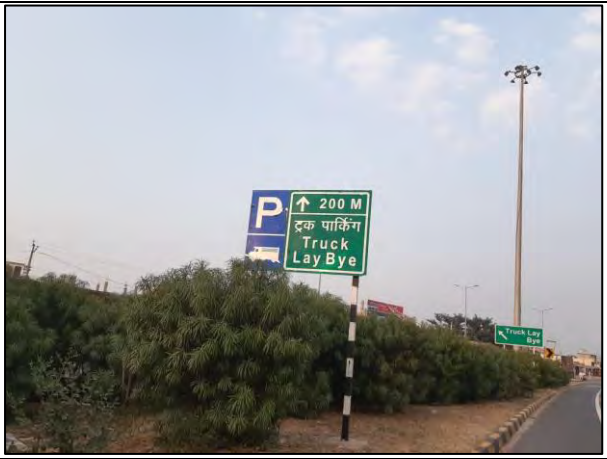
5.2.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay byes

S. No	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	90+900	LHS	Not available	Available	Available
2	114+000	LHS	Not available	Available	Available
3	91+450	RHS	Not available	Available	Available
4	114+000	RHS	Not available	Available	Available

As per Schedule C, total four numbers is to be provided.



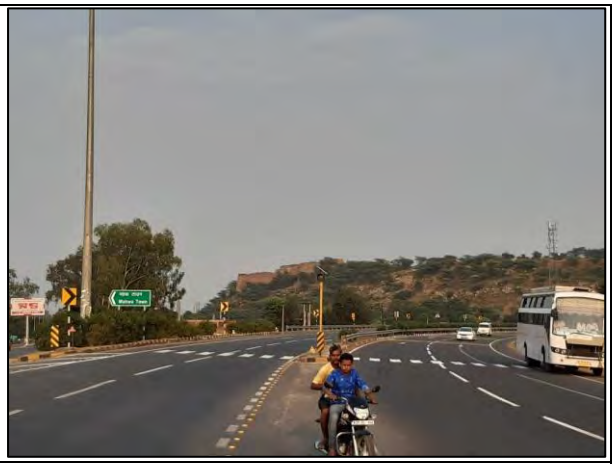
Toilet Block and Truck Laybye at Km 85+800 RHS

5.2.12 Signage and Marking

Road Signs

649 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Direction Sign on the Project Road



Sign Boards fixed at Junction

Summary of different sign board found along the project road is presented below:

TYPE OF SIGN BOARD	Nos
Overhead Gantry	4
Hazard Marker	72
Chevron	151
Direction Board	44
Turn Right	15
Route Marker	29
Turn Left	7
Cantilever gantry	6
Bus Stop	31
Pedestrian crossing	24
No Stoppage	24
Toll Boards	16
Filling Station	1
Restaurant	6
Place Identification Board	19
Emergency Numbers	7
Speed Limit	26
School Ahead	8
Petrol Pump	15

TYPE OF SIGN BOARD	Nos
Destination Board	10
Median Opening	36
Object Marker	23
Left Turn	2
Road Left	13
Informatory Board	8
Cross Road	8
Police	6
Overhead Gantry	0
Service Road Starts	3
Road Width	3
Service Road Ends	2
Truck Lay bye	8
Merging ahead	1
STOP	1
Hospital	4
Double Hazard Marker	12
Road Diverging Ahead	1
Accident zone	2
Road Right	1

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way

Road marking at the junction	Road marking along the carraigeway

5.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Plantation at Narrow Median	Plantation at 4.5 m Median

6.3 Toll Plaza and Associated Facilities

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement. Proposed toll plaza as per Concession Agreement is as below:

1. Ludhwai Toll Plaza TP1 at km.64.570
2. Amoli Toll Plaza TP2 at km.98.730

A) Ludhwai Toll Plaza TP1 at Km 64.570:

Concessionaire Agreement Provision**:** Open system of toll collection shall be provided on the Project Highway with collection of user fee from vehicles only at Toll Plaza. There shall be total number of minimum 8 lanes having a semi-automatic system of toll collection comprising equipment's of vehicle classification, ticket issuing, data processing and power supply. One toll lane in each direction shall be provided for traffic not required to pay fees. Appropriate technology shall be used in this regard so that not more than 6 vehicles per lane queue up during the peak hours.

Site Observations:

1. During the site visit, it was observed that the Toll Plaza located at Km 64+570 has 5 LHS + 5 RHS lanes.
2. One dedicated ETC lane in each direction of travel and remaining lanes (4LHS +4RHS) are in hybrid mode.
3. The Toll Plaza is equipped with the Administrative Building having all the provisions mentioned in Concessionaire Agreement.
4. There is no reversible lane.
5. There are total numbers of 10 MSWIMs (5 LHS+5 RHS) in this plaza.
6. There are 2 nos. Static Weigh Bridges; one in each direction of travel.
7. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc are as per the provisions of Concessionaire Agreement.
8. There are 2 PTZ cameras; one in each direction of travel.

Facilities available at Ludhwai Toll Plaza at Km 64.570

The available facilities at existing Toll Plaza along with condition are presented in Table below:
Table: Facilities available at Ludhwai Toll Plaza

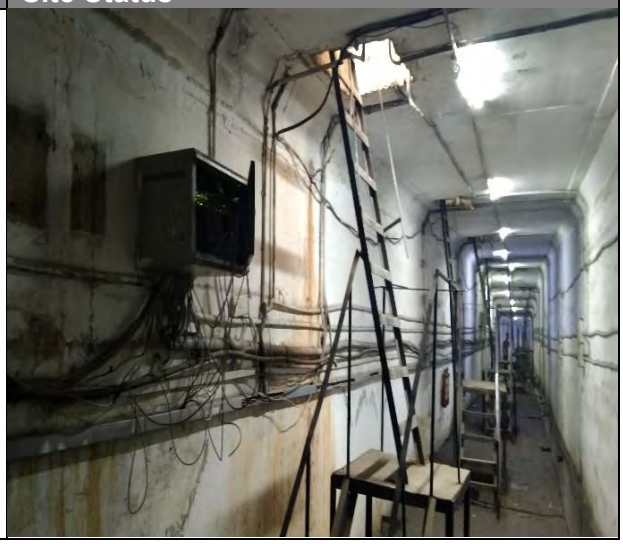
Parameter	As per Manual of Specifications and Standards for four laning Schedule 'D'	Current Status
AVC (Automatic Vehicle Classifier) System	Should be installed in each and every lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.	All such basic equipments are required to be installed and functional in all the lanes.	Installed and working in all the lanes.
Preventions for overloading	WIM should be installed Static Weigh Bridge should be installed in each direction of travel.	MSWIM installed in 5 LHS +5 RHS lanes. SWB installed in 1 LHS+1 RHS lanes. All MSWIMs and SWBs are installed and operational.

Parameter	As per Manual of Specifications and Standards for four laning Schedule 'D'	Current Status
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Available with all basic requirements.

S. No.	Description	Site Status
1.	Toll Plaza is at Km 64+570 has 5 LHS+ 5 RHS lanes.	
2.	Toll booths are equipped with all the required systems/equipments.	

S. No.	Description	Site Status
3.	All the required equipments are placed outside the toll booth.	
4.	MSWIMs are installed in 5 LHS +5 RHS lanes.	
5.	There are 2 nos. Static Weigh Bridges; one in each direction of travel.	

S. No.	Description	Site Status
6.	Administrative Building is available in Toll Plaza locations having all the basic requirements mentioned in Concessionaire Agreement.	
7.	Toll Management System (TMS) has been installed by BHARI INFRA in April 2018 and even day to day operations as well as AMC is also taken care by same vendor.	
8.	TMS Server Room is equipped with all the required servers and switches.	

S. No.	Description	Site Status
9.	View of the Tunnel at the Toll plaza	

B) Amoli Toll Plaza TP1 at Km 98.500:

Concessionaire Agreement Provision: Open system of toll collection shall be provided on the Project Highway with collection of user fee from vehicles only at Toll Plaza. There shall be total number of minimum 8 lanes having a semi-automatic system of toll collection comprising equipments of vehicle classification, ticket issuing, data processing and power supply. One toll lane in each direction shall be provided for traffic not required to pay fees. Appropriate technology shall be used in this regard so that not more than 6 vehicles per lane queue up during the peak hours.

Site Observations:

1. During the site visit, it was observed that the Toll Plaza located at Km 98+500 has 5 LHS+4 RHS lanes.
2. One dedicated ETC lane in each direction of travel and remaining lanes (4LHS +4RHS) are in hybrid mode.
3. The Toll Plaza is equipped with the conventional Administrative Building as per the provisions mentioned in Concessionaire Agreement but Control Room, and Server Room are located above the Toll Booths.
4. There is no reversible lane.
5. There are total numbers of 10 MSWIMs (5 LHS+5 RHS) in this plaza.
6. There are 2 nos. Static Weigh Bridges; one in each direction of travel.
7. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc are as per the provisions of Concessionaire Agreement.
8. There are 2 nos. PTZ cameras; one in each direction of travel.

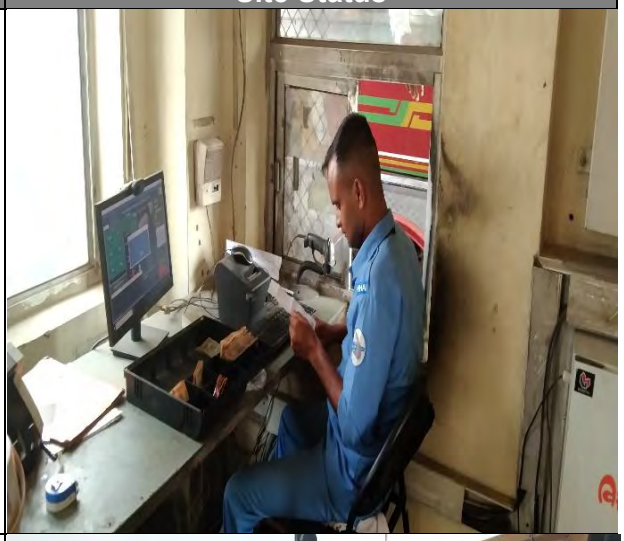
Facilities available at Amoli Toll Plaza at Km 98.500

The available facilities at existing Toll Plaza along with condition are presented in Table below:

Table: Facilities available at Amoli Toll Plaza

Parameter	As per Manual of Specifications and Standards for four laning Schedule 'D'	Current Status
AVC (Automatic Vehicle Classifier) System	Should be installed in each and every lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.	All such basic equipment's are required to be installed and functional in all the lanes.	Installed and working in all the lanes.
Preventions for overloading	WIM should be installed Static Weigh Bridge should be installed in each direction of travel.	MSWIM installed in 5 LHS +5 RHS lanes. SWB installed in 1 LHS+1 RHS lanes. All WIMs and SWBs are installed and operational.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Administrative Building available but Control room and server room are located above the toll booths.

S. No.	Description	Site Status
1.	Toll Plaza is at Km 98+500 has 5 LHS+ 5 RHS lanes.	

S. No.	Description	Site Status
2.	Toll booths are equipped with all the required systems/equipments.	
3.	All the required equipments are placed outside the toll booth.	
4.	WIMs are installed in 5 LHS +5 RHS lanes.	

S. No.	Description	Site Status
5.	There are 2 nos. Static Weigh Bridges; one in each direction of travel.	
6.	Toll Management System (TMS) has been installed by BHARI INFRA in April 2018 and even day to day operations as well as AMC is also taken care by same vendor.	
7.	TMS Server Room is equipped with all the required servers and switches.	

S. No.	Description	Site Status
8.	Route Patrol Vehicle and Ambulance parked in the Toll premises.	

Change of Scope Status:

COS related to toll plaza facilities is as follows:

S. No.	Description	Reference	COS Status
1	MSWIM & SWB in both Toll Plazas	NHAI Letter NHAI/14024/1/2017-ROJ/ETC/02440 dated 31.10.2017	COS approved for Rs. 2.99 Crores
2	Hybrid ETC System in both Toll Plazas.	IE Letter TES/IE/O&M/NHAI//2017-18/407 dated 4.1.2018	COS recommended for 16 lanes instead of 20 lanes (as 4 lanes were dedicated ETC lanes) to NHAI for Rs.1.37 Crores by IE.

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation

- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 1 no of Major Bridge of total length of 318.50 m having span arrangement of 7 x 39.75 + 1 x 40.25 is in good condition
- 5 nos. of Minor bridges having total length varies from 12.8 m to 32 m are generally found in good condition.
- 5 nos. of Underpass having span arrangement of 1 x 11.16 are found in good condition.
- 1 nos. of Railway over Bridge total of total length of 52.12 m having span arrangement 1 x 14.56 + 1 x 23 +1 x 14.56 is in good condition
- 1 no of Flyover of total length of 40 m having span arrangement of 1 x 12 + 2 x 16 + 1 x 12 is found in good condition
- 37 (pipe/slab/box) nos. of culverts found at site

6.4.2 Detailed Description of Structures

1. Major bridge – CH.95+450

It consists of new bridge on both the carriageways. It has span arrangement of 7x39.75 + 1x40.25m. The super structure comprises of PSC Girder. The Foundation adopted is well foundation. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Expansion joint in poor condition

Major Bridge at Ch. 95+450

2. Minor Bridge

Salient features of the 04 Minor bridges are discussed here.

a) Minor Bridge – CH.62+800

It consists of old bridge on LHS and new bridge on RHS. The old bridge has a span arrangement of 5x6.4m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on SM Wall type abutment & Pier. New bridge has a span arrangement of 5x6.4m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

RCC Railing damage

Poor pitching

Minor Bridge at Ch. 62+800

b) Minor Bridge – CH.63+600

It consists of old bridge on LHS and new bridge on RHS. The old bridge has a span arrangement of 2x6.4m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on SM Wall type abutment & Pier. New bridge has a span arrangement of 2x6.4m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of fillet joint is required after 15 years from date of construction. The existing bridge is using as underpass. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Wing wallin fair condition (LHS)

Span Arrangement (RHS)

Minor Bridge at Ch. 63+600

c) Minor Bridge – CH.92+350

It consists of new bridge on both carriageways. It has a span arrangement of 3x10.0m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriageway

Span arrangement

Minor Bridge at Ch. 92+350

d) Minor Bridge – CH.108+180

It consists of new bridge on LHS and old bridge on RHS. The new bridge has a span arrangement of 2x7.0m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. The old bridge has a span arrangement of 2x7.0m. The super structure comprises of RCC solid slab. The Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on SM Wall type abutment & Pier

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriageway

Poor pitching

Minor Bridge at Ch. 108+180

3. Pedestrian Under-Passes (PUPs)

There is a total of 05 PUPs has been provided. All PUPs are single span of 11.16 m with RCC wall type abutment and elastomeric bearings are adopted for resting RCC Girder. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

PUPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

View of Carriageway

Span Arrangement

PUP at Ch. 66+305

View of Carriageway

Span Arrangement

PUP at Ch. 83+050

Super structure in fair condition

Span Arrangement

PUP at Ch. 105+435

View of Carriageway

Span Arrangement

PUP at Ch. 105+570

View of Carriageway

Span Arrangement

PUP at Ch. 118+110

4. Railway over Bridge (ROBs)

ROB at Ch. 63+236

It consists of old bridge on LHS and new bridge on RHS on over railway tracks. The old bridge has a span arrangement of 1x48.65m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC portal type abutment. The new bridge has a span arrangement of 1x14.56+1x23+1x14.56m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC portal type abutment & pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Elastomeric bearing

Super structure in fair condition

ROB at Ch. 63+236

5. Grade Separators (Flyover)

Grade Separator at Ch. 116+839

It consists of new flyover on both carriageways. It has a span arrangement of 1x12+2x16+1x12.0m. The super structure comprises of RCC Girder. The Foundation is not visible. Elastomeric bearings are adopted for resting of superstructure on RCC Wall type abutment.
The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction.

A few pictures to ascertain the conditions of Grade Separator are presented as follows: -

View of Carriageway

Span Arrangement

Cracks in RCC Railing

Expansion joint damage

Flyover at Ch. 116+839

6. Culverts:

There are 37 numbers of culverts in entire project corridor.
The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

Slab Culvert at Ch. 62+313

Slab Culvert at Ch. 67+376

Slab Culvert at Ch. 72+901

Slab Culvert at Ch. 73+745

Slab Culvert at Ch. 115+830

Slab Culvert at Ch. 118+336

Slab Culverts

A Few pictures to ascertain the conditions of Pipe culverts are presented as follows:

Pipe Culvert at Ch. 68+298

Pipe Culvert at Ch.86+500

Pipe Culvert at Ch. 92+177

Pipe Culvert at Ch.114+530

Pipe Culverts

i. Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water [illegible]	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
MJB	1	95+450	LHS	7x39.75 + 1x40.25	13.950	MJB	Y	■	■	■	■	■	■	■	■	■		■	Stable	
			RHS	7x39.75 + 1x40.25	13.950			■	■	■	■	■	■	■	■	■		■	Stable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
MNB	2	62+800	LHS	5x6.4	12.000	MNB	Y	■	■	■		■	■	■	■	■		■	Stable	
			RHS	5x6.4	13.950			■	■	■		■	■	■	■	■		■	Stable	
	3	63+600	LHS	2x6.4	12.000	MNB	Y	■	■	■		■	■	■	■	■		■	Stable	
			RHS	2x6.4	13.950			■	■	■		■	■	■	■	■		■	Stable	
	4	92+350	LHS	3x10.0	13.950	MJB	Y	■	■	■		■	■	■	■	■		■	Stable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
			RHS	3x10.0	13.950			■	■	■		■	■	■	■	■		■	Stable	
	5	108+180	LHS	2x7.0	13.950	MNB	Y	■	■	■		■	■	■	■	■			Stable	
			RHS	2x7.0	11.000			■	■	■		■	■	■	■	■			Stable	
UNDERPASS	6	66+305	LHS	1X11.16	12.25	Underpass		■	■	■	■	■	■	■	■	■		■	Stable	
			RHS	1X11.16	12.25			■	■	■	■	■	■	■	■	■		■	Stable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	7	83+050	LHS	1X11.16	12.25	Underpass		■	■	■	■	■	■	■	■	■			Stable	
			RHS	1X11.16	12.25			■	■	■	■	■	■	■	■	■			Stable	
	8	105+435	LHS	1X11.16	12.25	Underpass		■	■	■	■	■	■	■	■	■		■	Stable	
			RHS	1X11.16	12.25			■	■	■	■	■	■	■	■	■		■	Stable	
	9	105+570	LHS	1X11.16	12.25	Underpass		■	■	■	■	■	■	■	■	■			Stable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
			RHS	1X11.16	12.25													Stable	
	10	118+110	LHS	1X11.16	12.25	Underpass												Stable	
			RHS	1X11.16	12.25													Stable	
GS	11	116+839	LHS	1X12+2X16+1X12.0	13.5	GS												Stable	
			RHS	1X12+2X16+1X12.0	13.5													Stable	
ROB	12	63+236	LHS	1X48.65	12	ROB												Stable	

Type	Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water	Existing Structure Condition										Overall Condition	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
			RHS	1X14.56+1X23+1X14.56	12.5			▪	▪	▪	▪	▪	▪	▪	▪	▪		▪	Stable	

Condition Summary of Culverts based on Visual Observation is presented below:

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
1	62+373	Slab		●	●					●	No	No	√		4 Nos	
2	64+750	HPC			●	●				●	No	No	√		4 Nos	
3	66+580	HPC			●	●				●	No	No	√		4 Nos	
4	67+376	Slab		●	●					●	No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
5	68+298	HPC			●	●				●	No	No	√		4 Nos	
6	68+710	HPC			●	●				●	No	No	√		4 Nos	
7	70+300	HPC			●	●				●	No	No	√		4 Nos	
8	72+901	Slab		●	●					●	No	No	√		4 Nos	
9	73+745	Slab		●	●					●	No	No	√		4 Nos	
10	74+790	HPC			●	●				●	No	No	√		4 Nos	
11	76+218	HPC			●	●				●	No	No	√		4 Nos	
12	76+500	HPC			●	●				●	No	No	√		4 Nos	
13	79+771	Slab		●	●					●	No	No	√		4 Nos	
14	81+341	HPC			●	●				●	No	No	√		4 Nos	
15	85+290	HPC			●	●				●	No	No	√		4 Nos	
16	86+500	HPC			●	●				●	No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
17	89+590	Slab		●	●					●	No	No	√		4 Nos	
18	90+609	HPC			●	●				●	No	No	√		4 Nos	
19	91+332	HPC			●	●				●	No	No	√		4 Nos	
20	92+177	HPC			●	●				●	Yes	No	√		4 Nos	
21	98+166	HPC			●	●				●	No	No	√		4 Nos	
22	100+504	HPC			●	●				●	No	No	√		4 Nos	
23	101+143	HPC			●	●				●	No	No	√		4 Nos	
24	109+503	Slab		●	●					●	No	No	√		4 Nos	
25	114+53	HPC			●	●				●	Yes	No	√		4 Nos	
26	115+203	HPC			●	●				●	No	No	√		4 Nos	
27	115+379	HPC			●	●				●	No	No	√		4 Nos	
28	115+830	Slab		●	●					●	No	No	√		4 Nos	

Sn	Chainage	Type of Culvert	Sufficiency of water way	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructures	Slab/Pipe/Box/Arch	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt	Quadrant Pitching	
29	116+385	HPC			●	●				●	No	No	√		4 Nos	
30	116+790	HPC			●	●				●	No	No	√		4 Nos	
31	116+900	HPC			●	●				●	No	No	√		4 Nos	
32	117+650	HPC			●	●				●	No	No	√		4 Nos	
33	118+332	Slab		●	●					●	No	No	√		4 Nos	
34	118+515	HPC			●	●				●	No	No	√		4 Nos	
35	118+945	Slab		●	●					●	No	No	√		4 Nos	
36	119+033	Slab		●	●					●	No	No	√		4 Nos	
37	119+176	Slab		●	●					●	No	No	√		4 Nos	

TECHNICAL DUE DILIGENCE REPORT

Madurai Kanyakumari Tollway Limited

Report Number:

ACM-60657056-TDD-MKTL-001-R0

Date:

June, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Madurai Kanyakumari Tollway Limited**, and **Cube Highways and Transportation Assets Advisors Private Limited,** the proposed Project Manager to the **Cube Highways Trust** ("Trust"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Madurai - Kanyakumari Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Madurai Kanyakumari Tollway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset 5B,
Aerocity Hospitality District, IGI Airport
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

Project Background 3
Project Salient Features 3
Project Principal Participants 4
Project Operation and Maintenance Cost 4
Limitation of Scope 7

1. INTRODUCTION 8

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 11
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS 13

2.1 General 13
2.2 Estimation of Design Traffic 14
2.3 Test Pit 14
2.3 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 17
2.4 Pavement Condition Survey using Network Survey Vehicle (NSV) 17
2.5 Roughness Survey using Network Survey Vehicle (NSV) 18
2.6 Determination of Pavement Major Maintenance 20
2.7 Base Year Pavement Rehabilitation Requirement 20
2.8 Future Maintenance Requirements 21

3 CAPEX REQUIREMENT 22

3.1 CAPEX needs 22
3.3 Unit Rate Analysis 25
3.4 Cost Estimate 26

4 MAJOR MAINTENANCE COST 27

4.1 Major Maintenance Cycle 27
4.2 Major Maintenance Quantity 27
4.3 Unit Rate Analysis 27
4.4 Cost Estimate 29

5 OPEATION AND MAINTEANCE COST - OPEX 31

5.1 O & M Requirement as per CA 31
5.2 O & M Strategy 33
5.3 Routine and Preventive Maintenance 34
5.4 Preventive Maintenance: 34
5.5 Highway Lighting 34
5.6 ATMS and TMS Cost 35
5.7 Incident Management 35
5.8 Manpower Cost 36
5.9 Office Expenses 36

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT 38

6.1 Reconnaissance Survey 38
6.2 Road Inventory and Condition Survey 38
6.3 Inventory and Condition Survey of Structures 51

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge

MKTL	Madurai-Kanyakumari Tollway Limited
MNB	Minor Bridge
MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Madurai Kanyakumari Tollway Limited ("MKTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and MKTL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Madurai – Kanyakumari Section from Km 0+000 to Km 52+300 of NH 44 (Old NH-7) in the State of Tamil Nadu (Package-1) is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (''NHAI''). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and documents and test reports provided by the Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Madurai to Kanyakumari section from KM 0+000 to Km 52+300 Package-1 on NH-44 (Old NH-7) in the state of Tamil Nadu.
Project Length	52.30 Km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Madurai Kanyakumari Tollway Limited
Signing of Agreement	27th December 2019
Appointed Date	20 Oct 2020
Concession Period	30 years
End of Concession Period	21 Oct 2050
Likely End of Concession Period	Oct 2045*
EPC Contractor for Six laning	EPC Contractor yet to be determined, Likely in FY 28 to FY 30*

Number of Toll Plaza	1 nos, Toll Plaza having 10 Hybrid lanes including Extra wide Lane

* - as per information provided by the Company

Project Principal Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Madurai Kanyakumari Tollway Limited
3	Independent Engineer	Bloom Companies LLC
4	Maintenance Contractor	1) Toll Operation (TBR Infra Pvt Ltd., Hyderabad), 2) Incident Management (Markolines Traffic Controls Private Limited) 3) G4S Security Solutions India Pvt Ltd., For Security 4) Routine Maintenance- M/s Racy Projects
5	EPC Contractor for Schedule B Work	Yet to be determined

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 12 months.

- Maintenance and rehabilitation of Pavement
- Construction of New Service Road & Structures
- Repair and Rehabilitation of Structures and Cross Drainage Works
- Minor Junction Improvement
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is Rs. 12.63 crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 years. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
2.	2027/28 2029/30	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA	
3.	2036/37	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Microsurfacing in 50 % length of Service Road	**87.63**
4.	2043/44	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**121.68**

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

As per Concession agreement, it is not clear whether overlay on existing four lane during six laning shall be executed by Authority under EPC or not. As per current practice during six laning, overlay on existing four lane is being done during six laning therefore same is considered while fixing MM cycle.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement. As per Cube Highways traffic assessment, the six laning of highways is projected in Year 2027/28 to 2029/30

c) Operation and Maintenance (OpEX)

As per Schedule F, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	14,361,781
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	16,016,978
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	4,302,800
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	7,794,808
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	4,178,625
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	3,095,695
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	2,634,545
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	6,549,590
11	Community Development	Includes CSR related expenses.	1,097,727
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	11,526,136
15	IE Fees	Includes IE fees.	3,842,045

Sl. No.	Description	Remarks	Amount (in INR)
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	11,867,952
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	4,018,952
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	1,840,792
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	280,933
		O & M Cost for FY 2022-23	**112,151,740**

A total of Rs. **11.22** crore is estimated to be incurred by the Concessionaire as OpEX as on FY 23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs

1. INTRODUCTION

1.1 Project Background

Madurai Kanyakumari Tollway Limited (hereinafter referred to as MKTL or the Concessionaire), is a company to undertake Tolling, Operation, Maintenance & Transfer (**TOT Model**) of Madurai Kanyakumari Section of NH-44(Old NH-7) from Km 0+000 to Km 52+300 in the State of Tamilnadu is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI)

In this context, **M/s AECOM India Pvt. Ltd** is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 21 Oct 2050.

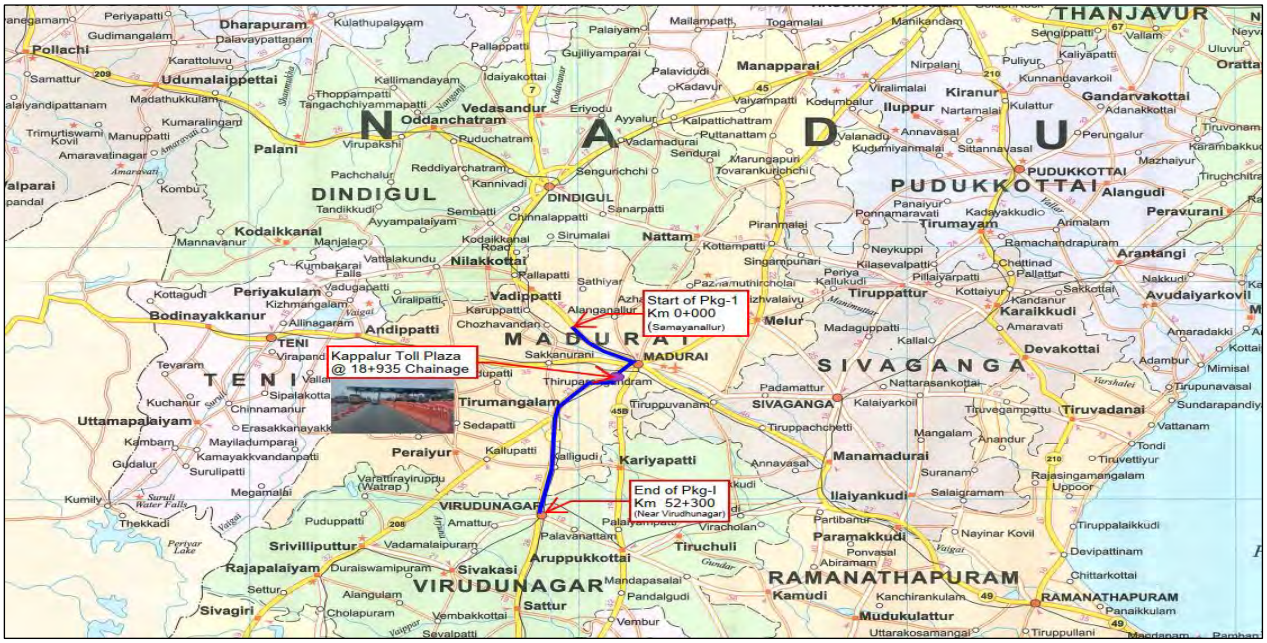
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 44 start from Km 0+000 at Samayallannur and ends at Km 52+300. NH 44, National Highway 44 (NH 44) is a major north–south National Highway in India, the longest in the country. It passes through the Union Territory of Jammu and Kashmir, in addition to the states of Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.

It came into being by merging seven national highways, in full or part, starting with the Jammu-Srinagar National Highway (former NH 1A) from Srinagar in Jammu and Kashmir, former NH 1 in Punjab and Haryana ending at Delhi, part of former NH 2 starting from Delhi and ending at Agra, former NH 3 (popularly known as Agra-Bombay National Highway) from Agra to Gwalior, former NH 75 and former NH 26 to Jhansi, and former NH 7 via Lakhnadon, Seoni, Nagpur, Adilabad, Nirmal, Hyderabad, Kurnool, Anantapur,[2] Bangalore, Hosur, Krishnagiri, Dharmapuri, Salem, Namakkal, Karur, Dindigul, Madurai, Virudhunagar and Tirunelveli terminating at Kanyakumari. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	52.30 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1 m to 2 m earthen for MCW at Rural Area
Service Road / Slip Road	43.606 km one side length having width of varying from 5.5 m to 7.0 m
Major / Minor Junction	1 Major & 7 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 6.061 Km
Median Opening	38 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	Nil
Bus Bays with shelter	12 Bus Bay and 27 Bus Shelter
Highway Lighting	22 Nos. Double Arm
High Mast	15 nos
Highway Patrol	1 nos

Description	Project Features
Ambulance	1 nos
Crane	1 nos

b) Structure

Description	Project Features
Major Bridge	3 No
Minor Bridge	12 Nos
ROB and RUB	2 No ROB
VUP	9 VUP & 1 PUP
Culverts	78 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With **approximately 1,00,000 employees** (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in **more than 150 countries** around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments**.**

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of **AECOM** based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) **Desk Study**: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) **Site Visit**: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) **CAPEX and OPEX:** calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue, if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates

- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

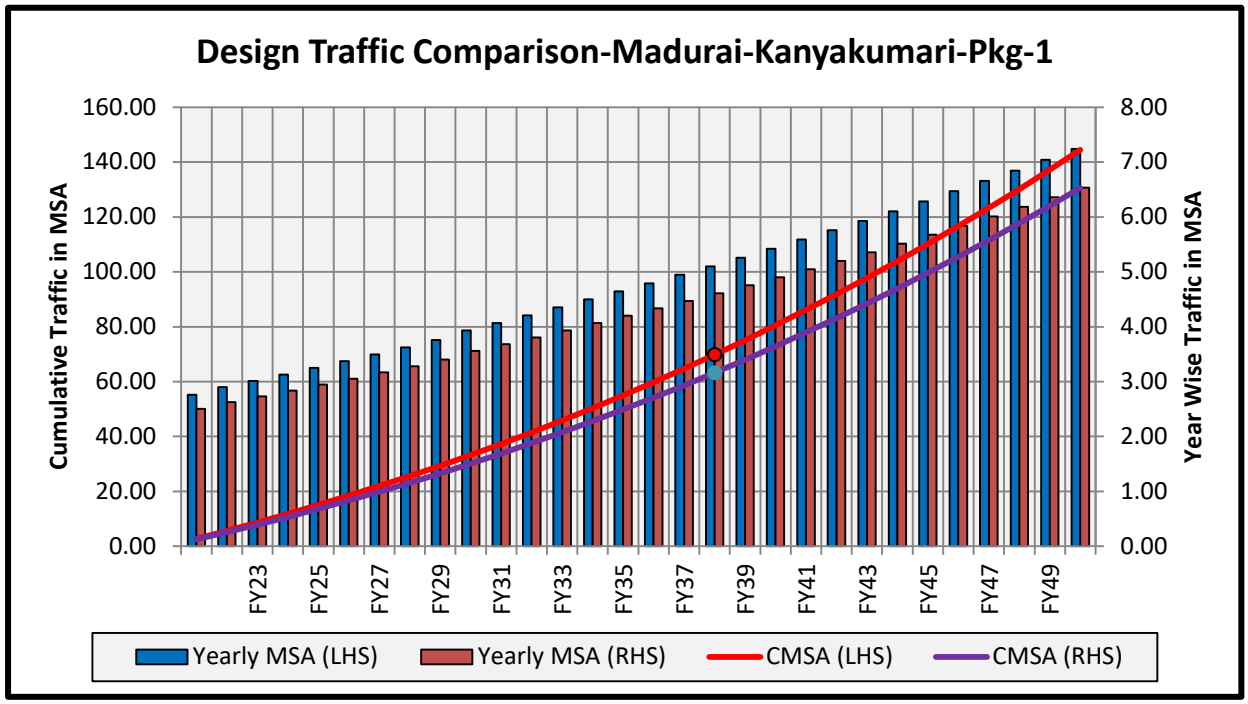
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till FY 2031 for 1st Cycle of MM design period for LHS (MK) 33.24 MSA and RHS (KM) 30.11 MSA whereas cumulative MSA upto FY 2051 is 144.45 MSA for LHS (MK) and 130.61 MSA for RHS (KM). Year wise and cumulative MSA is presented in graph below:



MK – Madurai Kanyakumari (Samayallannur to Virudha nagar) direction

KM –Kanyakumari Madurai (Virudha nagar to Samayallannur) direction

2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S. No	Existing Chainage (km)	Side	DCP-CBR	4 day soaked CBR in %
1	0+000	LHS	24.7	20.3
2	2+300	RHS	13.8	11.7
3	5+050	LHS	11.4	11.3
4	7+500	RHS	10.3	10.7
5	10+000	LHS	11.8	9.8
6	12+500	RHS	14.4	10.9
7	17+500	RHS	12.2	11.2
8	20+500	LHS	12.6	14.3
9	22+500	RHS	14.4	13.5
10	25+200	LHS	17.7	16.5
11	27+600	RHS	18.5	20.2
12	30+000	LHS	17.4	16.1
13	32+500	RHS	14.5	13.6
14	35+000	LHS	17.9	15.0
15	37+500	RHS	18.2	18.9
16	40+000	LHS	11.6	10.1

S. No	Existing Chainage (km)	Side	DCP-CBR	4 day soaked CBR in %
17	42+500	RHS	10.9	10.8
18	45+000	LHS	13.7	14.3
19	46+800	RHS	17.5	18.7
20	49+000	LHS	17.1	20.2
21	49+950	LHS	17.4	13.3
22	51+600	RHS	14.6	13.6
Average DCP-Equivalent CBR 15.1				

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from **170 mm to 270 mm** and granular layer thickness varies from **380 mm to 500 mm**.

Samples were also collected for Existing ground soil and GSB material, the test results of the Natural ground Soil are Tabulated below

S: No	Location (Km.)	Side (LHS/ RHS)	Soil Classification as per IS: 1498	Gradation: Percent by weight passing through the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS :2720-Pt-V]			Modified Proctor Test (IS:2720-Pt-VIII)		4-Days Soaked CBR (%)	Free Swell Index (%)
				19.0 mm	10.0 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. dry density (gm/cc)	OMC (%)		
1	11+500	LHS	MI	100.0	99.8	98.8	88.5	74.5	68.8	68.8	38	26	12	1.90	13.2	6.6	20.0
2	13+750	LHS	CI	100.0	100.0	95.5	88.2	77.5	59.2	59.2	40	25	15	1.92	12.9	6.8	30.0
3	21+500	LHS	SM	100.0	85.2	75.5	65.2	38.5	28.5	28.5	23	NP	NP	2.05	8.0	13.7	0.0
4	21+500	RHS	SM	100.0	99.5	85.2	68.5	55.1	21.5	21.5	18	NP	NP	2.07	8.3	14.1	0.0
5	23+000	RHS	CL	100.0	99.0	98.0	75.5	68.9	55.9	55.9	32	22	10	1.97	10.1	9.4	25.0

The test results of GSB Materials are tabulated below.

S.No	Chainage (km)	Side (LHS/RHS)	Type of Sample	Cumulative Percetage of Passing through IS Sieve (mm)												MoRTH 5th Revision
				75	53.0	45.0	26.5	22.4	11.2	9.5	4.75	2.36	0.600	0.425	0.075	
1	0+000	LHS	GSB	100.0	91.9	69.1	31.1	30.4	26.1	26.7	19.3	17.4	12.3	10.2	0.2	53 mm, 26.5mm IS Sieve Material is Slightly Side in GSB-III & IV
2	2+300	RHS	GSB	100.0	80.8	79.0	50.0	46.7	27.7	22.0	16.6	12.2	6.2	4.3	0.2	53mm IS Sieve Material is Slightly Coarser GSB-IV
3	5+050	LHS	WMM	100.0	100.0	100.0	58.3	51.2	37.5	32.2	26.3	21.6	9.5	6.9	1.0	22.4mm,11.2mm IS Sieve Material Slightly side in WMM Gradation
4	7+500	RHS	WMM	100.0	100.0	100.0	50.2	40.3	29.8	29.0	27.6	23.3	16.3	13.0	1.7	22.4mm,11.2mm IS Sieve Material is Slightly Side in WMM Gradation
5	10+000	LHS	GSB	100.0	100.0	92.6	61.6	52.4	34.8	30.4	24.9	21.9	10.7	8.1	0.9	Confirming to GSB-III & IV
6	12+500	RHS	GSB	100.0	98.3	86.4	76.5	64.3	48.6	26.4	13.2	9.5	6.0	4.2	1.3	53mm,4.75mm IS Sieve Material is Slightly Side in GSB-IV
7	17+500	RHS	WMM	100.0	100.0	100.0	65.5	55.6	43.5	30.5	28.8	19.2	13.8	7.9	0.7	22.4mm IS Sieve Material is Slightly Coarse WMM Gradation
8	20+500	LHS	GSB	100.0	90.7	72.2	37.3	29.2	13.9	10.2	6.8	5.4	2.3	1.8	0.2	Not Conforming to Any Gradation
9	22+500	RHS	GSB	100.0	100.0	72.3	62.3	29.2	20.3	17.6	9.8	8.2	6.4	2.3	1.2	4.75mm IS Sieve Material Slightly Coarser GSB-III & IV
10	25+200	LHS	WMM	100.0	100.0	100.0	98.8	52.0	45.2	21.1	22.2	19.0	13.2	10.8	3.4	22.4mm, 4.75mm IS Sieve Material is Sli Coarser Side in WMM Gradation
11	27+600	RHS	WMM	100.0	100.0	98.6	66.6	58.7	35.2	29.6	24.5	19.5	11.6	8.8	0.5	22.4mm,11.2mm 4.75mm IS Sieve Mate Slightly Coarser Side in WMM Gradatic
12	30+000	LHS	GSB	100.0	89.2	89.9	58.6	53.0	38.1	33.1	26.0	19.6	6.6	4.0	0.3	53 mm, IS Sieve Material is Slightly Coarse GSB- IV
13	32+500	RHS	GSB	100.0	100.0	86.5	58.1	45.2	41.1	37.1	34.0	28.1	22.1	10.2	4.1	Confirming to GSB-IV
14	35+000	LHS	WMM	100.0	100.0	100.0	74.2	66.8	45.5	39.0	30.6	26.9	14.6	10.3	0.9	Conforming to WMM Gradation
15	37+500	RHS	WMM	100.0	100.0	100.0	79.8	72.8	44.8	34.6	25.8	22.7	13.5	10.7	1.3	Conforming to WMM Gradation
16	40+000	LHS	GSB	95.3	95.3	85.4	55.6	52.2	39.4	36.4	31.6	26.6	15.6	11.4	0.6	53 mm, IS Sieve Material is Slightly Coarse GSB- IV
17	42+500	RHS	GSB	100.0	100.0	94.4	57.3	51.2	37.8	32.3	26.0	21.0	11.2	8.0	0.3	Conforming to GSB-III & IV
18	45+000	LHS	WMM	100.0	100.0	100.0	59.6	52.3	38.1	32.5	28.3	22.8	12.3	8.2	1.2	22.4mm,11.2mm IS Sieve Material Slightly side in WMM Gradation
19	46+800	RHS	WMM	100.0	100.0	100.0	92.3	76.5	45.6	34.2	29.1	19.2	14.3	8.5	1.6	Confirming to WMM Gradation
20	49+000	LHS	WMM	100.0	100.0	100.0	47.6	41.8	32.8	28.4	25.6	21.5	18.2	15.2	1.1	22.4mm,11.2mm IS Sieve Material is Slightly Side in WMM Gradation
21	49+950	LHS	GSB	100.0	100.0	100.0	79.4	71.5	39.2	30.1	21.3	15.4	6.7	4.7	0.7	Conforming to GSB-IV
22	51+600	RHS	GSB	100.0	100.0	100.0	73.5	26.3	22.4	20.1	18.5	15.6	10.4	8.4	0.7	Conforming to GSB-III& IV

2.3 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	Length in km	
	LHS	RHS
Length of Road where MSA is less than 10-year design MSA i.e. 33.24 MSA in LHS and 30.11 MSA in RHS	20	8
Less than 144.45 MSA in LHS and 130.61 MSA on RHS	8	6
Greater than 144.45 MSA in LHS and 130.61 MSA on RHS	24.3	38.3
Total Length	52.3	52.3

Based on remaining life of pavement, structural overlay is required and same is planned in FY 2021/22.

2.4 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	**Cracks**	- **Type:** Longitudinal, Transverse, Block, Alligator - **Extent: %** of Pavement Area Influenced by distress - **Severity:** High (> 3mm wide), Low (<3mm wide)
2	**Pothole**	- **Extent: %** of Pavement Area Influenced by distress - **No. of Potholes** - **Depth Severity:** Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	**Raveling**	- **Extent: %** of Pavement Area Influenced by distress - **Severity:** Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	**Patching**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	**Shoving**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<15mm), High (>15mm)
6	**Flushing/Bleeding**	- **Extent: %** of Pavement Area Influence by distress

Sn	Distress	Details Captured and Yard Stick adopted for Classification
		- **Severity:** Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	**Depression**	- **Extent: %** of Pavement Area Influence by distress - **Severity**
8	**Delamination**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<1 sq.m area), High (>1 sq.m area)
9	**Edge Break**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	**Pavement Missing**	- **Extent: %** of Pavement Area Missing
11	**Rutting**	- **Rut Depth**

2.5 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

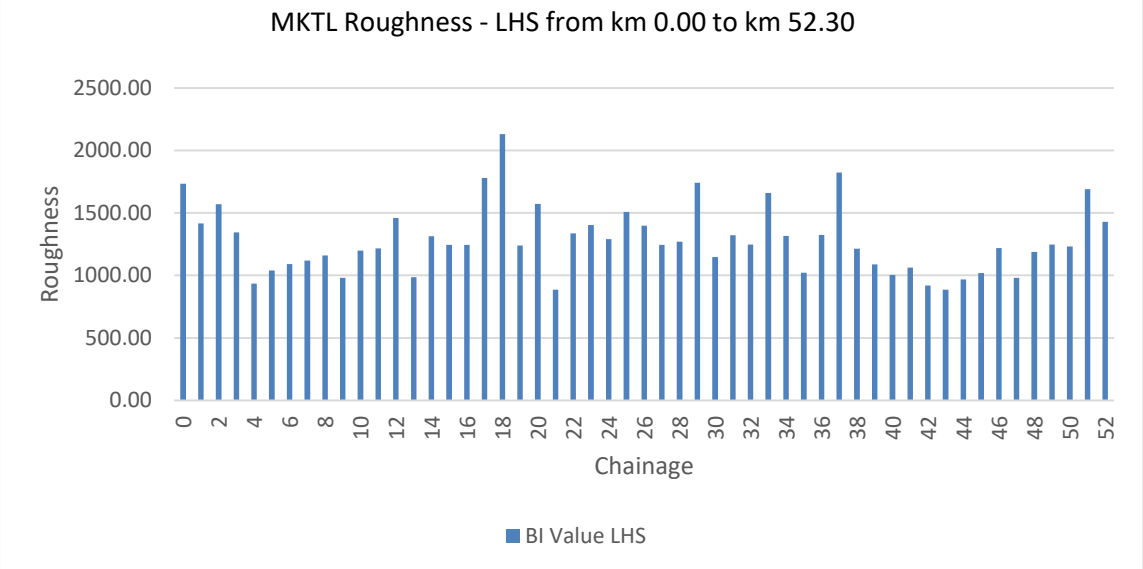
IRI = International Roughness Index

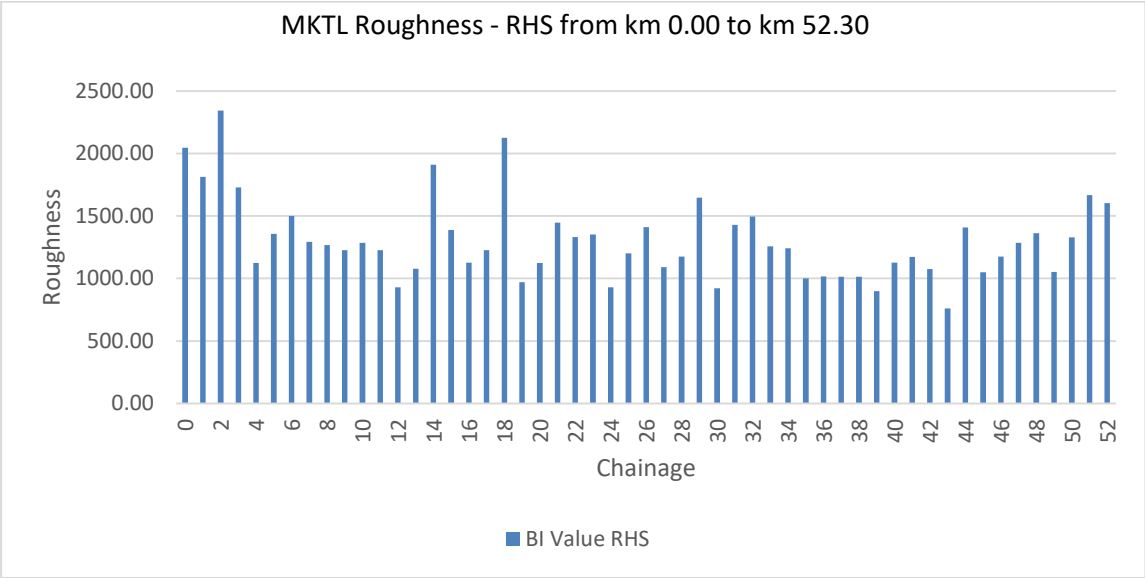
Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

Ratings	Roughness Value (mm/km)	LHS in km*	RHS in km*
Good	<2000	52	50
Fair	2000 - 3000	1	3
Poor	>3000		

***- Source of Information**: Based on NSV Survey Carried out by M/s V R Techniche Private Limited in the month of **April 2022**.

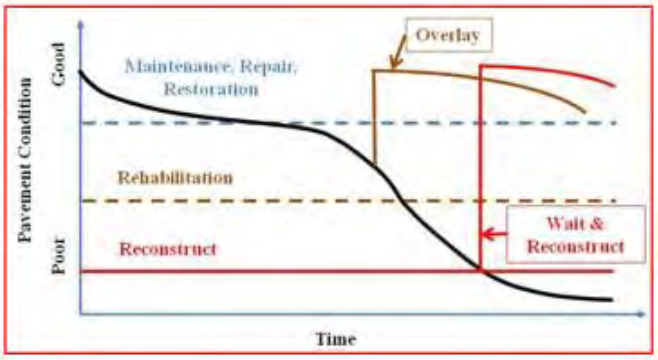
Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.




MKTL Roughness - RHS from km 0.00 to km 52.30
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Roughness
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
Chainage
BI Value RHS

2.6 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.7 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is not required however functional overlay is required to bring down roughness value less than 2000 mm / km and to maintain performance requirement till next MM cycle. Also, as per Concession agreement, minimum overlay is to be provided at location as specified in Section 3.1 of Schedule B. The combined overlay location to be provide in FY 2021/22 based on pavement condition survey caried out and as specified in Schedule B is as below:

LHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	0+000	42+000	42.00	30	Full Width	BC Overlay
2	42+000	52+300	10.30	40	Full Width	BC Overlay

RHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	0+000	52+300	52.30	30	Full Width	BC Overlay

In addition to above, additional area for milling and overlay by BC also considered. Pavement Rectification has been completed in line with Pavement Design Report and CA.

2.8 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Pave and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. Based Company information, Authority shall execute six laning under EPC from FY 2027/28 to 2029/30. The Concession agreement do not clearly mention whether overlay on existing four lane shall be executed by the Authority during six laning under EPC or not. However, providing top layer in one go is required and providing one layer of overlay during six laning is considered to be executed by the Authority. In view of above major maintenance cycle is considered as follows:

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2027/28 to 2029/30	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		2027/28 to 2029/30
2	2036/37	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %
3	2043/44	Functional Overlay	30 mm BC	30 mm BC in 50 % and Microsurfacing in 50 %

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

MM Cycle of FY 2021/22 has been completed.

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 1050 m having width of 5.50 m
2. Widening of Pipe Culvert– 1 Nos
3. Rehabilitation of Pavement – 40 mm BC in 42 km 2 Lane and 52.3Km+10.3 Km=62.6Km 30mm BC 2 Lane.
4. Minor Repair of Structures – Major Bridge 3nos, Minor Bridge 12 nos, Culverts – 78 nos, ROB – 2 nos, VUP – 9 nos.
5. Junction Improvement – 1 Major Junction and 7 Minor Junctions
6. RCC Drain – 1050 m along slip road
7. Road Furnitures – Solar Blinker 81 nos, Transverse Marking 52.3 km, W Beam 1885 m, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
8. Toll Plaza Taper Portion as Rigid Pavement.
9. Landscaping and tree plantation
10. Way Side Amenities: to be constructed by NHAI
11. Incident Management – Highway Patrol, Ambulance, Crane
12. ATMS
13. Rainwater Harvesting
14. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from Appointed Date
4	Repair and Rehabilitation of Structure	12 months from Appointed Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol,	1 Month from Appointed Date

Sn	Description of Work	Date of Completion
	Ambulance, Cranes	
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in **Schedule C**, Engineering and Safety Improvements along the Project Highways shall confirm to **IRC: SP: 84 -2014**, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. **Construction of new / widening of Service Road /Slip Road**
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. **Reconstruction of existing Service Road /Slip Road**
   No existing service roads in this package.
3. **Construction of new / widening of culverts / bridges / Grade separated structures**
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. **Repair / Rehabilitation of pavement (overlay)**
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.
5. **Repair / Rehabilitation of structures**
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
6. **Junction improvement**
   A list of improvements to be carried out at Major / Minor junction has provided in Schedule B. Consultant has prepared Typical Layout Plan for junction development based on IRC SP 84-2014 and quantity calculation arrived accordingly. Pavement thickness for Junction is as follows:
   a) Junction having Flexible Pavement
      Area adjoining to MCW: BC – 40 mm, DBM -60 mm, WMM – 250 mm, GSB – 200 mm.
      Area adjoining to Cross Road - BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm.
   b) Junction having Rigid Pavement: PQC – Not appliable
7. **Construction of new drain**
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. **Road furniture**
   a) Street Lighting – Not applicable

b) High mast lighting – Not applicable
c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
i) Road marking – quantity considered along entire length of project road
j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. Construction of new Toll plaza

Existing Toll Plaza is to be retained without adding additional lane. The existing toll plaza is having PQC on tapper as well as central portion therefore additional PQC has not considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.

10. Landscaping and tree plantation

The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.

11. Highway Patrol vehicles, Ambulance, Cranes

Two numbers at each toll location has been considered.

12. ATMS / TMS

Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.

13. Rainwater harvesting systems

Rainwater harvesting system is proposed as recommended in schedule B at 500 m interval.

14. Slope protection

As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates as of March 2022 is as follows:

Bitumen Price @ 16th March 2022	Chennai		
Bitumen	**Base Price**	**Discount**	**Ex MI price**
VG30	51752	5100	46652
VG40	55232	3800	51432

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	441
2	Granular Subbase	Cum	1,345
3	Wet mix macadam	Cum	1,684
4	Dense Bituminous Macadam	Cum	9,975
5	Bituminous Concrete (BC)	Cum	11,751
6	Pavement Quality Concrete (PQC)	Cum	6,906
7	RCC M 20 for Drain	Cum	6,187
8	Reinforcement Steel	MT	106,922
9	Metal "W" Beam crash barrier	Rm	4,297

Note: above unit rates are excluding GST and non-escalated.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs
1	Cost of Strengthening of existing carriageway	0
2	Cost of Service/Slip Road	22,975,684
3	Cost of Road Furniture	0
4	Cost of Drain	4,848,062
5	Cost of Miscellaneous works	0
6	Cost of Structure (BOX Culvert and Pipe culvert)	1,140,476
7	Cost of repairs of existing structures	0
8	Cost of Toll Plaza Improvement	77,371,824
9	Cost of ATMS	64,518,900
10	Cost of Hybrid ETC	0
	Total	**112,787,935**
	Add 12% for GST	**13,534,552**
	Total including GST	**126,322,487**

Total CAPEX balance work – Rs Rs. 12.63 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
2	2027/28 to 2029/30	Six Laning under EPC Contract to be executed by NHAI as per Article 14 of CA		
3	2036/37	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro-surfacing in 50 %
4	2043/44	Functional Overlay	30 mm BC	30 mm BC in 50 % and Micro-surfacing in 50 %

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

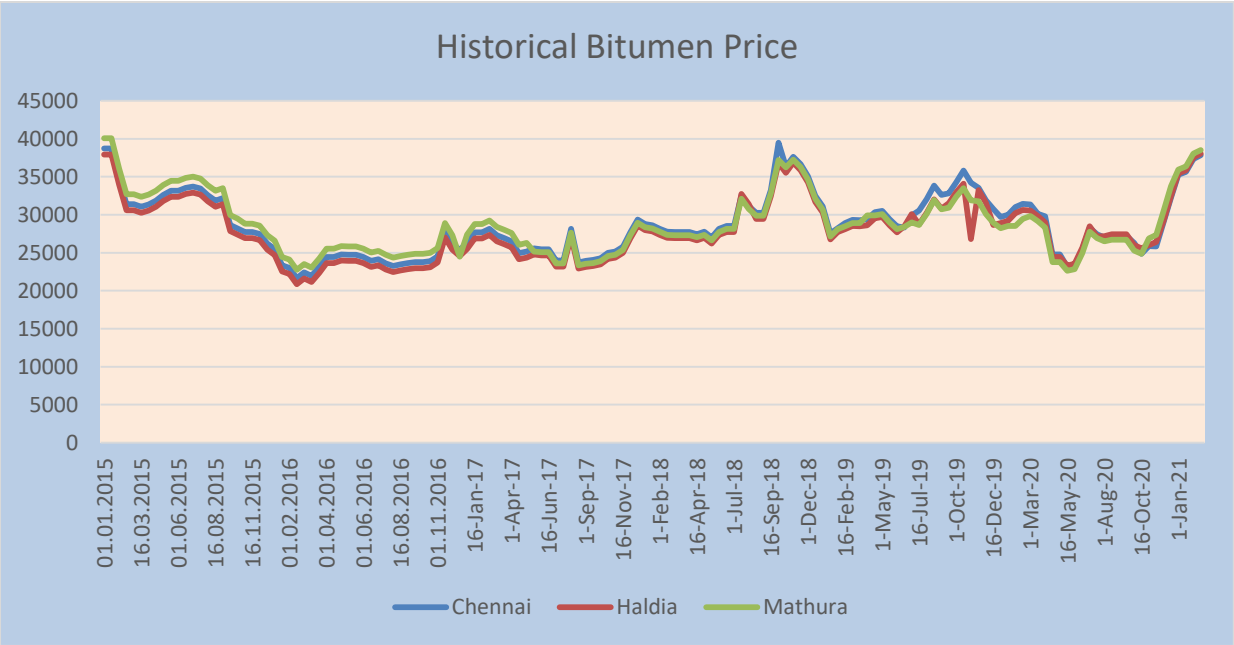
4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024. The

bitumen rate post 2024 to end of Concession period is considered flat (fixed throughout the period).

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 1st March 2021	IOC Chennai		
Bitumen	**Base Price**	**Discount**	**Ex MI price**
VG30	31,835	5100	26,735
VG40	35,315	3800	31,515

Basis of projection of Bitumen Price do not vetted by AECOM and any fluctuation on MM Cost due to changes in bitumen price to be covered by the Company.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

FY	Growth Rate	Cumulative Factor
FY 20	1.89%	
FY 21	0.41%	1.000
FY 22	2.83%	1.000
FY 23	4.66%	1.047
FY 24	5.65%	1.106
FY 25	5.37%	1.165
FY 26	5.52%	1.229

FY	Growth Rate	Cumulative Factor
FY 27	5.25%	1.294
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665

FY	Growth Rate	Cumulative Factor
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948
FY 38	3.98%	2.026
FY 39	4.00%	2.107
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464

FY	Growth Rate	Cumulative Factor
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as FY 23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	7,425
2	Bituminous Concrete	Cum	8,624
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in this report.
Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Major Maintenance				
			Quantity		Unit Rate 2022	Amount	
			2036/37	2043/44		2036/37	2043/44
	Main Carriageway - Flexible Pavement						
1	Tack Coat	Sqm	1,318,985	1,318,985	12	16,368,606	16,368,606
2	Bituminous Concrete - VG 40 / CRMB	Cum	39,570	39,570	8624	341,237,563	341,237,563
	Main Carriageway - Rigid						
1	Joint sealant replacement every 5th Year (5 %)	m	5,597	5,597	220	1,231,330	1,231,330
	Service Road					-	-
1	Tack Coat	Sqm	148,583	148,583	12	1,843,913	1,843,913
2	DBM - VG 30	Cum					
3	BC - VG 30	Cum	4,457	4,457	7873	35,094,898	35,094,898
4	Microsurfacing	Sqm	148,583	148,583	176	26,150,582	26,150,582
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)						
1	Tack Coat	Sqm	20998	20998	12	260,583	260,583
2	Bituminous Concrete - VG 40 / CRMB	Cum	630	630	8624	5,432,387	5,432,387
3	Dense Bituminous Macadam VG-40	Cum				-	-
4	Milling of existing Wearing Coat	Sqm	20998	20998	77	1,616,831	1,616,831
5	Painting of Crash Barrier	sqm	16963	16963	121	2,052,508	2,052,508
6	Microsurfacing	Sqm			176		
	Other Works						
1	Raising of Road Kerb	m		100,380	439	-	44,066,864
2	Replacement of Road Studs					-	-
	Road Studs	Nos	26,008	26,008	220	5,721,760	5,721,760
	Solar Studs	Nos	490	490	1647	807,030	807,030
3	Painting of Road Kerb	Sqm	37,643	37,643	121	4,554,747	4,554,747
4	Road Marking - MCW	Sqm	54204	54204	439	23,795,768	23,795,768
5	Shoulder Filling	Sqm	104600	104600	22	2,301,200	2,301,200
6	Median Filling	Cum	6276	6276	439	2,755,164	2,755,164
7	Cost for fixing Other CA Issue at Handback Time	LS					
8	PMC Cost for Overlay @ 20 lakh per month	Month	8	8	2,000,000	16,000,000	16,000,000
9	Bearing and Expansion Joint Replacement						
	Major Maintenance Cost Per Year					487,224,869	531,291,733
	Major Maintenance Cost Per Year with GST					545,691,854	595,046,741
			Considered in Capex			54.57	59.50
	Escalation Factor					1.948	2.562
	Esclated Amount keping Bitumen Component w/o Escalation					87.63	121.68

5 OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the "Maintenance Requirements"). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organising itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;

b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
   i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
   ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
   iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
   iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
   v) Risk of disturbance or damage or destruction to property of third party is minimised.
   vi) Members of the public are treated with due courtesy and consideration.
   vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
   viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
   ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
   x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
   xi) The Scope for Operation and Maintenance includes but not limited to following:
      - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
      - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
      - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance
      - Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
      - Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
      - Road property management – this includes management of access, encroachment and ribbon development
      - General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
      - Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimsed staff requirement at Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 18,369 / km / month excluding GST.

5.4 Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 11,501 / km / month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180 watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 8.33 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost (FY 23) for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	2.06	104,284	215,242
2	Highway Lighting Electricity Charge	Kwh	428,948	9.14	3,922,020
3	Operation and Maintenance of DG Set	Nos	1	112,188	112,188
4	Solar Blinker	Nos	16	3,293	53,350
	Total				**4,302,800**

5.6 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is **1.36 crore** per year and additional cost of **26.64 crore** for replacement of equipment at every 7 (seven) years for TMS/ATMS.

5.7 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is **Rs. 1.60 crore** per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower.

   As per Company, overloading shall not be collected from this asset therefore only six (6) Toll Collector is considered for 10 lane plaza from FY 2023 onwards.

The cost of manpower is estimated as **Rs. 3.63 core** for FY 22 an **Rs. 3.06 crore** per year from FY 2022/23 onwards.

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 2.65 crore** per year.

Note:

All the cost mentioned in this report are non-escalated except Major maintenance cost (escalated Cost)

Year wise O & M Cost (OPEX) without escalation is presented in next page.

Operation and Maintenance Cost

Year in Nos	FY	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	6,140,677	11,867,952	4,302,800	11,973,433	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	112,151,740
3	2023-24	8,625,456	11,867,952	4,302,800	14,480,608	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	117,143,694
4	2024-25	9,997,196	11,867,952	4,302,800	16,152,058	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	120,186,883
5	2025-26	11,377,735	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,238,873
6	2026-27	11,946,622	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,807,760
7	2027-28	12,305,021	11,867,952	4,302,800	74,388,054	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	180,730,705
8	2028-29	4,279,043	11,867,952	4,302,800	10,301,983	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	108,618,656
9	2029-30	6,140,677	11,867,952	4,302,800	11,973,433	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	112,151,740
10	2030-31	8,625,456	11,867,952	4,302,800	14,480,608	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	117,143,694
11	2031-32	9,997,196	11,867,952	4,302,800	16,152,058	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	120,186,883
12	2032-33	11,377,735	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,238,873
13	2033-34	11,946,622	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,807,760
14	2034-35	12,305,021	11,867,952	4,302,800	74,388,054	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	180,730,705
15	2035-36	4,279,043	11,867,952	4,302,800	10,301,983	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	108,618,656
16	2036-37	6,140,677	11,867,952	4,302,800	11,973,433	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	112,151,740
17	2037-38	8,625,456	11,867,952	4,302,800	14,480,608	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	117,143,694
18	2038-39	9,997,196	11,867,952	4,302,800	16,152,058	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	120,186,883
19	2039-40	11,377,735	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,238,873
20	2040-41	11,946,622	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,807,760
21	2041-42	12,305,021	11,867,952	4,302,800	74,388,054	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	180,730,705
22	2042-43	4,279,043	11,867,952	4,302,800	10,301,983	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	108,618,656
23	2043-44	6,140,677	11,867,952	4,302,800	11,973,433	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	112,151,740
24	2044-45	8,625,456	11,867,952	4,302,800	14,480,608	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	117,143,694
25	2045-46	9,997,196	11,867,952	4,302,800	16,152,058	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	120,186,883
26	2047-48	11,377,735	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,238,873
27	2048-49	11,946,622	11,867,952	4,302,800	17,823,507	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	123,807,760
28	2049-50	4,279,043	11,867,952	4,302,800	74,388,054	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	172,704,728
29	2050-51	6,140,677	11,867,952	4,302,800	10,301,983	16,016,978	1,778,318	30,694,650	2,634,545	26,742,387	110,480,290
	Total	**252,522,659**	**332,302,653**	**120,478,397**	**651,772,601**	**448,475,381**	**49,792,904**	**859,450,188**	**73,767,273**	**748,786,843**	**3,537,348,900**
	Total Cost in Crore	**25.25**	**33.23**	**12.05**	**65.18**	**44.85**	**4.98**	**85.95**	**7.38**	**74.88**	**353.74**

6 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Madurai - Kanyakumari section of NH 44. Project road starts from Km 0+000 at Samayallannur to Km 52+300 near Virudha Nagar in the state of Tamilnadu. The total length of the project road is 52.30 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Madurai Kanyakumari Section of NH – 44 Package-1 on TOT Basis in the State of Tamilnadu	0+000	52+300	52.30	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.

Start Point of Project Road at Km 0+000

End Point of Project Road at Km 52+300

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	**Project Road Start**	Km 0+000 at Samayallannur of NH-44 (Old NH-7)	Km 0+000 at Samayallannur of NH-44 (Old NH-7)
2	**Project Road End**	Km 52+300 at Virudha nagar of NH-44 (Old NH-7)	Km 52+300 at Virudha nagar of NH-44 (Old NH-7)
3	**Project Length**	52.30 Km	52.30 Km
6	**Carriageway**	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	**Shoulders**	1 m to 2 m earthen for MCW	1 m to 2 m earthen for MCW
8	**Median**	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	**Service Roads**	LHS: 20.903 km RHS: 22.703 km	LHS: 20.903 km RHS: 22.703 km
10	**Major Bridge**	3 No.	3 No.
11	**Minor Bridge**	12 Nos.	12 Nos.
12	**Pipe, Box & Slab Culverts**	78 Nos.	78 Nos.
13	**Major/Minor Junctions**	1Major & 7 Minor	1Major & 7 Minor
14	**Underpass**	9 VUP	9 VUP
15	**Grade Separator**	Nil	Nil
15	**ROB/RUB**	2 No	2 No
16	**Toll Plazas**	1 No	1 No
17	**Truck Lay-byes/Truck Parking**	Nil	Nil
18	**Bus Shelter**	12 Bus Bay and 27 Bus Shelter	12 Bus Bay and 27 Bus Shelter

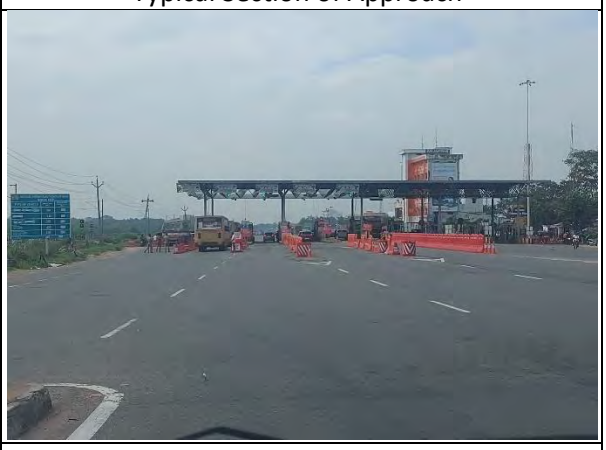
6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

Typical Cross Section having Service Road

Typical Section of Approach

Typical Rural Section



Toll Plaza

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length
	From	To	LHS	RHS	
1	0+000	18+910	BT	BT	18.910
2	18+910	18+935	CC	CC	0.05
3	18+935	52+300	BT	BT	33.34

Flexible Pavement	Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA 43.606 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 43.606 Km length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road vary from 5.5m to 7m width has been proposed for the length of 1050 m.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in fair to poor condition.

Typical 1.5 m wide median with Antiglare	4.5m wide Median with Shrubs

38 nos. of authorized and 2 number of unauthorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers and railing/safety barrier at narrow median near median opening throughout the project is not provided except at few locations.

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order, silt deposit need to be cleared through routine maintenance. Total 5.506 Km of covered/open line side drain is found on site. Median drain has observed in 0.55 Km of length and 8.11 Km Chute drain found at site. The condition of the same is good to fair.

6.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 58 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

RCC Covered Drain at Project Road	Median Cut Drain at Project Road

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	30.607
	Median	0.956
Pedestrian Guard Rail	Carriageway Edge	0.240

PGR and W-Beam present on the project road	

6.2.8 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 18+965 at Kappalur with the configuration 2 x (4+1). This has 9

single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Sch-B states within 12 months these works to be completed. As per Sch-B toll plaza taper portion is to be constructed as rigid pavement as per IRC SP – 84: 2014.

The Details of Toll plaza are given below.

1. There is 01 Toll Plaza in the project road. Following are the details:
2. Centre of Toll Plaza : Km 18+935
3. Start of Taper : Km 18+810
4. Start of Straight : Km 18+905
5. End of Straight : Km 18+965
6. End of Taper : Km 19+060
7. Taper in Length : 95.0m
8. Taper Out Length : 95.0m
9. Total Length of Toll Plaza : 250.0m
10. Lanes at Toll Plaza : 1+4+4+1 (10 Lanes, 5 lanes in each carriageway)

The Concessionaire has running the operation at the toll plaza with temporary iron cabins as there is no admin building in the project highway.

Toll Plaza	Toll Plaza

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and urban section. Additionally, 16 High Mast has provided at Toll Plaza, major junction and flyover. 22 Nos. Double Arm poles has been provided at site.

Highway Lighting Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	02+185	Median	1	Double Arm	Working
2	12+990	LHS	1	Double Arm	Working
3	13+000	RHS	1	Double Arm	Working
4	14+263	RHS	1	Double Arm	Working
5	14+270	LHS	1	Double Arm	Working
6	15+235	Median	1	Double Arm	Working
7	16+448	LHS	1	Double Arm	Working
8	16+468	RHS	1	Double Arm	Working
9	17+480	LHS	1	Double Arm	Working
10	18+210	Median	1	Double Arm	Working
11	18+235	Median	1	Double Arm	Working
12	19+456	Median	1	Double Arm	Working
13	22+101	LHS	1	Double Arm	Working
14	22+101	RHS	1	Double Arm	Working
15	28+010	Median	1	Double Arm	Working
16	29+850	Median	1	Double Arm	Working
17	31+233	Median	1	Double Arm	Working
18	32+332	Median	1	Double Arm	Working
19	33+553	Median	1	Double Arm	Working
20	33+904	Median	1	Double Arm	Working
21	41+615	Median	1	Double Arm	Working
22	49+471	Median	1	Double Arm	Working

High Mast Location

Highway Lighting					
SN	Existing Chainage From	Side	Nos.	Type	Condition
1	00+789	LHS	1	High mast	Working
2	00+789	RHS	1	High mast	Working
3	01+522	RHS	1	High mast	Working
4	03+362	RHS	1	High mast	Working
5	15+721	Median	1	High mast	Working
6	17+281	Median	1	High mast	Working
7	18+235	LHS	1	High mast	Working
8	18+870	RHS	1	High mast	Working
9	18+955	RHS	1	High mast	Working

Highway Lighting					
SN	Existing Chainage From	Side	Nos.	Type	Condition
10	23+119	Median	1	High mast	Working
11	23+870	Median	1	High mast	Working
12	38+633	RHS	1	High mast	Working
13	38+789	Median	1	High mast	Working
14	39+321	LHS	1	High mast	Working
15	41+629	LHS	1	High mast	Working
16	50+521	Median	1	High mast	Working

High Mast Light

Highway Lighting

6.2.10 Bus Bays and Bus Shelter

There are 12 Bus Bay and 27 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter	Bus Bay with Bus Shelter

6.2.11 Truck Lay Byes

Two Nos of Truck Lay bye found at site at KM 10+870 and at Km 11+200

Details of Truck Lay bye

Truck Laybye

6.2.12 Signage and Marking

Road Signs

886 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Route Marker Board on the Project Road

Sign Board fixed at Project Road

Road Marking

Summary of different sign board found along the project road is presented below:

Sl. No.	Sign Type	Approx. Nos.	Remarks
1	90 cm equilateral triangle	340	Approx. 16 to be replaced
2	60 cm equilateral triangle		
3	60 cm circular	49	
4	75 cm circular		
5	Route Marker	342	Approx. 15 to be replaced
6	60 cm x 45 cm rectangular	38	Approx. 7 to be replaced
7	60 cm x 60 cm square	96	Approx. 10 to be replaced
8	90 cm high octagon (Stop)	4	
9	60 cm high octagon (Go Slow)		
10	Overhead Gantry Sign	5	
11	Cantilever Gantry Sign	12	Approx. 1 to be replaced
Total		**886**	

Road marking along the carriageway

6.2.13Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is Not good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road

Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc**.** and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

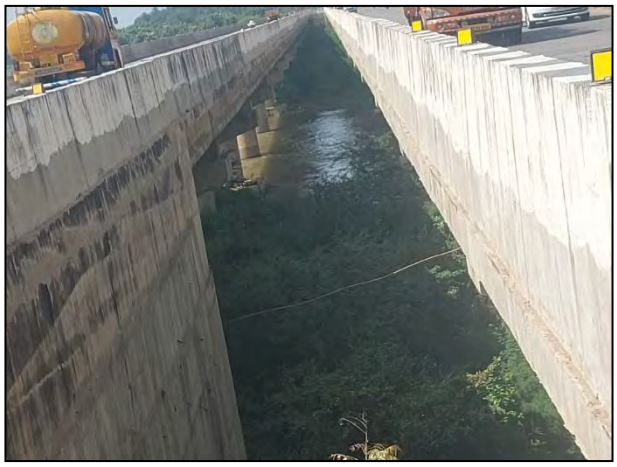
- 3 no of Major bridges having total length varies from 61.6 m to 404.6 m are generally found in good condition.
- 12 nos. of Minor bridges having total length varies from 6 m to 49.4 m are generally found in good condition.
- 9 nos. of Underpass having minimum span arrangement of 1 x 10 are found in good condition.
- 2 nos. of Railway over Bridge are found in good condition
- No Flyover is available within chainage 0+000 to km 52+300
- 78 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

a) Major bridge – CH.2+994

It consists of bridge on both the carriageways. Both the bridge has span arrangement of 17x23.8m. The super structure comprises of RCC T-Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and Circular pier. Wearing coat repairing is required and slope pitching is not in good condition and other condition of the bridge is good. It requires regular repair works such painting and repairing of Cross barrier, repairing of drainage spouts, etc. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of the Carriageway



Span Arrangement

Major Bridge at Ch. 2+994

b) Major Bridge – CH.33+150

It consists of bridge on both the carriageways. Both the bridge has span arrangement of 7x8.8 m. The super structure comprises of RCC Solid Slab. Superstructure is resting on RCC Wall type abutment and pier. The general condition of the bridge is fair. It requires regular repair works such painting and repairing of RCC Parapet, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span arrangement

Major Bridge at Ch. 33+150

c) Major Bridge – CH.51+350

It consists of bridge on both the carriageways. LHS bridge has span arrangement of 5x20 m. The super structure comprises of RCC T-Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. RHS bridge has span arrangement of 15x6.5 m. The super structure comprises of RCC Solid Slab. Superstructure is resting on RCC Wall type abutment and pier.

General condition of the both bridges is good. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Major Bridge at Ch. 51+350

d) 2.3.2.2 Minor Bridge

Salient features along with condition of 12 Minor bridges are discussed here.

e) Minor Bridge – CH.6+280

It consists of bridge on LHS and RHS of the carriage way. Both sides bridge has Span arrangement of 1x6m. The bridge is of RCC Box.:

f) Minor Bridge – CH.7+800

It consists of bridge on LHS and RHS of the carriage way. Both sides bridge has Span arrangement of 1x10m (sq). The bridge is of RCC Box. Slope pitching is in poor condition. Minor repairing of Wearing coat is required. Other condition of the bridge is Good. It requires regular repair works such painting and repairing of RCC Cross barrier, repairing of RE wall etc. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 7+800

g) Minor Bridge – CH.20+620

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 1x9.6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Slope Pitching is in poor condition. Parapet wall needs to be repaired. Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arangement

Minor Bridge at Ch. 20+620

h) Minor Bridge – CH.20+960

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 1x9.6m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. The general condition of the bridge is fair. It requires regular repair work like painting and repairing of RCC Parapet wall. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of carriageway

Span Arangement

Minor Bridge at Ch. 20+960

i) Minor Bridge – CH.21+230

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 1x9.6m. The super structure comprises of RCC solid slab. The Foundation is Open Foundation. Superstructure is resting on RCC Wall type abutment. The general condition of the bridge is Fair. A few pictures showing the conditions of Minor Bridge are presented as follows:

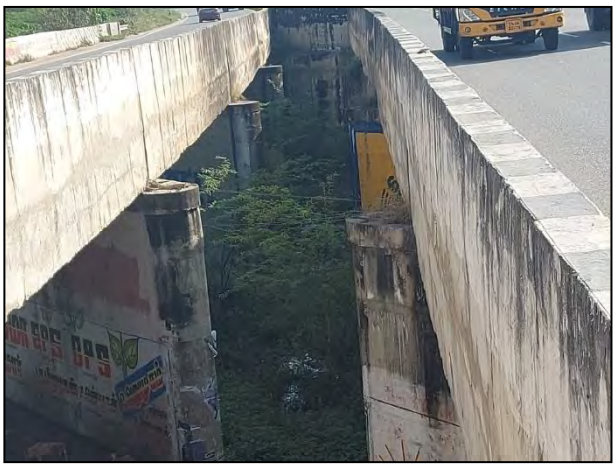
View of Carriageway

Span Arrangement

Minor Bridge at Ch. 21+230

j) Minor Bridge – CH.23+850

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 4x8.8m (sq). The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint and wearing coat is required. A few pictures showing the conditions of Minor Bridge are presented as follows:



Span Arrangement

View of carriage way

Minor Bridge at Ch. 23+850

k) Minor Bridge – CH.26+370

It consists of bridge on LHS and RHS of the carriage way. Both sides bridge has Span arrangement of 1x10m. The bridge is of RCC Box. It requires painting and repairing of RCC Parapet wall. Wearing coat and Other condition of the bridge is Good.

A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 26+370

l) Minor Bridge – CH.31+980

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 2x4.4m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. It requires painting and repairing of RCC Parapet wall. Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 31+980

m) Minor Bridge – CH.37+902

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 2x7.1m. The super structure comprises of RCC solid slab. The Foundation is open foundation. Superstructure is resting on RCC Wall type abutment & Pier. Slope Pitching is in poor condition. It requires painting and repairing of RCC Parapet wall. Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows

View of Carriageway

Span Arrangement

n) Minor Bridge – CH.39+555

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 2x8m. The super structure comprises of RCC solid slab. The Foundation is open foundation. Superstructure is resting on RCC Wall type abutment. Slope Pitching is in poor condition. It requires painting and repairing of RCC Parapet wall. Wearing coat and Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 39+555

o) Minor Bridge – CH.46+000

It consists of bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 2x6.9m. The super structure comprises of RCC solid slab. The Foundation is open foundation. Superstructure is resting on RCC Wall type abutment & Pier. Slope Pitching is in poor condition. It requires repairing of RCC Parapet wall. Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows

View of Carriageway

Span Arrangement

p) Minor Bridge – CH.51+000

It consists of bridge on LHS and RHS of the carriage way. LHS bridge has span arrangement of 13x3.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. RHS bridge has span arrangement of 12x3.8m. The super structure comprises of RCC solid slab. The Foundation is open foundation. Superstructure is resting on RCC Wall type abutment & Pier.

Slope Pitching is in poor condition. It requires repairing of Wearing coat and RCC Parapet wall. Other condition of the bridge is good. A few pictures showing the conditions of Minor Bridge are presented as follows

Pitching in poor condition

Span Arrangement

Minor Bridge at Ch. 51+000

2.3.2.3 Under-Passes (UPs)

There is a total of 09 PUPs has been provided. All UPs have minimum single span of 1 x 10 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages. A few pictures to ascertain the conditions of PUPs are presented as follows:

RCC Box is in fair condition

Span Arrangement

UP at Ch. 0+980

RCC Box is in fair condition

Span Arrangement

UP at Ch.7+080

RCC Box is in fair condition

Span Arrangement

UP at Ch. 8+900

RCC Box is in fair condition

Span Arrangement

UP at Ch. 14+630

RCC Box is in fair condition

Span Arrangement

UP at Ch. 20+370

RCC Box is in fair condition

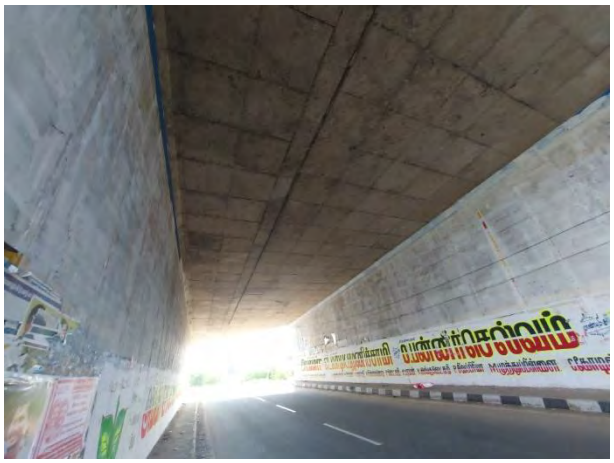
Span Arrangement

UP at Ch. 22+754

RCC Box is in fair condition

Span Arrangement

UP at Ch. 25+625



RCC Box is in fair condition

Span Arrangement

UP at Ch. 26+645

RCC Box is in fair condition

Span Arrangement

UP at Ch. 49+850

2.3.2.4 Railway over Bridge (ROBs)

1. ROB at Ch. 0+590

It consists of Rail over bridge on LHS and RHS of the carriage way. LHS bridge has span arrangement of 2x19m. The super structure comprises of RCC Girder and Steel Girder. Pot-PTFE type Bearings are used for resting the superstructure on RCC Wall type abutment & Circular as well as wall type Pier.

RHS bridge has span arrangement of 3x22m. The super structure comprises of RCC Girder and Steel Girder. The Foundation is open foundation. Pot-PTFE type bearings are used for resting the superstructure on RCC Wall type abutment & Circular as well as wall type Pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of abutment

Span Arrangement

Suuper structure in fair condition

Super structure in fair condition

ROB at Ch. 0+590

2. ROB at Ch. 8+800

It consists of Rail over bridge on LHS and RHS of the carriage way. Both the bridge has span arrangement of 1x29.6m. The super structure comprises of RCC Girder and Steel Girder. The Foundation is not visible. Pot-PTFE type Bearings are used for resting the superstructure on RCC Wall type abutment & Circular as well as wall type Pier. Cleaning of chute drainage and replacing of wearing coat is required. Other conditions of these bridges are good. A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Chute drain

Super structure in fair condition

ROB at Ch. 8+800

2.3.2.5 Grade Separators (Flyover)

There are not any Grade seperator (Flyover)

2.3.2.6 Culverts:

There are 78 numbers of culverts in entire project corridor. The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	**Good**	No immediate Repair / Maintenance Works Required
●	**Fair / Satisfactory**	Minor Repair Works Required
●	**Poor**	Major Repair Works or Replacement of components Required
N/A	**Not Applicable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	2+994	LHS	17x23.8	10	**MJB**	Y	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	17x23.8	10			●	●	●	●	●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
2	33+150	LHS	7x8.8	10.25	**MJB**	Y	●	●	●	●	●	●	●	●	●			**Stable**	
		RHS	7x8.8	10.25			●	●	●	●	●	●	●	●	●			**Stable**	
3	51+350	LHS	5x20	10.00	**MJB**	Y	●	●	●	●	●	●	●	●	●			**Stable**	
		RHS	15x6.5	11.00			●	●	●	●	●	●	●	●	●			**Stable**	
4	6+280	LHS	1x6	16.42	**MNB**	Y	●	●	●		●	●		●	●		●	**Stable**	
		RHS	1x6	16.42			●	●	●		●	●		●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
5	7+800	LHS	1x10	13.5	MNB	Y	●	●	●		●	●		●	●		●	Stable	
		RHS	1x10	13.5			●	●	●		●	●		●	●		●	Stable	
6	20+620	LHS	1x9.6	10.25	MNB	Y	●	●	●		●	●		●	●		●	Stable	
		RHS	1x9.6	10.25			●	●	●		●	●		●	●		●	Stable	
7	20+960	LHS	1x9.6	10.25	MNB	Y	●	●	●	●	●	●		●	●		●	Stable	
		RHS	1x9.6	10.25			●	●	●	●	●	●		●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
8	21+230	LHS	1x9.6	10.25	**MNB**	Y	●	●	●	●	●	●		●	●		●	**Stable**	
		RHS	1x9.6	10.25			●	●	●	●	●	●		●	●		●	**Stable**	
9	23+850	LHS	4x8.8	10.25	**MNB**	Y	●	●	●	●	●	●		●	●		●	**Stable**	
		RHS	4x8.8	10.25			●	●	●	●	●	●		●	●		●	**Stable**	
10	26+370	LHS	1x10	13.8	**MNB**	Y	●	●	●		●	●		●	●			**Stable**	
		RHS	1x10	13.8			●	●	●		●	●		●	●			**Stable**	
	31+980	LHS	2x4.4	10.25	**MNB**	Y	●	●	●	●	●	●		●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
11		RHS	2x4.4	10.25			●	●	●	●	●	●		●	●		●	Stable	
12	37+902	LHS	2x7.1	10.25	**MNB**	Y	●	●	●		●	●		●	●		●	Stable	
		RHS	2x7.1	10.25			●	●	●		●	●		●	●		●	Stable	
13	39+555	LHS	1x8	10.25	**MNB**	Y	●	●	●		●	●		●	●			Stable	
		RHS	1x8	10.25			●	●	●		●	●		●	●			Stable	
14	46+000	LHS	2x6.9	10.25	**MNB**	Y	●	●	●		●	●		●	●			Stable	
		RHS	2x6.9	10.25			●	●	●		●	●		●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
15	51+000	LHS	13x3.8	10.5	**MNB**	Y	●	●	●		●	●		●	●			**Stable**	
		RHS	12x3.8	9.5			●	●	●		●	●		●	●			**Stable**	
16	0+980	LHS	2x10	27.5	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	2x10	27.50			●	●	●		●	●	●	●	●		●	**Stable**	
17	7+080	LHS	2x10	27.5	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	2x10	27.5			●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
18	8+900	LHS	1x14.5	31.0	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x14.5	31.0			●	●	●		●	●	●	●	●		●	**Stable**	
19	14+630	LHS	1x10	27.5	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x10	27.5			●	●	●		●	●	●	●	●		●	**Stable**	
20	20+370	LHS	1x10	27.5	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	
		RHS	1x10	27.5			●	●	●		●	●	●	●	●		●	**Stable**	
	22+754	LHS	1x10	27.50	**UP**	NA	●	●	●		●	●	●	●	●		●	**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
21		RHS	1x10	27.50			●	●	●		●	●	●	●	●		●	Stable	
22	25+625	LHS	2x10	27.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	2x10	27.5			●	●	●		●	●	●	●	●		●	Stable	
23	26+645	LHS	1x10	27.50	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	27.50			●	●	●			●	●	●	●		●	Stable	
	49+850	LHS	2x10	24.70	UP	NA	●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of Water Way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
24		RHS	2x10	24.70			●	●	●			●	●	●	●		●	Stable	
25	0+590	LHS	2x19	11	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	3x22	10			●	●	●	●	●	●	●	●	●		●	Stable	
26	8+800	LHS	1x29.6	12	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	1x29.6	12			●	●	●	●	●	●	●	●	●		●	Stable	

TECHNICAL DUE DILIGENCE REPORT

NELAMANGALA DEVIHALLI EXPRESSWAY PRIVATE LIMITED

Report Number:

ACM-60655667-TDD-ND-001-R0

Date:

June, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Nelamangala Devihalli Expressway Private Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Nelamangala Devihalli Expressway Private Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Nelamangala Devihalli Expressway Private Limited

5th Floor, OSE Commercial Block, Asset 5B,
Aerocity Hospitality District,
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

1.	**EXECUTIVE SUMMARY**	**3**
1.1	Basis of Preparation	3
1.2	Overview of the Project	4
1.3	Key Findings	5
1.4	Asset Condition	9
1.5	Toll Plaza and TMS	11
1.6	Change of Scope (COS)	12
1.8	Requirement of O & M and Periodic Maintenance as per Concession Agreement	13
1.9	Insurance	14
1.10	Introduction of Asset	15
1.11	Review of Pavement	17
1.12	Major Maintenance	21
1.13	Operation & Maintenance Works	22
1.14	List of Document Reviewed	23
2.	**PAVEMENT EVALUATION AND TEST**	**25**
2.2	Determination of Pavement Major Maintenance	32
2.3	Toll Plaza and Associated Facilities	34
2.3.1	Toll Plaza TP1@ 32.500 km and TP2@ 100.950 km	34
2.3.2	Pictorial representation for present site conditions:	35
2.3.3	Highway Traffic Management System (HTMS):	37
2.3.4	CHANGE OF SCOPE:	37
2.4	Road Safety Assessment	38
3.	**CAPEX REQUIREMENT**	**39**
4.	**MAJOR MAINTENANCE COST**	**40**
4.1	Major Maintenance Cycle	40
4.2	Major Maintenance Quantity	40
4.3	Unit Rate Analysis	41
4.4	Cost Estimate	43
5.	**OPERATION AND MAINTENANCE COST**	**45**
5.1	Introduction	45
5.2	Forecast Methodology	45
5.3	Requirement of CA (Schedule L and Concession Agreement)	46
5.4	Routine and Preventive Maintenance	46
5.5	Highway Lighting	47
5.6	TMS Cost and ATMS	47
5.1	Corridor Management	48
5.2	Manpower Cost	48
5.3	Office Expenses	48
6.	**PROJECT ROAD ANALYSIS**	**50**
6.1	Reconnaissance Survey	50
6.2	Road Inventory and Condition Survey	50
8.1	Inventory and Condition Survey of Structures	70

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract	FWD	Falling Weight Deflectometer
ATMS	Advanced Traffic Management System	GAD	General Arrangement Drawing
BC	Bituminous Concrete	GSB	Granular Sub-base
BHS	Both Hand Side	GST	Goods and Services Tax
BI	Bump Integrator	HSYD	High Yielding Strength Deformed
BOQ	Bill of Quantity	INR	Indian Rupees
BT	Bituminous Top	IRC	Indian Road Congress
CA	Concession Agreement	ITM	Integrated Traffic Management
CAPEX	Capital Expenditures	KVA	Kilo-Volt-Ampere
CC	Control Centre	LCV	Light Commercial Vehicle
CCTV	Closed Circuit Television Systems	LED	Light Emitting Diode
CMSA	Cumulative Million Standard Axles	LHS	Left Hand Side
COS	Change of Scope	LIU	Light Interface Units
COD	Commercial Operation Date	LVUP	Light Vehicular Underpass
CUP	Cattle Underpass	MAV	Multi Axle Vehicle
DBM	Dense Bituminous Macadam	NDEPL	Nelamangala Devihalli Expressway Private Limited
DG	Diesel Generator	MCA	Model Concession Agreement
DLC	Dry Lean Concrete	MCW	Main Carriageway
ECB	Emergency Call Box	MDS	Metrological Data System
EPC	Engineering, Procurement, and Construction	MET	Metrological
ESAL	Equivalent Standard Axle Load	MIS	Management Information System
ETC	Electronic Toll Collection	MJB	Major Bridge
EW	East West	MNB	Minor Bridge
FO	Flyover	MoRTH	Ministry of Road Transport and Highways
FOB	Foot Over Bridge	MSA	Million Standard Axles

MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Nelamangala Devihalli Expressway Private Limited ("NDEPL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning From Nelamangala Junction on NH-4 to Devihalli on NH-48 from Km.28.200 to Km 110.000 in the state of Karnataka under NHDP Phase-IIIA on BOT Basis (herein after refer as "the Project") which is being operated by "M/s Nelamangala Devihalli Expressway Private Limited" (hereinafter refer as "the Concessionaire or Company or NDEPL").

1.1.2 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on the visual condition survey of highway and structures and test reports provided by the Client.

In this report, AECOM provides an overview of the asset from technical perspective, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.1.3 Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

a) Project Document

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- O and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepared by IE
- Test Report
- Traffic Data

b) Test Report
- Axle Load Survey Data with VDF
- NSV Survey Data
- FWD Test Report with analysis
- Test Pit and Core Test Report

Apart from data room, information / data provided thorough email and information received at SPV office has also reviewed and included in this report.

1.1.4 Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.2 Overview of the Project

Agreement was signed between NATIONAL HIGHWAYS AUTHORITY OF INDIA and (M/s LANCO DEVIHALLI HIGHWAYS PRIVATE LIMITED) (herein after called "the former Concessionaire") on 9th Day of July 2007 Four Laning From Nelamangala Junction on NH-4 to Devihalli on NH-48 from Km.28.200 to Km 110.000 in the state of Karnataka under NHDP Phase-IIIA on BOT Basis (hereinafter called "the Project"). Further a Supplementary agreement was signed on 22 June 2012 as per NHAI Letter dated June 22nd, 2012.

Project Corridor	Four Laning of Nelamangala Junction to Devihalli on NH 48 from Km 28.200 to Km 110.000 in the state of Karnataka on BOT Basis.
Employer	National highways authority of India
Concessionaire	Nelamangala Devihalli Expressway limited

Independent Engineer (During construction and During O & M)	During Construction- Consulting Engineers Group Ltd., During O&M - MSV international Inc in Association with MSV International Tech Pvt Ltd.,
EPC Contractor	M/s Lanco Infratech limited
Project Road Length	80.273 km (As per toll collection receipt the effective length of toll being collected is 79.20 Km)
Project Cost	INR. 441 Crores (as per IE MPR June 2019)
Grant	175.92 crore (Clause 23.2 of CA)
Date of Concession Agreement	9th July 2007
Appointed Date	5th January 2008
Concession Period	25 years including Construction Period of 30 Months
Construction Period	30 months
Schedule Date of Completion	4th July 2010
PCOD	23rd June 2012 for a length of 80.273km from km 28.2 to Km 110.0. (as per toll receipt toll collection is for 79.20 km)
Completion certificate	Not issued
O & M Contractor	
Number of Toll Plaza and Lanes	2 nos TP1- (4+1) x 2 - i.e. 10 Lanes and TP2- (4+1) x 2 - i.e. 10 Lanes
End of Concession Period	29 December 2032

Source: IE MPR July 2019, Concession Agreement

1.3 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (CC)	Provisional Completion Certificate was issued on 23rd June 2012 and Project completion certificate not yet issued.	🟡
Operation and Maintenance	As per Article 18 of Concession Agreement, Concessionaire shall maintain project highway in conformity with Maintenance Requirements, the Maintenance Manual or Maintenance Program as the case may be. Concessionaire is fulfilling O & M obligations completely except the Periodical Renewal which is under dispute and penalty of INR. 23.4 Lakhs against for not carrying out the test on Major Bridges. (FIPL/NHAI/ND/21-22/272 dated:05.11.2021).	🔴

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td></td><td>Concessionaire is advised to carryout day to day routine maintenance activity no major defects has identified. Concessionaire has appointed various agencies for carrying out Operation and Maintenance of project. As per AECOM assessment O & M cost per year 20.08 crore.</td><td></td></tr>
<tr><td>Major Maintenance (MM)</td><td>As per Schedule L, the concessionaire has to ensure that the road condition is good both structurally and functionally. The roughness of the road should not exceed 3000mm/km and the characteristic deflection should not exceed 0.8mm.
As per sub clause 3.3.7 (i) of Schedule L of the CA, renewal / strengthening course to be provided on as required basis (once 5 years). Major maintenance cycle for the year 2022 is currently in progress and the concessionaire has completed approximately 30% of the work as on March 2022.

The cost of Major Maintenance for Balance concession period shall be
1) Year 2022 – MM Cost 45.99 crore
2) Year 2027 – MM Cost 73.76 crore
3) Year 2032 – MM Cost 86.30 crore
The above cost includes escalation.</td><td>●</td></tr>
<tr><td>Maintenance Manual and Yearly Program</td><td>As per Article 18.2 of Concession Agreement, Concessionaire required to submit the revised and updated Maintenance manual 45 days prior to each accounting year.
Proposed Programme not later than 45 days before beginning of each accounting year. Concessionaire has submitted Maintenance Program for Year 2019/20.</td><td>●</td></tr>
<tr><td>Pavement Design</td><td>Pavement design has done for 15 year of design traffic as per IRC 37 – 2001 considering CBR 8% and Pavement crust from Plate-2 of IRC-37-2001 for the stretch from Km.28.200 to 110.00, Key fact of pavement design is as follows:

- Pavement design for 15 years with 8% CBR
- Design Traffic 70 MSA for MCW and 10 MSA for Service road.
- Total Traffic till year 2033 – 41.45 MSA
Adopted Pavement thickness:
<table>
<tr><th rowspan="2">Pavement Layer</th><th colspan="2">Thickness (mm)</th></tr>
<tr><th>Main Carriageway</th><th>Service Road</th></tr>
<tr><td>BC</td><td>50</td><td>40</td></tr>
<tr><td>DBM</td><td>130</td><td>60</td></tr>
<tr><td>WMM</td><td>250</td><td>250</td></tr>
<tr><td>GSB</td><td>200</td><td>200</td></tr>
</table>
Adopted pavement design for MCW is in line with the Sub Clause 5.1b Pavement Design of Schedule D.</td><td>●</td></tr>
<tr><td>Pavement Condition</td><td>As per Roughness Survey carried out by M/s V R Techniche Consultants Private Limited in the month of Feb 2022, the project road is in Good to Fair condition. The summary of test is presented below:
<table>
<tr><th rowspan="2">Riding Condition</th><th rowspan="2">Roughness Index(mm/km)</th><th colspan="2">Length in km</th></tr>
<tr><th>LHS</th><th>RHS</th></tr>
<tr><td>Good</td><td><2000</td><td>75</td><td>76</td></tr>
<tr><td>Fair</td><td>2000-3000</td><td>6</td><td>5</td></tr>
</table></td><td>●</td></tr>
</table>

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td></td><td><table>
<tr><td></td><td>Poor</td><td>>3000</td><td>0</td><td>0</td><td></td></tr>
</table></td><td></td></tr>
<tr><td>Pavement Condition Survey Test</td><td>As per Sub Clause 3.4.2.2 of Schedule L, roughness value to be measured at least twice in a year (before monsoon in the month of April and after monsoon in the month of October) and BBD survey is to be carried out every year as per IRC 81. Concessionaire has conducted FWD Survey in April 2021.</td><td></td></tr>
<tr><td>Change of Scope</td><td><table>
<tr><th>SL.NO</th><th>SUBJECT</th><th>Amount</th><th>Status</th></tr>
<tr><td>1</td><td>COS Proposal for Installation of WIM</td><td>3.08 Crores</td><td>Work is in Progress</td></tr>
<tr><td>2</td><td>Submission of COS for Providing Toilets under Swachh Bharat Mission</td><td>52.52 Lakhs</td><td>Work is in Progress (2 completed out of 4)</td></tr>
<tr><td>3</td><td>COS proposal for upgrading Cart Track to Service Road from 65+000 to 80+000 (LHS & RHS)</td><td>40 Crores</td><td>Pending</td></tr>
<tr><td>4</td><td>COS proposal for Service Road & Minor Bridge at CH: 87+230 to 90+400 LHS</td><td>5.63 Crores</td><td>Pending</td></tr>
<tr><td>5</td><td>Enhancement of ETC Infrastructure on all the lanes at Toll Plazas along the National Highways on Hybrid ETC Mode – Revised submission of Positive Change of Scope</td><td></td><td>Pending</td></tr>
</table>Hybrid ETC Lanes are already provided at site.</td><td></td></tr>
<tr><td>Balance Work</td><td>There is no balance work pending, the concessionaire has completed the works where land is handed over. The cost towards balance work has been paid off at the time of takeover of the asset. (Ref : Letter No. NHAI/22012/ PIU-Hassan/2017/1060 Dated 08.01.2021.)</td><td></td></tr>
<tr><td>Toll Plaza and TMS</td><td>There are two toll plazas along project corridor at Km 32+500 (TP 1) having 4 + 1 lanes in both directions i.e. Total 10 Lanes and at km 100+950 (TP-2) having 4 + 1 Lanes in both Directions i.e. Total 10 Lanes.
Flexible pavement has provided at tapper portion and Rigid pavement provided at Straight portion of toll lanes as per CA. Concessionaire has provided the toll office at all toll plaza.
TMS at both toll plaza installed in year 2014, The existing system is in order and do not envisaged any issue. As per CA there are 2 toll plazas with 4 lanes on either side. The Que Line shall not exceed 6 vehicles per lane in entire concession period.</td><td></td></tr>
<tr><td>Major Issue Identified by IE</td><td>Based on the information provided by the concessionaire, there are no major issues in the project. Current issue is as follows:
Total of INR 24.30 Lakhs Outstanding Penalty towards testing of Bridges as on 11th September 2021.</td><td></td></tr>
<tr><td>Road Safety</td><td>Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement.
As per AECOM site visit, following additional measures are recommended to enhance safety for road users:
• Lightings to be provided at all Junctions/median opening, since most of them are located at semi-urban or urban areas.</td><td></td></tr>
</table>

Diligence Area	Findings	Risk
	• Lightings to be provided at Truck Lay-byes and delineate rock areas on the edge of MCW to caution the road users • Un-authorized access to Service road from Main carriageway leads to high risk of accidents, which needs to be closed. • The Exit and Entry Ramp at Kunigal Bypass needs to easy climbing gradient and visibility to the road user and cross road traffic. • The Exit Ramp is not provided for cart track in Kunigal Bypass due to land acquisition problem, to avoid any undue incidents and easy access exit ramp may be provided before the litigated land. • The markings shall be provided at the acceleration and deceleration lanes in order to separate the waiting traffic from main carriageway. • Though concessionaire requested negative change of scope for junction improvements, measures shall be taken to safeguard the junction traffic crossing/joining the main carriageway within the available ROW. • The provided Sign boards are not sufficient. • Provide missing median plant to reduce glare affect during night • In complete Service Road are to be delineated properly and allow the traffic on traffic worthy surface. • Missing/damaged Guard post need to replace and need delineated for better night visibility with reflectors. • The approach to bridge footpaths shall be cleared from vegetation and made accessible always for Pedestrians. • Studs/Raised reflective markers are not provided after periodical maintenance and in the balance stretches also not provided; which need to be provided on priority in order to delineate the surface for nigh visibility to road user. • Black spots to removed based on accident history all along the road. Safety Audit through independent agency (M/s VR Tech) has conducted in the month of October 2011 after construction and during O&M. It is recommended to implement suggestion made by the Safety Consultant.	
Geometric Design	The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows: Design Speed – 100 kmph-Ruling 80 kmph Minimum in plain terrain, 3.3% as Ruling Gradient, Minimum Radius 360 m as ruling and absolute minimum, Stopping Sight distance of 180m for 100 kmph and 120m for 80 kmph and min length of Vertical Curve 60m for 100kmph and 50m for 80kmph. Project road confirms requirement of Schedule D.	
As-Built Drawing	As per provision of Contract Sub Clause 33.2 (iv), the Concessionaire is to deliver relevant records and reports pertaining to the Project Highway and its design, engineering, construction, operation and maintenance including all and all operation and maintenance records and programmes and manuals pertaining thereto and complete As-Built Drawing on the Date of Divestment. As Built Drawings are available at Project office	
Hand-back requirement	As specified in Schedule L, all defects and deficiencies specified in this Schedule –L shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date.	

Diligence Area	Findings	Risk
	Prior to expiry of the concession period the concessionaire and the Independent Consultant shall conduct a joint inspection of the project highway and all the project facilities. As per the Clause 34.11 of CA, From the date which is 2 year prior to the expiry of the concession period a sum equal to the fess realizable during last two years of the concession period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or higher sum estimated by the Independent consultant for renewal works shall be retained in the Escrow Account. And as per clause 34.12 if second inspection found that no renewal works required 50% of the sum retained in the Escrow account will be released within 14 days.	
Capacity Augmentation	As per Clause 8A.1 OF Chapter-II of CA, NHA may at any time after 8 years following COD decide to augment the capacity of the Project. In case the concessionaire after participating in the biding procedure, fails to give the lowest offer, the concessionaire shall be given the first right of refusal to match the preferred offer. If the concessionaire matches the preferred offer, the parties shall enter into a suitable agreement supplement to present agreement. In such an event the concessionaire shall pay to the bidder who had made the lowest offer sum of Rs. 10 Lakhs towards bidding costs incurred by such bidder.	

1.4 Asset Condition

In general, the condition of asset is in Good condition. As per AECOM study, with existing arrangement for Operation and Maintenance and the first cycle of Major Maintenance is required in 2022, project road will continue to fulfill Level of Service as set forth in Schedule L and requirement of Article 18 of Concession Agreement except following improvements are required:

- Removal of encroachments.
- Enhance avenue plantation preservation system.
- Safety enhancement.
- Roughness Survey need to be conducted as per frequency stated in Schedule K and rectified within the stipulated time frame.

The summary of asset condition is tabled as follow:

Sn	Asset	Condition
1	Main Carriageway	Project road is four lane having paved width of 17 m (2 x 7 m with Paved shoulder of 1.5 m on rural and 2.5 m earthen shoulder. The pavement condition of existing pavement is in Good condition except few stretches where Major Maintenance / periodical Renewal is pending from 2017.
2	Service Road	7.0 m Service road has provided at Pedestrian/Cattle Underpass and at built up area. 5.5m width Cart track has provided at Kunigal bypass. Total one side length of 44.170 km Service road and 27.92 Km of Cart track has provided. The condition of service road is in fair condition while condition of cart track is poor.

Sn	Asset	Condition
3	Median	4.5m raised median is provided along the project road, median plantation is provided, additional plants are required to reduce glare effect. It is suggested to provide metal beam crash barrier at Median Opening at median to enhance safety.
4	Median Opening	39 nos of Median openings have provided along with reserve/shelter lane. it is suggested to provide the metal beam crash barrier at median to enhance the safety of the road user. The delineators are to be replaced at damaged locations and blinkers are also required to be replaced at damaged locations.
5	Drainage arrangement	Lined drain has provided between Main Carriageway and Service road at built up area and at outer edge of slip road at approach of grade separated structures (FO, PUP / CUP). Maintenance of existing at built up area is in poor condition which required cleaning for effective drainage system. Existing drainage system along rural area is in order except cleaning of silt is required.
6	Major and Minor Junctions	9 Nos Major Junctions and 29 Minor junctions found along the project road.
7	Safety Barrier	36.525km of Metal Beam Crash barrier has provided at site. Existing metal beam crash barriers are found in fair condition
8	Pedestrian Guard Rail	Pedestrian Guard Rail has provided in between MCW and SR at built up area to guide pedestrian safely to cross road at designated location. As per Inventory condition survey report 21355 m is found at site and 150 m is missing / damaged required rectification.
9	Toll Plaza	Km 32+500 TP-1: (4+1) X 2 lanes in both directions combined. Km 100+950 TP-2: (4+1) X 2 Lanes both directions combined. Existing toll plaza including administrative building, TMS are in order and complying project requirement.
10	Highway Lighting	181 Nos of Highway lighting has provided AT rob, Approach of Grade Separator. 12 nos of High Mast has provide at Toll Plaza.
11	Bus Bays and Bus Shelters	32 nos of bus bays and 43 Nos bus shelter has observed at site and conditions of bus bays and shelters are found to be in good condition.
12	Truck Laybys	6 nos of truck laybys has been provided with only lightings, there is no facilities like drinking water rest area, telephone booth ☎ and toilet.
13	Traffic Sign and Marking	632 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good except 45 nos of sign boards are required to be replaced with new. Road Marking along the project corridor was found to be in fair condition, in most of the locations marking is worn out which needs to be rectified and, in some locations, where periodical renewal incomplete marking not found at site.

Sn	Asset	Condition
14	Major Bridge	2 Nos of Major bridge found at site and span varies from 68 to 90m, the bridges are generally in good condition except minor repairs which can be taken care in routine maintenance.
15	Minor Bridge	25 numbers of Minor Bridge are found at site (2 Nos-CUP Cum Minor Bridge) and are good condition. Maintenance / cleaning of Expansion Joint, drainage spouts and protection work are required.
16	CUP	3 Nos of Cattle underpass and 2 CUP Cum Minor Bridge has been provided and fair in condition.
17	PUP & Sub way	9 Nos of PUP are structurally in good condition. The under-structure lights are being provided and some are damaged which is to be maintained at 70 Lux as per CA. 3 Nos Subway found at site but not functional, gate is closed at both ends except subway at 28+250Km
18	VUP	10 Nos of VUP found at site and good in condition.
19	ROB	2 nos. of Railway over Bridge having span arrangement of 1 x 11.00 m and 2 x 24.5+ 1 x 14.00 found at site.
20	Cross Drainage	Total 103 Culverts (Pipe/Box) are found at site. It is noticed some of culverts are blocked and vent cleaning is required.

The project road has been visited by Consultant's team of Engineers in the month of Oct 2019.

Note: The project road has a long operational history and we had forecasted the operations & maintenance costs/ strategies for the entire balance concession period primarily based on i) the original pavement design during construction phase, ii) the various investigations and surveys carried out to assess the technical performance and quality of the project road and iii) other information provided to us by the Client and we don't expect any material change in operations & maintenance costs/ strategies year on year.

1.5 Toll Plaza and TMS

Toll Plaza including collection and TMS is operated / maintained by Nelamangala Devihalli Expressway Private Limited., through Greentech for operation. Existing system is as per requirement of applicable Manual all equipment are found to be working condition.

Existing toll lane configuration with type of equipment is summarized as follows:

Item	TP 1	TP 2
Total Number of Lane	10	10
Total number of Regular Lane	8	8
Total Number of Extra Width Lane	2	2
Tolling Equipment		
Number of Dedicated ETC Lane	2	2
Number of Hybrid ETC Lane	8	8
Number of Reserved Lane	1	1

As per AECOM assessment total cost of TMS System is approximately 4.15 crore. The life TMS equipment is considered 7 years and 70 % of cost of TMS is forecasted as replacement cost which will occurred in every 7 year i.e. in Year 2022, 2027 and 2032 (at the end of Concession Period).

1.6 Change of Scope (COS)

As per Article XVI, Government may, notwithstanding anything to the contrary contained in the Agreement, require provision of additional works and services which are not included in the scope of the project as contemplated by the Agreement. All such changes shall be made by Government by an order ("the Change of Scope"). The list of COS along with status of COS order is tabled below:

SL.NO	Description of Item	Amount in Crores	Status
1	COS Proposal for Installation of WIM	3.08	Work is in Progress
2	Implementation of dedicated ETC		work completed & Amount Released
3	Implementation of ETC on pan India basis-Segregation traffic island for ETC lanes-Submission of COS Positive proposal under clause 17 of CA	0.0365	work completed & Amount Released
4	Submission of COS for Providing Hoardings and Dust Bins at Toll Plazas under Swachh Bharat Mission	0.0622	work completed & Amount Released
5	Construction of New Bus Shelter at Sahukarpalya Village in Project Highway under COS of Clause 17 Of CA	0.0213	Work completed but amount not yet received
6	Submission of COS for Providing Toilets under Swachh Bharat Mission	0.5252	Work is in Progress (2 completed out of 4)
7	COS proposal for upgrading Cart Track to Service Road from 65+000 to 80+000 (LHS & RHS)	40	Pending
8	COS proposal for Service Road & Minor Bridge at CH: 87+230 to 90+400 LHS	5.63	Pending
9	Enhancement of ETC Infrastructure on all the lanes at Toll Plazas along the National Highways on Hybrid ETC Mode – Revised submission of Positive Change of Scope	2.75	Pending

1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule L, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

i) Ensure the safety of personnel deployed on and users of the project facilities or part thereof
ii) Keep the Project Facilities from undue deterioration and wear
iii) Permit unimpaired performance of statutory duties and functions of any party in relation to

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule-L elaborates requirement various service factor desirable level and acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (overlay) is required to be provided at least once in every 5th year (from COD) and in the last year of concession period. Also, overlay requirement in case of Deflection and Roughness value is 0.50mm Deflection for Level-1(Desirable) and 0.8mm for Level-2(Acceptable); Roughness value for Level-1 desirable is 2000mm/Km and for Level-2 Acceptable is 3000mm/km.

Structural overlay is required if design MSA is less than anticipated MSA till end of Concession Period. As per Pavement design report, anticipated MSA till end of Concession.

1.8.1 Staff Requirement

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule-L. Staff requirement at Toll plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.8.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	Out source
2	Preventive Maintenance	Out source
3	Operation cost of Toll Plaza and Administration Building	Operation by Pavaman
4	Security of Toll Plaza and Cleaning	Out Source
5	Highway Lighting	In House
6	Maintenance of ATMS / TMS	Out Source AMC
7	Corridor Management	Out Source
8	Major Maintenance	Out Source

1.8.3 Hand back Requirement

As per Clause 33.3 of Concession Agreement, not earlier than 90 days before termination/expiry but not later than 30 days before effective date of such terminations/expiry of concession period IE Shall verify inspect the road and state the cure required under maintenance requirements under Schedule-L and Clause 33.2 of CA, compliance by the concessionaire with maintenance requirements shall be cured by the concessionaire.

all project assets including the road, pavement, structure and equipment shall have been renewed and cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in this Agreement.

All the section of each traffic lane of the project highway shall have a roughness index of not more than 2500mm per km and shall free from defects in accordance of O&M requirements, All lamps shall be in working condition, concessionaire delivers operation and maintenance records and program and manuals pertaining thereto and complete as built drawing at

Also, as per Clause 25.3.2 & 34.11 of CA, From the Date, which is two years prior to the expiry of the concession period, a sum equal to the fees realizable during the last two years of the concession period for a traffic volume calculated at the rate of 10,000 PCU's per day per year, or a higher sum estimated by the Independent consultant for renewal works, be retained in the Escrow accounts provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, 50% of the retention amount will be released within 14 days.

1.9 Insurance

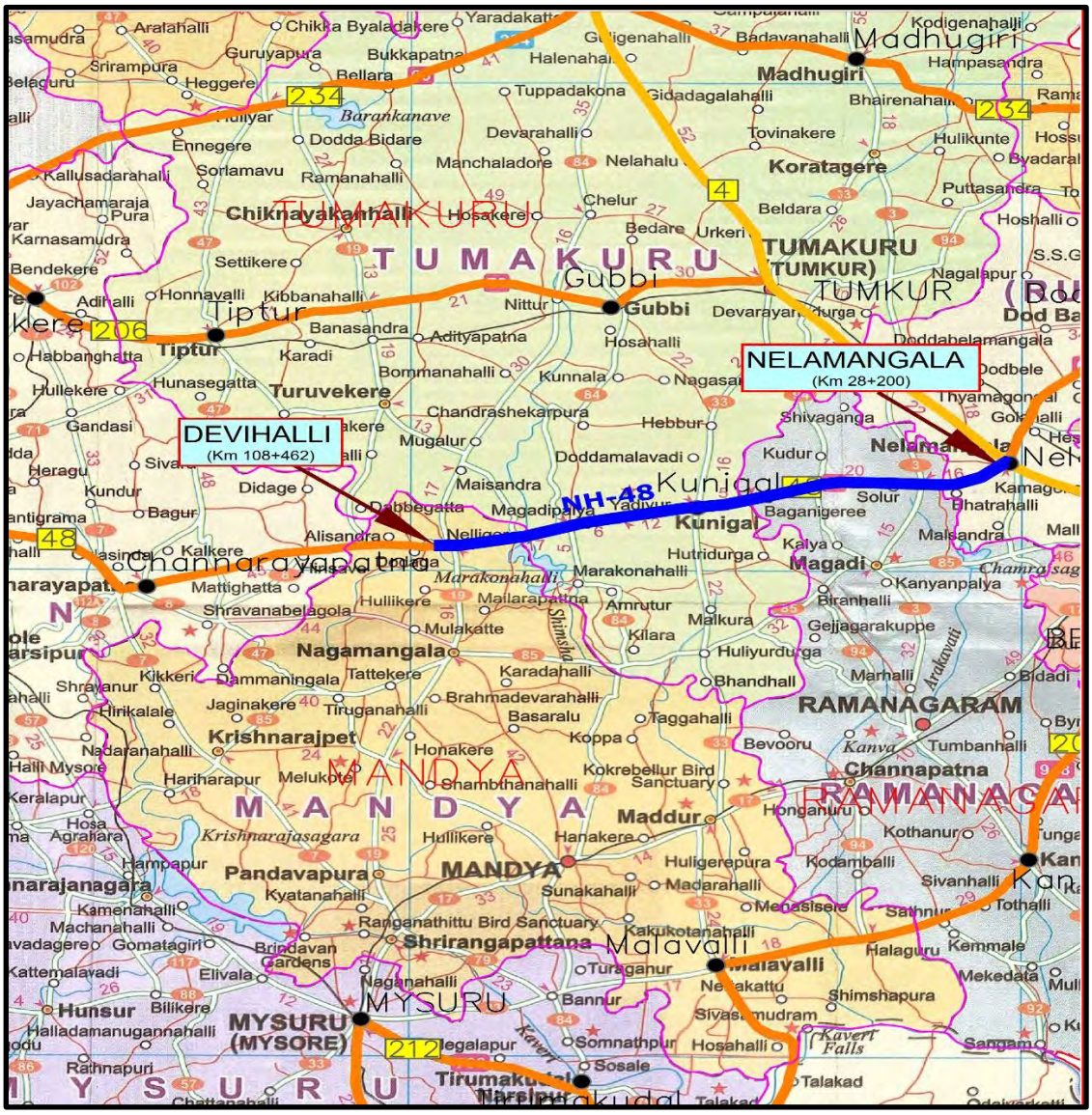
As per Sub Clause 27.2 of Concession Agreement, Concessionaire shall obtain and maintain at no cost to Government during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Standard Fire Insurance
2	Business interruption insurance
3	General Public Liability insurance
4	Construction plant and Machinery
5	Accident
6	Automobile
7	Worker's Compensation

1.10 Introduction of Asset

1.10.1 Project Corridor

This project road starts from NH-4 at Nelamangala Junction to Devihalli at NH-48 Bangalore-Mangalore Section of NH-48 in the state of Karnataka. Project road starts from Km 28+200 (Design Ch. 28+200) at Nelamangala to Km 110+000 (Design Ch. 108+463) at Devihalli located in Plain terrain. The Total Length of the Project road is 80.273 Km. The Key Map is shown below.



Location Map

Project Start KM 28+200

Project End KM 110+000

1.10.2 Salient Features of the Project:

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	80.273 km	80.273 km (as per Toll Receipt the Toll fee is being collected for a length of 79.2 km)
Carriageway	Four Lane (2 x 7 Paved Width) with 1.5m Paved Shoulder and 0.25m shyness.	Four Lane (2 x 7 Paved Width) with 1.5m Paved Shoulder and 0.25m shyness.
Shoulder	1.5m Paved Shoulder and 2.5m Earthen Shoulder	1.5m Paved Shoulder and 2.5m Earthen Shoulder
Service Road / Slip Road	7m Width Service road-43.606 5.5m Cart track-From 65/600 to 79/500	7m Width Service road-44.17Km 5.5m Cart track-27.92 Km
ROW	28 to 50m	28 to 50m
Major / Minor Junction	9 Nos Major and 29 Minor Junctions	9 Nos Major and 29 Minor Junctions
RCC Drain	Covered drain at Urban Section and open pucca drain between MCW and SR	RCC Drain 46.711 km as per Site Inventory
Median Opening		39 Nos Authorised
Toll Plaza	2 Nos (With 8 lanes)	2 Nos (With 10 lanes)
Truck Lay-bys	6 Nos	6 Nos Lay Byes
Bus Bays with shelter	32 Nos of Bus bay and 64 Bus Shelter	32 Bus bays and 43 bus Shelter

Description	As per Schedule B and C	Existing Features
Highway Lighting	Highway, Toll plaza, ROB, traffic aid posts and Main administrative base camp	Total 181 nos of single arm/Double Arm lighting provided at highway and ROB, Lightings are provided are provided at Toll plaza and Administrative building also
High Mast	At Major Junctions, Toll plaza	Provided as per Schedule C (12 nos of high mast provided)
Highway Patrol	2 Nos	2 Nos
Ambulance	2 Nos	2 Nos
Crane	1 No	1 No

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	2 No	2 No
Minor Bridge	23 Nos	25 Nos (2 Nos are Minor Bridge cum CUP)
VUP, PUP and Subway	9 Nos VUP and 0 Nos PUP 6 Nos Sub-way	10 Nos VUP and 9 Nos PUP 3 Nos Sub-way
ROB and RUB	1 Nos ROB	2 Nos ROB
CUP	8 Nos	3 CUP (2 Nos MNB Cum CUP)
Culverts	103 Nos	103 Nos

1.11 Review of Pavement

Pavement Design

During construction of road, pavement deign was carried out for 70 MSA till year 2027 (15 years design traffic) whereas Concession Period ends at Year 2033. Summary of Report is presented as below:

Section	Design Traffic MSA	CBR	Pavement Thickness (mm)			Remarks
			BC	DBM	WMM + GSB	
Section	70	8 %	50	130	250 + 200	Full Stretch

The proposed design at the time of construction confirms requirement of Concession Agreement.

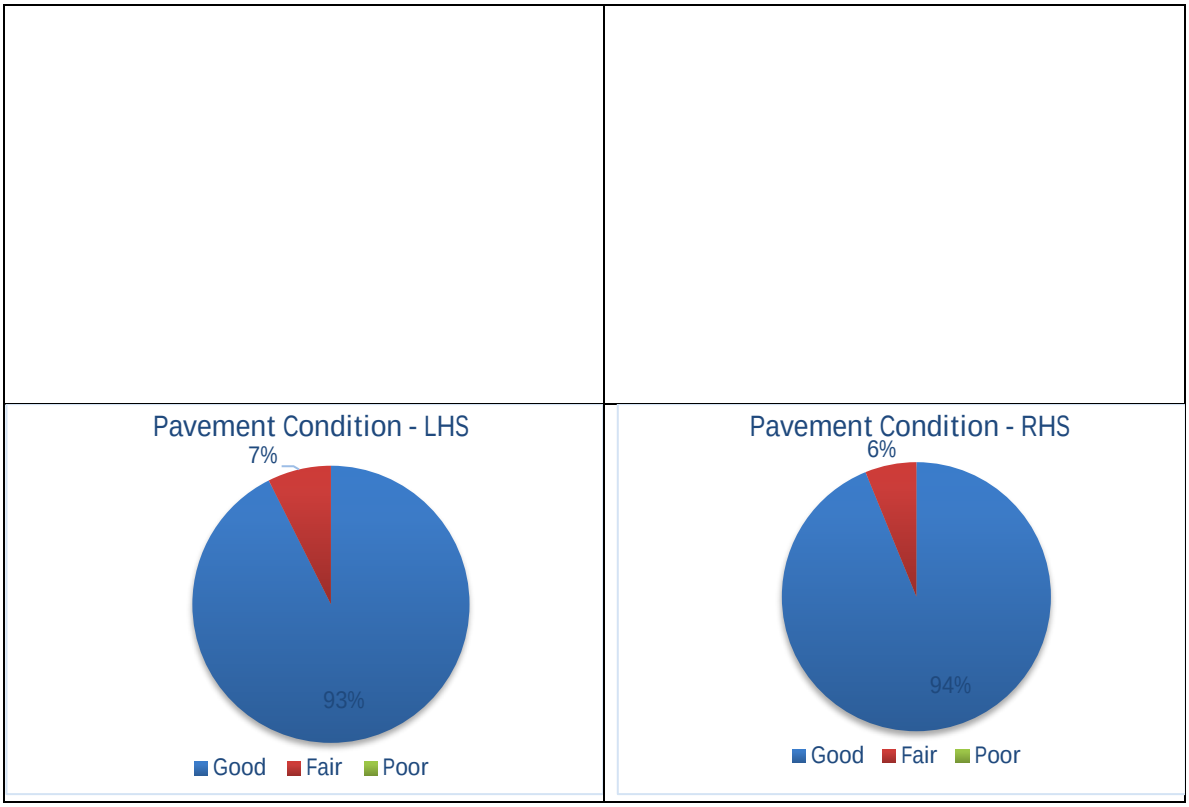
Analysis of Existing Pavement Condition

To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

Roughness Survey: Roughness Survey was carried in January 2022 as per past DD report. Pavement classification done as per following criteria:

Good - less than 2000 mm / km
Fair -2001 to 3000 mm / km
Poor – above 3000 mm / km

Graphical presentation of roughness survey report is appended below:



Note: Data from past DD Report

a) Analysis of Existing Pavement – FWD Test

Evaluation of existing pavement using Falling Weight Deflectometer (FWD) survey was carried out in year April 2021. FWD provides deflection of existing pavement under dynamic loads by simulating actual wheels in both response and duration. FWD survey has carried out along entire length of project road and remaining life of pavement found to be 1.19 MSA to above 544.81 MSA. Summary of FWD Survey report is presented as below:

MSA	LHS Inner	LHS Outer	RHS Inner	RHS Outer
less than 10 MSA	29	21	20	26
10 to 150 MSA	23	36	47	38
above 150 MSA	30	25	15	18
Total Tested Length	82	82	82	82

Note: Required remaining life of pavement till end of Concession Period 30 MSA.

b) Test Pit

Ten (12) numbers of test pit results were provided to assess the existing pavement crust composition. Abstract of existing subgrade test result is as follows:

- Degree of compaction 91.3 % to 96 %
    - Free Swell Index 0 to 12.5
- Four days Soaked CBR 10.4 to 15.8

Design CBR is 8 and existing subgrade CBR is more than 8 thus confirms requirement.

c) Core Test

Thickness of existing pavement layers has provided based by conducting Core Test and test pit. Furthermore, the core samples and granular material (base and subbase layers) were also taken for laboratory test in order to determine various material properties such as bitumen content, aggregate properties of bituminous layers etc. The test result is summarized as below:

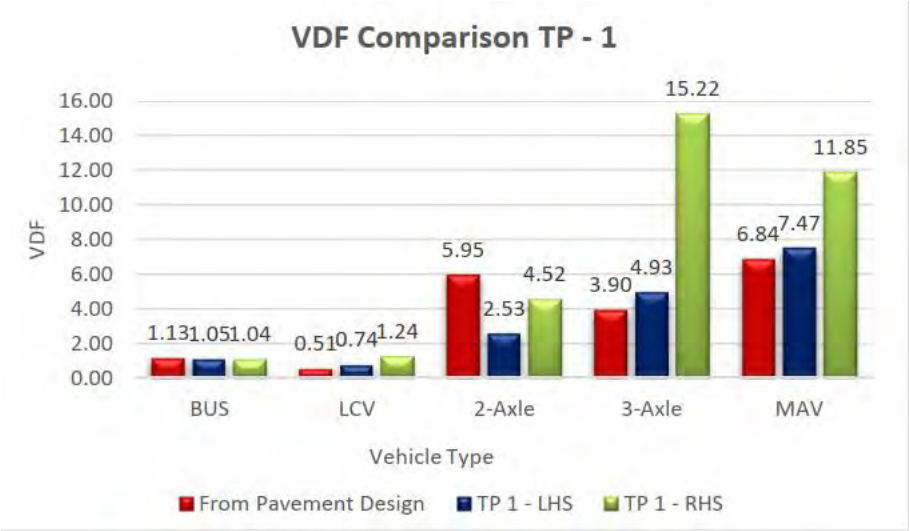
- Pavement Thickness –

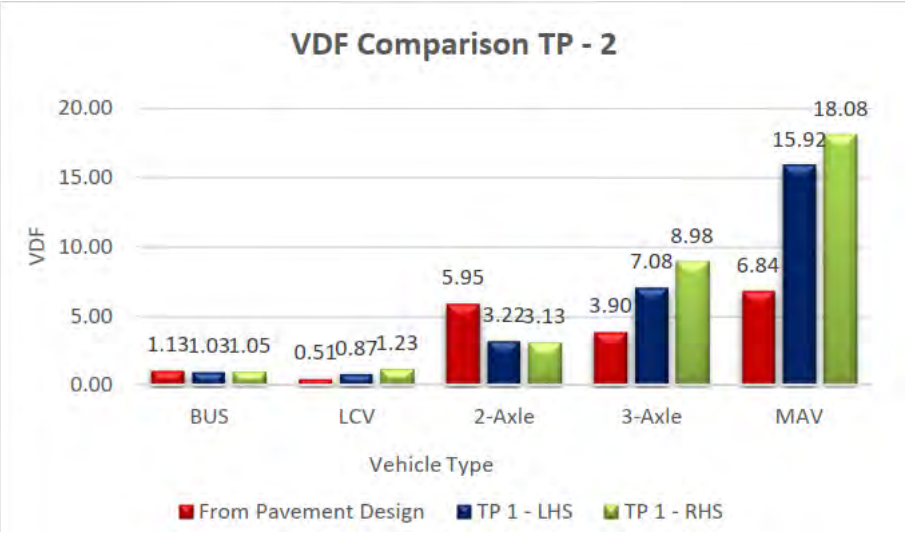
- based on Core Cutting bituminous layer thickness 180 mm to 280 mm. Thickness shown in imperfect core has not taken into account.

- Thickness of Granular Layer (GSB + WMM) – 370 mm to 500

d) Axle Load Survey

VDF as adopted during pavement design and VDF as per current Axle Load Survey data conducted in Year 2018 at Toll Plaza 1 (TP1 VDF) and Toll Plaza 2 (TP2 VDF) are presented as below:



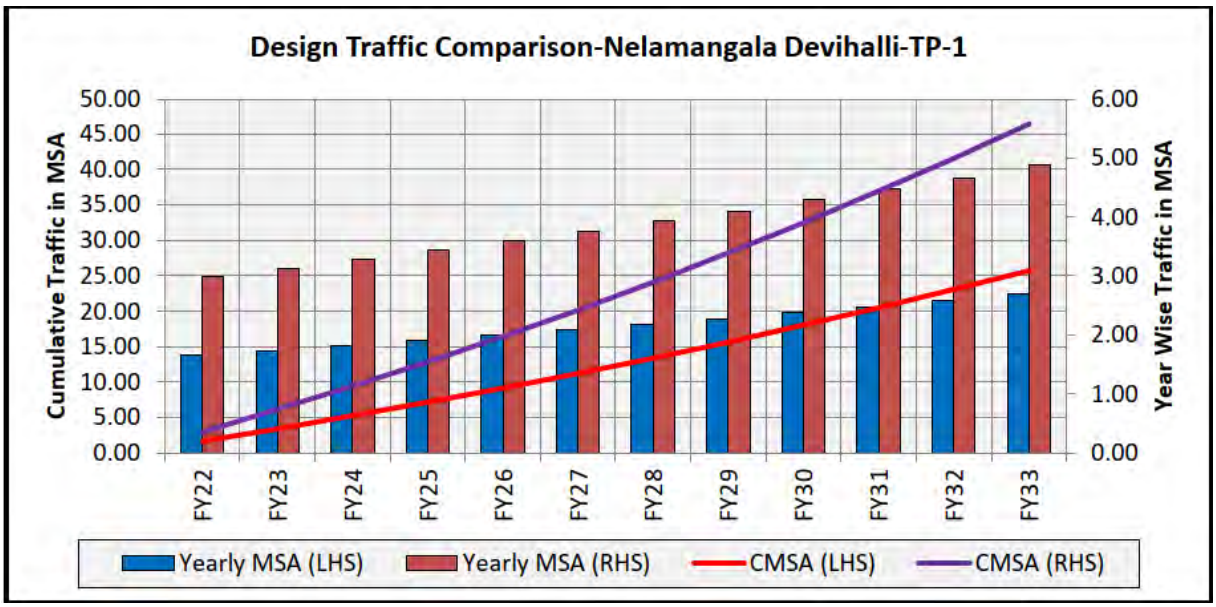


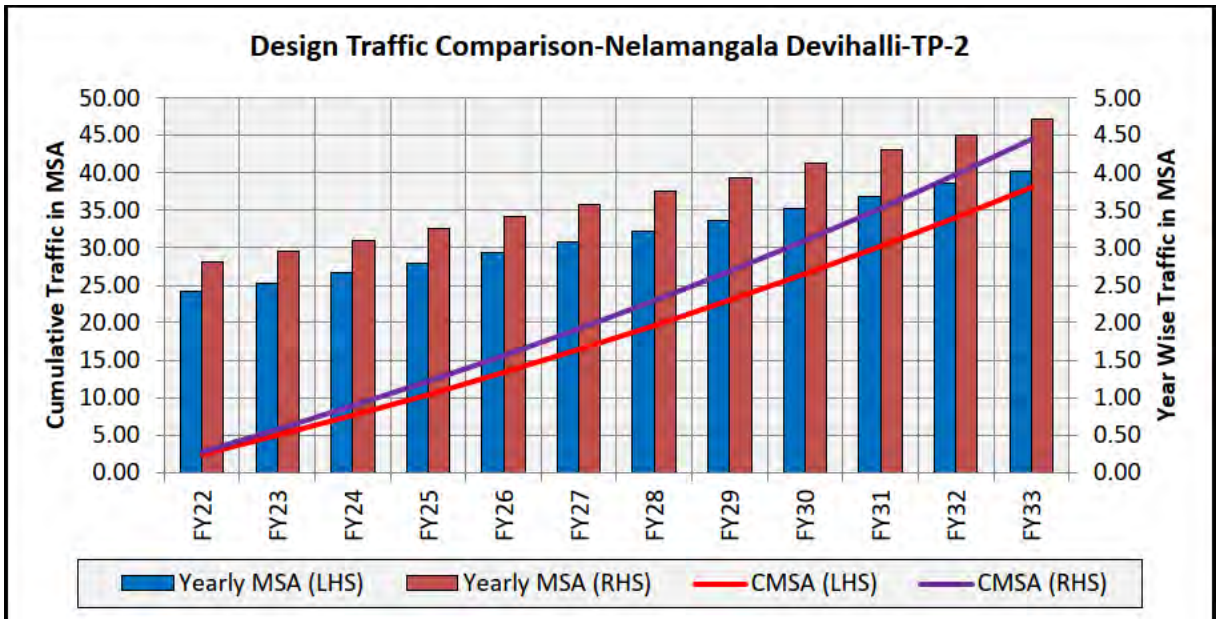
e) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from Year 2019 to Year 2033

Homogenous Section	Location		As per Pavement Design	As per Current Data	
	From	To		LHS	RHS
HS -1 (TP 1)	28+000	72+000	70	25.8	46.5
HS-2 (TP 2)	72+000	108+000	70	38.1	44.5





1.12 Major Maintenance

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. It is noted that Concessionaire has carried out MM in Year 2018 / 2019. The MM work scheduled in 2022 is being executed now and will be completed in this FY 22. MM Cycle for Balance Concession Period

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. Balance MM work of 2017 has been completed and the MM2022 is currently in progress. MM Cycles for balance concession period based on CA and as per test data analysis is recommended as follows:

S.N.	Year	Description	Length (4Lane Km)
1	2022	30mm BC Overlay in 57% length, Microsurfacing in 43% length and 50mm DBM in 6% length	Entire Length
2	2027	30mm BC Overlay	Entire Length
3	2032	30mm BC Overlay	Entire Length

i) Service Road: 100 % Micro surfacing in year 2022 as 30 mm Overlay has been caried out as balance MM work of 2017. 2027 and 2032 – 50 % Micro surfacing and 50 % with 30 mm Overlay

ii) Structure Major Maintenance

a) Replacement of Elastomeric Bering in Year 2027
b) Replacement of Wearing Coat with milling in Year 2022, 2027 and 2032
c) Replacement of Elastomeric Strip Seal of all Strip Seal Joint
d) Replacement of Filler board expansion joint
e) LS provision of 20 lakh for rectification of other defects (drainage spout, crack sealing, repairing of railing etc.) in year 2022, 2027 and 2032.

1.13 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period (13 years). O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. TMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per AECOM calculation average yearly O & M Cost is Rs. 20.08 rore per year.

O and M Expense			
Project - Neelmangala to Devihalli (GODOT)			
Sl.No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	16,250,761
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accomodation etc.	27,040,515
3	Security Services	Includes manpower associated with security services.	14,441,853
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	28,141,544
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and street lights.	10,969,245
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	42,036,359
7	HTMS related Expenses	AMCs for HTMS and repalcement of requipment	-
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	3,227,318
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	4,610,455
10	Professional Fee	Includes secretarila expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	7,162,602
11	Community Development	Includes CSR related expenses.	1,097,727
12	Communication Expenses	Includes phone charges.	603,750
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance Expenses	Includes project insurance expenses.	8,013,409
15	IE Fees	Includes IE fees.	7,903,636
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	21,371,894
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	3,860,783
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furnitures, repair of kerbs, kerbs painiting, sign borads repair, drain repair, shoulder repair, Raod Marking repair, replacement of Safety Barriers	3,298,432
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expension joint replacement, grouting, RE wall repair	408,799
		O & M Cost (2022)	200,768,401
		O & M Cost (2022) in Crores	20.08

1.14 List of Document Reviewed

Documents uploaded till 5 Nov 2019 has reviewed during preparation of this DD report. The followings documents were reviewed during study:

Sn	List of Document	Status	Remarks
1	Concession Agreement – all Vols.	Available	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	Available	
3	Detail Highway Inventory and Condition Survey Report	Available	
4	Detail Structure Inventory and Condition Survey Report	Available	
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	Available	
6	Balance Work List with BOQ if any	Available	
7	Past Technical DD Report	Not Available	
8	Change of Scope Documents	Available	
9	Provisional COD Letter along with Punch List	Available	
10	Final COD Letter with Exclusion List if any	Available	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	Available	
12	NCR Status	Not Available	
13	Operation and Maintenance Manual, Yearly Maintenance Program	Manual Of 2009 And 2011	
14	Current Operation and Maintenance Arrangement / Strategy	Available	Maintenance program for 2019-2020
15	Detail of TMS and ATMS / HTMS installed at site	Available	TMS Data
16	Pavement Design Report	Available	
17	Historical Major Maintenance and Strategy	Available	Methods for MM in Year 2018
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	Available	Axle Load, Core Cutting, Roughness, FWD, Pavement Composition and Investigation Report
19	As Built Drawing	Available	

Sn	List of Document	Status	Remarks
20	MPR during Construction Stage (only last three months)	Not Available	
21	MPR of Independent Engineer during Maintenance stage	Available	6 Months
22	MPR Lender Report	Not Available	
23	Monthly Inspection Report during O and M	Available	
24	Historical O&M and MM Cot Cost	Available	O & M Contract with vendor
25	Major Maintenance Forecast	Not Available	
26	Traffic Data (Actual till now and projection till end of Concession Period)	Available	
27	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	Available	Safety Audit Report of May 2019.
28	Other Documents		

2. PAVEMENT EVALUATION AND TEST

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

2.1.1 Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.1.2 Pavement Design

Pavement design was made for 15 years design period i.e. till year 2027 for 70 MSA.

a. Design Life and Design Traffic
   - Design CBR – 8 %
   - Design traffic – 70 MSA which is traffic up to Year 2027
   - Homogeneous Section - One
   - VDF adopted for calculation of design traffic by concessionaire is given below:

Vehicle Type	VDF Adopted
LCV	0.506
BUS	1.127
2A Truck	5.947
3A Truck	3.903
MAV	6.843

a. Subgrade

As per the Pavement Design Note provided to the consultant, it is mentioned that the Subgrade CBR value for pavement design is considered as 8% and 10% and pavement crust worked accordingly.

b. Design Thickness

Thickness of pavement as per Pavement Design Report is as under:

Bituminous Concrete (BC) - 50 mm
Dense Bituminous Macadam (DBM) – 130 mm
Wet Mixed Macadam (WMM) - 250 mm
Granular Sub-base (GSB) - 200 mm

2.1.3 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.1.3.1 Roughness Survey using Network Survey Vehicle (NSV)

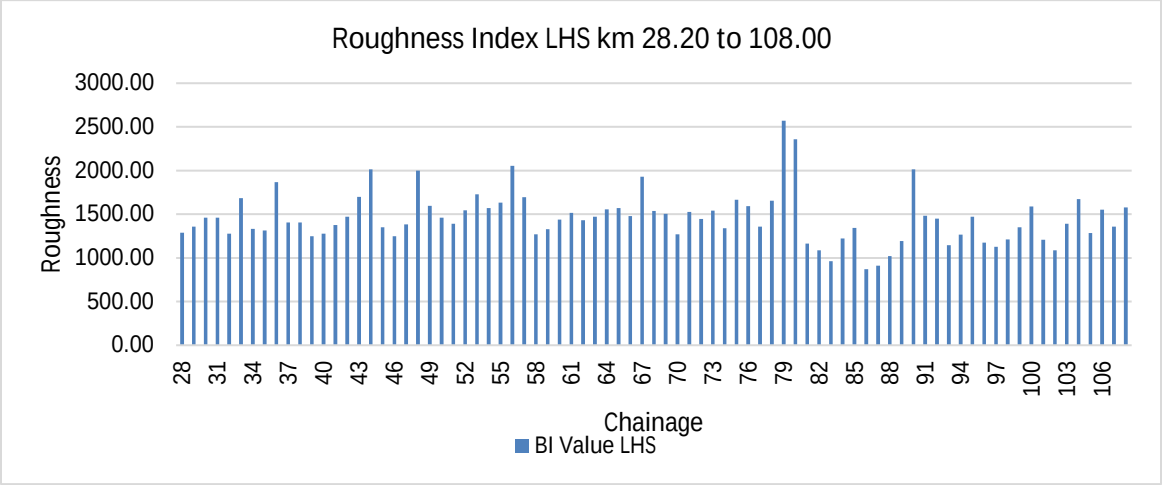
Roughness Survey was carried out in January 2022to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by Laser Profilometer.. Based on the Roughness value, project road was classified into following three categories:

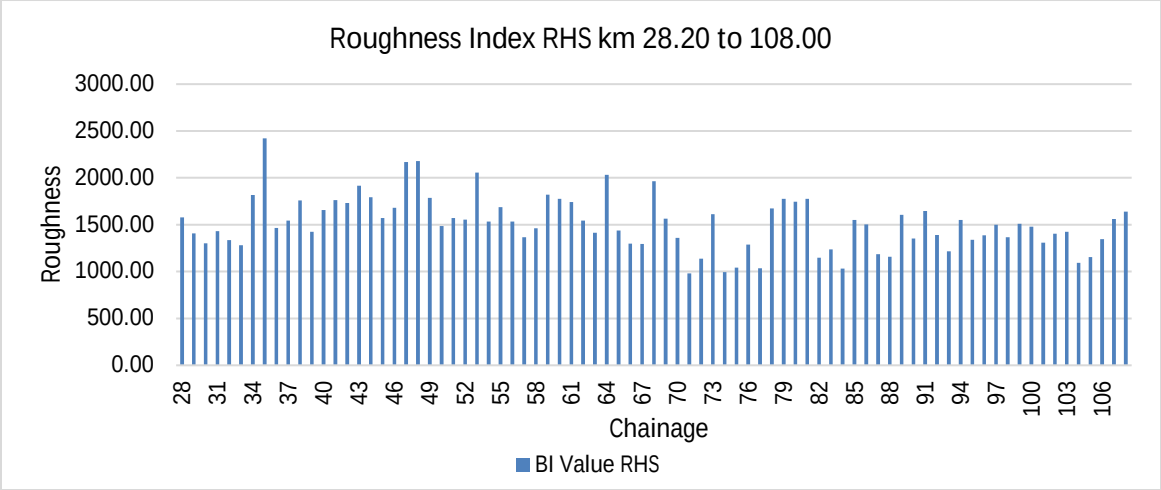
Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000-3000
Poor	>3000

The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:

Summary of Roughness Index

Riding Condition	Roughness Index (mm/km)	Length (in km)	
		LHS	RHS
Good	<2000	75	76
Fair	2000-3000	6	5
Poor	>3000	0	0





2.1.3.2 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade and embankment materials used in project road, test pits of size (approx.) 1m x 1m x 1m have been excavated alternatively on LHS and RHS carriageway at 12 locations and data provided by the Concessionaire.

Field Dry Density (FDD) and Field Moisture Content (FMC) tests were also conducted for subgrade soil at pit. The subgrade soil sample from each test pit was also collected and taken for laboratory examination.

Following tests were conducted on the samples:
- Gradation / Sieve Analysis
- Soil Classification
- Atterberg's Limit (Liquid Limit, Plastic Limit, Plasticity Index)
- Compaction Test (Modified Proctor Test)
- 4-day soaked CBR

Similarly, from some of the test pits, samples of Granular Material were also collected and taken for laboratory testing. Following tests were performed for laboratory material.
- Gradation / Sieve Analysis
- Specific Gravity
- Water Absorption

As per test conducted by the Concessioanrie, CBR result is found from 10.4 % to 15.8 %. Design CBR is 8 % thus confirm requirment of pavement design.

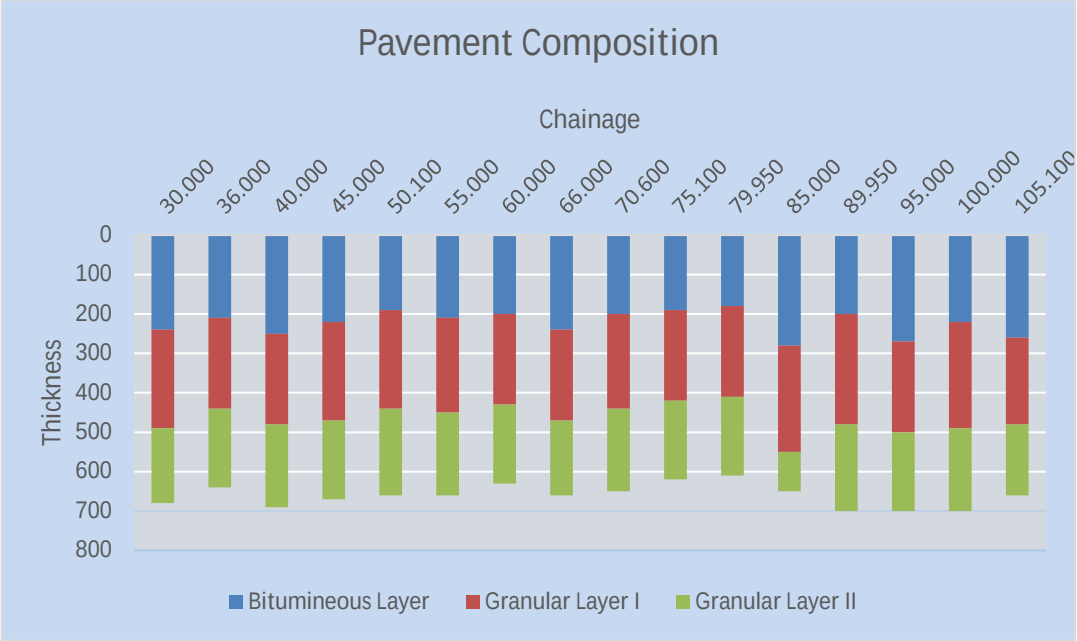
Crust Composition and Thickness:

From observation of test pits, it was found that the pavement crust along the project road composed of following three layers:

i) Bituminous Top (BT)
ii) Wet Mixed Macadam (WMM)
iii) Granular Sub-base (GSB)

Graphical illustration of pavment thickness and crust summary for the project road is given below:

Layer	Thickness (mm)		
	Minimum	Maximum	Average
Bituminous Top (BT)	180	280	225
Wet Mixed Macadam (WMM)	220	280	245
Granular Sub- base(GSB)	100	220	200



Existing average bituminous pavement thickness is more than pavement design thickness thus confirms requirement.

Subgrade Test:

As mentioned earlier, subgrade soil samples were collected from each test pit and taken for laboratory testing. Summary of laboratory test results for subgrade soil sample is given below

Subgrade Test Results

Properties	Minimum	Maximum	Average
Liquid Limit (LL) %	21.00	30.00	25.30
Plastic Limit (PL) %	21.00	24.00	22.50
Plasticity Index (PI)	6.00	7.00	6.50
Max. Dry density (gm/cc.)	1.97	2.10	2.025
OMC (%)	8.3	10.40	9.02
4-Days Soaked CBR (%)	10.4	15.8	12.92
Free Swell Index (%)	0.00	12.5	6.82

Note: As per previous DD Report.

2.1.4 Core Test

Core test result were provided along with test report of bitumen, aggregates used in pavement. Summary of core cutting report is summarized hereunder.

S.No.	Chainage (Km)	Side	Height of the Core (mm)	Remarks
1	30+000	LHS	340	De-bonded as 4 Layer
2	35+000	RHS	210	De-bonded as 2 Layer
3	40+000	LHS	190	De-bonded as 3 Layer
4	45+000	RHS	220	De-bonded as 2 Layer
5	50+000	LHS	190	Core is in good condition
6	55+000	RHS	160	Core is in good condition
7	60+000	LHS	200	Core is in good condition
8	64+900	RHS	180	De-bonded as 2 Layer
9	71+900	LHS	200	De-bonded as 2 Layer
10	75+000	RHS	210	De-bonded as 3 Layer
11	79+100	LHS	140	Core is in good condition
12	85+000	RHS	230	De-bonded as 2 Layer
13	90+000	LHS	210	Core is in good condition
14	95+000	RHS	250	De-bonded as 2 Layer
15	99+950	LHS	220	Core is in good condition
16	104+950	RHS	230	Core is in good condition

2.1.5 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD survey in the month of April 2021 before carrying out major maintenance. FWD survey report along with analysis has provided. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented:

Chainage		LHS		RHS	
From	To	Inner Lane	Outer Lane	Inner Lane	Outer Lane
28.000	29.000	277.5	235.8	499.1	523.4
29.000	30.000	280.0	247.3	77.0	511.6
30.000	31.000	105.0	136.8	481.6	494.6
31.000	32.000	242.4	226.0	399.0	407.0
32.000	33.000	240.2	259.3	390.0	406.2
33.000	34.000	303.3	182.4	132.0	393.0
34.000	35.000	361.0	388.7	5.3	142.4
35.000	36.000	355.8	412.5	10.7	220.4

Chainage		LHS		RHS	
From	To	Inner Lane	Outer Lane	Inner Lane	Outer Lane
36.000	37.000	347.7	72.8	23.6	71.3
37.000	38.000	127.9	93.2	17.1	205.8
38.000	39.000	8.1	87.3	19.0	23.8
39.000	40.000	27.1	121.0	18.9	38.2
40.000	41.000	9.9	54.7	14.0	335.5
41.000	42.000	7.0	22.3	7.5	9.2
42.000	43.000	5.8	8.6	17.0	13.2
43.000	44.000	9.9	28.0	8.7	8.2
44.000	45.000	254.6	210.4	16.0	13.8
45.000	46.000	248.6	364.1	17.3	172.8
46.000	47.000	243.0	388.7	15.0	46.2
47.000	48.000	121.9	159.6	4.5	9.6
48.000	49.000	2.5	5.3	4.4	5.7
49.000	50.000	3.3	85.4	2.9	3.7
50.000	51.000	2.0	56.5	3.3	4.5
51.000	52.000	3.1	12.0	5.1	1.2
52.000	53.000	116.2	209.7	3.0	32.4
53.000	54.000	203.3	315.3	19.5	1.2
54.000	55.000	73.7	544.8	14.8	2.3
55.000	56.000	5.7	26.0	15.0	5.7
56.000	57.000	10.8	9.5	16.7	28.2
57.000	58.000	2.0	10.4	128.9	119.8
58.000	59.000	4.8	6.9	58.9	24.5
59.000	60.000	151.2	16.3	3.3	25.7
60.000	61.000	65.9	53.7	5.7	2.9
61.000	62.000	68.6	64.2	167.1	18.9
62.000	63.000	111.9	9.4	89.2	5.9
63.000	64.000	4.4	9.1	89.6	3.2
64.000	65.000	4.9	11.1	2.3	8.7
65.000	66.000	12.2	8.0	198.5	7.1
66.000	67.000	4.3	7.1	6.9	5.2
67.000	68.000	4.2	7.1	6.3	5.0
68.000	69.000	2.3	2.3	4.3	4.9
69.000	70.000	3.6	2.2	11.0	5.4
70.000	71.000	3.7	4.7	29.4	5.2
71.000	72.000	3.3	4.0	10.5	5.2
72.000	73.000	10.2	5.4	6.2	7.9
73.000	74.000	7.0	2.0	5.9	4.8
74.000	75.000	5.1	10.1	7.9	39.5
75.000	76.000	6.2	6.6	12.8	48.8
76.000	77.000	4.8	11.6	15.5	10.2
77.000	78.000	15.2	12.1	24.1	30.8
78.000	79.000	12.0	8.1	25.6	12.2
79.000	80.000	4.7	3.1	106.8	12.2
80.000	81.000	5.0	3.2	17.9	12.4

Chainage		LHS		RHS	
From	To	Inner Lane	Outer Lane	Inner Lane	Outer Lane
81.000	82.000	229.0	178.7	339.0	16.3
82.000	83.000	25.3	176.3	31.0	61.7
83.000	84.000	218.8	18.0	27.2	19.0
84.000	85.000	281.4	15.9	140.0	143.5
85.000	86.000	379.5	14.2	106.4	5.5
86.000	87.000	427.2	11.8	395.9	162.5
87.000	88.000	435.7	13.5	388.2	46.8
88.000	89.000	174.6	11.6	81.6	254.2
89.000	90.000	422.9	18.8	150.0	326.8
90.000	91.000	6.5	5.4	387.2	377.2
91.000	92.000	177.7	15.9	287.7	18.3
92.000	93.000	438.7	348.6	322.7	80.5
93.000	94.000	409.0	365.4	23.0	83.1
94.000	95.000	5.5	45.6	23.3	87.7
95.000	96.000	139.6	72.8	63.2	262.1
96.000	97.000	375.0	298.5	9.9	14.8
97.000	98.000	381.8	126.3	29.6	161.0
98.000	99.000	161.1	441.3	28.4	244.0
99.000	100.000	333.5	416.4	13.2	9.4
100.000	101.000	135.1	420.5	4.6	8.7
101.000	102.000	410.3	227.7	368.3	82.9
102.000	103.000	376.1	123.9	378.5	28.1
103.000	104.000	11.3	21.4	83.4	11.7
104.000	105.000	62.8	66.5	130.0	12.1
105.000	106.000	37.8	161.3	212.8	155.9
106.000	107.000	59.3	60.7	24.6	41.5
107.000	108.000	95.0	165.6	55.0	69.6
108.000	109.000	11.8	17.1	14.9	17.7
109.000	110.000	7.8	9.4	45.0	13.9

2.1.5.1 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

Axle Load Survey was conducted in the Month June 2019 and analysis has been provided. Comparison between VDF based on historic traffic data and VDF adopted during Pavement Design is given below:

VDF Comparison at Toll Plaza 1 (KM 35+200)

Vehicle Type	VDF Adopted for Pavement Design	As per Cube Data		
		LHS	RHS	Adopted VDF
Bus	1.127	1.44	0.87	1.44
LCV	0.506	0.58	1.11	1.11
2A Truck	5.947	1.42	3.82	3.82
3A Truck	3.903	3.28	5.37	5.37
MAV	6.843	7.43	9.24	9.24

VDF Comparison at Toll Plaza 2 (KM 101+000)

Vehicle Type	VDF Adopted for Pavement Design	As per Cube Data		
		LHS	RHS	Adopted VDF
Bus	1.127	1.72	0.91	1.72
LCV	0.506	1.19	1.02	1.19
2A Truck	5.947	7.43	2.64	7.43
3A Truck	3.903	9.31	3.44	9.31
MAV	6.843	10.00	6.59	10.00

2.1.6 Homogeneous Section and Design MSA

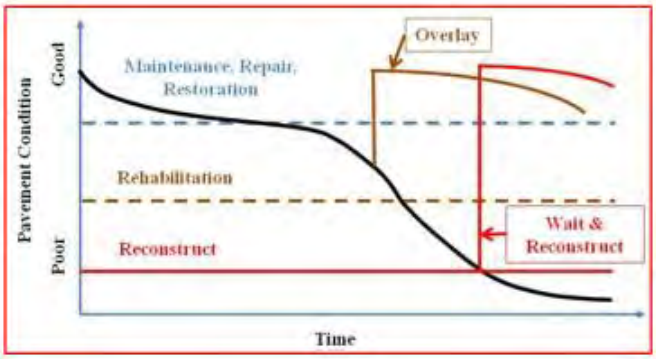
As per current traffic pattern, two homogeneous sections considered for calculation Design MSA. However, during pavement design one homogeneous section was considered. MSA has calculated based on traffic data provided for balance Concession period and VDF as calculated above for balance Concession period. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided is tabled below.

Homogeneous Section	Location - Km		As per Pavement design	As per Current Survey	
	From	To		LHS	RHS
HS 1	28+200	72+540	70	25.56	35.80
HS 2	72+540	108+462	70	41.45	23.94

2.2 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due

to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Concessionaire has conducted detail pavement investigation and Major Maintenance was carried out accordingly.

MMR Proposal in accordance with the balance work of previous MMR cycle and Remaining life Data.

In MM Cycle 2027 and 2032, 30 mm BC is Proposed for the entire stretch.

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. Proposed MM cycles for balance concession period is as follows:

Proposed MM Cycle for balance Concession Period

Main Carriageway

Sn	Year	Description	Length (4 Lane km)
1	2022*	30mm BC Overlay in 65% length and Microsurfacing in 35% length	Entire Length
2	2027	30mm BC Overlay	Entire Length
3	2032	30mm BC Overlay	Entire Length

*MM 2022 is currently in progress

Service Road: 100% Micro-surfacing in year 2022, 30m BC Overlay in 50% length and 50% Micro-surfacing in 2027 and 2032.

Structure Major Maintenance

a) Replacement of Elastomeric Bering in Year 2027
b) Replacement of Wearing Coat with milling in Year 2022, 2027 and 2032.
c) Replacement of Elastomeric Strip Seal of all Strip Seal Joint in Year 2027.
d) Replacement of Filler board expansion joint
e) LS provision of 20 lakh for rectification of other defects (drainage spout, crack sealing, repairing of railing etc.) in year 2022, 2027 and 2032.

2.3 Toll Plaza and Associated Facilities

Toll Plaza and Associated Facilities

Concessionaire Agreement Provision: As per Schedule-C; maximum number of two toll plazas are proposed. The exact locations shall be decided in consultation with NHAI.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

2.3.1 Toll Plaza TP1@ 32.500 km and TP2@ 100.950 km

Concessionaire Agreement Provision: There shall be total number of minimum eight lanes having a semiautomatic system of toll collection comprising equipment's for registering of vehicle classification, ticket issuing, data processing and power supply.

Site Observations:

1. During the site visit, it was observed that there are two Toll Plazas located at Km 32+500 and at km 100+950 having 5 LHS+5 RHS lanes.

2. Dedicated ETC lanes are installed and operational in 1LHS+1RHS lanes.

3. Remaining lanes 4LHS+4RHS are under Hybrid mode.

4. The Toll Plaza is equipped with the Administrative Building having all the provisions as mentioned in Concessionaire Agreement.

5. There are 10 WIMs (5 LHS+5 RHS) and 2 SWB (1 LHS+1 RHS) in both Toll Plazas. All WIMs and SWBs are not functional and not integrated with system.

6. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc are as per the provisions of Concessionaire Agreement.

Table: Facilities available at both Toll Plazas

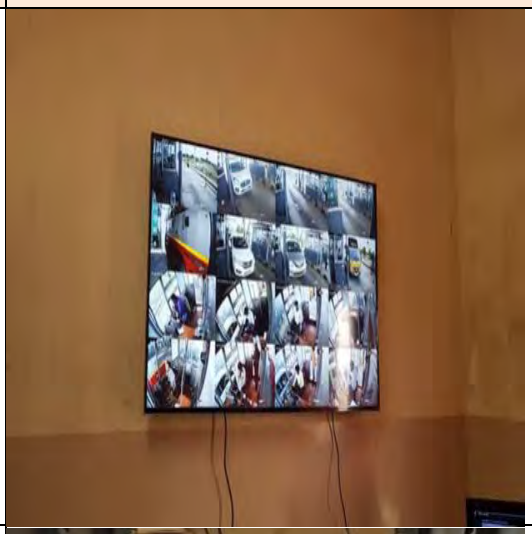
Parameter	Concessionaire Agreement Provision/ NHAI Norms	Current Status
Dedicated ETC Lane	Dedicated ETC lane should be at least in one lane in each direction of travel.	Dedicated ETC lane installed and operational in 1 LHS+1RHS lanes.
Hybrid ETC System	Hybrid ETC System should be installed in the lanes other than Dedicated ETC Lanes.	Remaining lanes (4 LHS+4RHS) are in Hybrid ETC System.
AVC (Automatic Vehicle Classifier) System	Should be installed in each and every lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer,	All such basic equipments are required to be installed and functional in all the lanes.	Installed and working in all the lanes.

Parameter	Concessionaire Agreement Provision/ NHAI Norms	Current Status
Dedicated ETC Lane	Dedicated ETC lane should be at least in one lane in each direction of travel.	Dedicated ETC lane installed and operational in 1 LHS+1RHS lanes.
Violation Alarm, booth camera etc.		
Preventions for overloading	WIM should be installed in each and every lane. Static Weigh Bridge should be installed in each direction of travel.	All WIMs installed are installed but non-operational. One SWB each installed and non-operational in each direction of travel.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Available with all basic requirements.

2.3.2 Pictorial representation for present site conditions:

S. No.	Description	Site Status
1.	Both Toll Plazas has 5 LHS+ 5 RHS lanes. Dedicated ETC Lanes are in 1LHS+ 1RHS. Remaining lanes are in Hybrid mode.	

S. No.	Description	Site Status
2.	Toll booths are equipped with all the required systems/equipments.	
3.	All the required equipment are placed outside the toll booth.	
4.	Admin Building is equipped with Control Room, Server Room, Manager Room etc.	

S. No.	Description	Site Status
5.	Toll Management System (TMS) was installed by Green Tech ITS Ltd in Dec 2018 and even day to day operations as well as AMC is also taken care by same Vendor. All the lanes are upgraded to Hybrid ETC System.	
6.	TMS Server Room is equipped with all the required servers and switches.	

2.3.3 Highway Traffic Management System (HTMS):

There is no HTMS in the entire stretch as the same is not mentioned in Schedule-C.

2.3.4 CHANGE OF SCOPE:

The status of Change of scopes in the project toward TMS are listed below.

S. No.	Description	Amount (in crores)	Current Status
1	Hybrid ETC System in all lanes at both the Toll Plazas.	Rs. 2.93	Work completed and fully operational. Entire COS amount approved vide Regional Office letter no. NHAI/RO-BNG/HOU-ETC/25014/1/2017-18/789 dated 9.6.2018
2	Weigh in Motion System (total 20. nos. in both Toll Plazas)	Rs. 3.08	WIM installed but nonfunctional as not integrated with system. RO approved letter no: NHAI/RO-BNG/End to End TMS/2016/1676 dated 28.7.2016 IE TES Recommended Rs. 46,72,668/-

2.4 Road Safety Assessment

Major Safety issue as identified in Safety Report as follows:

Sn	Safety Concern	Probable Accident Type	Risk Category	AECOM Observation
1	Unauthorized Median Opening (UMO)	Right Angled Collison	High	Closed all UMO
2	Improper Installation of Metal Beam Crash Barrier	Increased severity due to Hitting Fixed Object or Crash Barrier	High	Open Item
3	Installation of Wrong/Non-Standard OHM boards	Run off Road / Hit Fixed Object	High	Open Item
4	Missing OHM	Run off Road / Hit Fixed Object	High	Open Item
5	Unprotected High Embankments	Vehicle Out of Control/Run off Road	High	Open Item
6	Long Straight Sections	Run off Road, Single Vehicle Accident due to fatigue	Moderate	Open Item
7	Trees with girth diameter greater than 15 cm within the clear zone	Hit Fixed Object	Moderate	Open Item
8	Improper Night Visibility along the Project Road	Run off Road/ Hit Fixed Object	Moderate	Open Item
9	Improper condition of Signboards	Skidding, Rear end collision due to sudden breaking resulting from late information to users	Moderate	Open Item
10	Improper Placement of Service Road End Signboards	Run off Road or Side swipe collision with main carriageway traffic	Low to Moderate	Open Item
11	Number of 40 kmph boards along Main Carriageway	Rear End Collision due to variable speeds in the section	Low	Open Item

3. CAPEX REQUIREMENT

Sl No	Penalty Description	Period		Amount	Remarks
		From	To		
A.	Damage for Non-Compliance				
1	IE recommended Authority for imposing penalty on Concessionaire for failure in carrying out Periodical Renewal works in stipulated time period from 01/07/2019 to 31/07/2019 for an amount of 1.08 Crores vide letter no: MSV/NLG/O&M/NHAI/2019-20/417 dated: 03.08.2019	12.01.2021	Until start of MM		As per the information provided by the concessionaire penalty for this period is under dispute
2	IE recommended Authority for imposing penalty on Concessionaire for failure in conducting the required test at major bridges CH: 91+864 & 103+557 as per provision of the concession agreement for time period 01.07.2019 to 31.07.2019 (31 days) @ 10,000 Rs per day amounting to Rs. 3,10,000/- vide letter no: MSV/NLG/O&M/NHAI/2019-20/418 dated: 03.08.2019	12.01.2021	11.09.2021	24,30,000	
		Total Amount		24,30,000	

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

Sn	Year	Description	Length (4 Lane km)
1	2022*	30mm BC Overlay in 65% length and Microsurfacing in 35% length	Entire Length
2	2027	30mm BC Overlay	Entire Length
3	2032	30mm BC Overlay	Entire Length

i) Service Road: 100 % Micro surfacing in year 2022 as 30 mm Overlay is being caried out as balance MM work of 2017. 2027 and 2032 – 50 % Micro surfacing and 50 % with 30 mm Overlay

iii) Structure Major Maintenance

f) Replacement of Elastomeric Bering in Year 2027
g) Replacement of Wearing Coat with milling in Year 2022, 2027 and 2032
h) Replacement of Elastomeric Strip Seal of all Strip Seal Joint
i) Replacement of Filler board expansion joint
j) LS provision of 20 lakh for rectification of other defects (drainage spout, crack sealing, repairing of railing etc.) in year 2022, 2027 and 2032.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provided by the Cube Highways as follows applicable for FY 2022:

Bitumen Price @ 1st March 2021	CPCL Chennai		
Bitumen	Base Price	Discount	Ex MI price
VG30	51,752	5100	46,652
VG40	55,232	3800	51,432

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

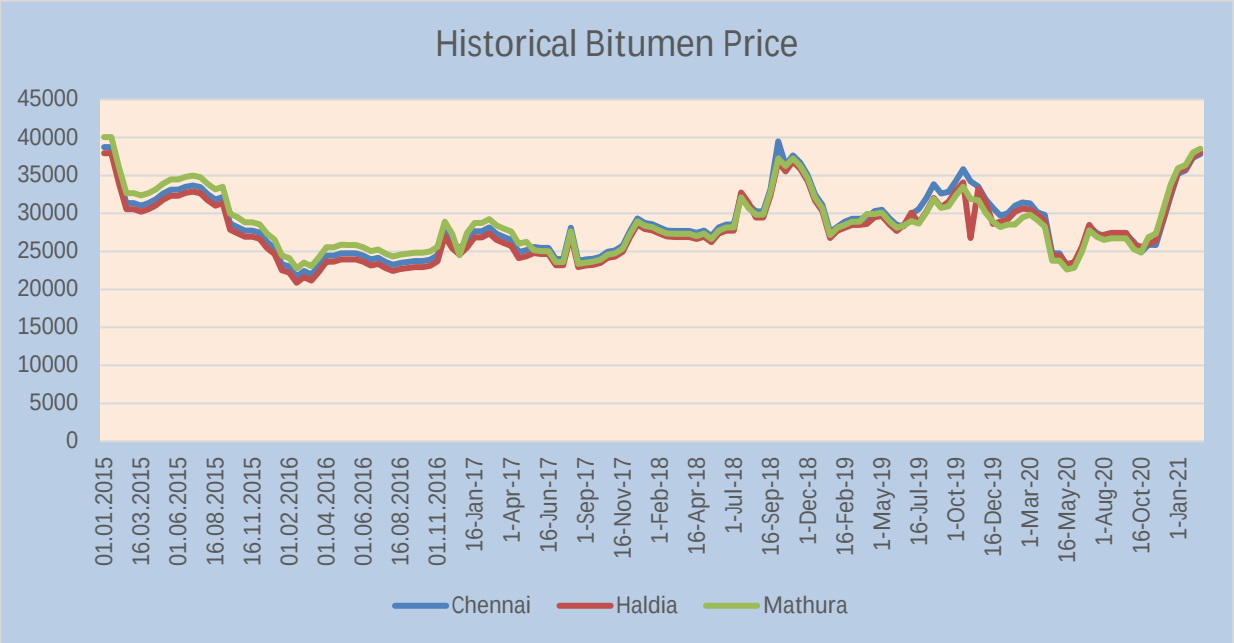
viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on Year 2021.

xii) The historical bitumen price from year 2015 to till date is present in below graph.



xiii) Cube Highway forecast Bitumen for upcoming year as follows:

a) FY 2023

VG 40 – 32,367, VG 30 – 30,977 Rs / MT

b) FY 2024 onwards till end of Concession Period, Bitumen Price is considered same rate as below:

VG 40 – 27,614, VG 30 – 26,224 Rs / MT

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

FY	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:
Unit Rate as of 2021/22 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.) FY 23	Rate (Rs) for FY 24 onwards
1	Dense Bituminous Macadam – CAPEX	Cum	7659	8,071
2	Bituminous Concrete	Cum	8817	9,261
3	Micro surfacing	Sqm	160	176
4	Raising of Road Kerb	m	400	439
5	Road Marking	sqm	400	439
6	Kerb and Crash Barrier Painting	sqm	110	121
7	Shoulder Filling	cum	280	307
8	Road Studs - Normal	nos	200	220
9	Road Studs - Solar	nos	1500	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in next page.
Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)

Sl. No.	Activity	Unit	Unit Rate 2022	Unit Rate 2021 for FY 24 onwards	Treatment Cycle 2 Qty	Treatment Cycle 3 Qty	Treatment Cycle 4 Qty	Treatment Cycle 2 Amount	Treatment Cycle 3 Amount	Treatment Cycle 4 Amount
					2022	2027	2032	2022	2027	2032
A	**Main Carriageway - Flexible Pavement**									
1	Tack Coat	Sqm	12	12	581,553	1,428,818	1,428,818		17,731,626	17,731,626
2	Bituminous Concrete with VG-40 Bitumen	Cum	12,388	9,261	13,335	42,814	42,865	123,495,821	396,487,207	396,956,378
3	Dense Bituminous Macadam (VG-40)	Cum	10,622	8,071	1,106	-	-	8,923,784	-	-
4	Milling of existing BC	Sqm		66	180,700	71,441	71,441	11,901,546	4,705,356	4,705,356
5	Raising of Road Kerb	m		439		51,626	51,626	-	22,668,361	22,668,361
6	Painting of Road Kerb	sqm		121		1,230	1,230	-	148,572	148,572
7	Miscrosurafacing	sqm	176	176	1,038,073			182,323,427	-	-
								-	-	-
B	**Structure(Including FO,ROB,VUP,PUP,CUP and Bridges)**							-	-	-
1	Tack Coat	Sqm		12		17,972	17,972	-	223,027	223,027
2	Bituminous Concrete with VG-40 Bitumen (30 mm)	Cum		9,261		539	539	-	4,992,888	4,992,888
3	Milling of existing 30mm BC	Sqm		66		17,972	17,972	-	1,183,672	1,183,672
4	Painting of Crash Barrier	sqm		121		-	-	-	-	-
								-	-	-
C	**Toll Plaza and Truck Laybye - Rigid**							-	-	-
1	Retexturing and Grinding (as per Cl 6.3.4.1 of IRC-58-2015) 100%	Sqm	132	132		5,916	5,916	-	779,299	779,299
								-	-	-
D	**Service Road**							-	-	-
1	Tack Coat	Sqm	12	12		153,718	153,718	-	1,907,641	1,907,641
2	Functional Overlay using VG-30	Cum	11,388	8,510	4,000	4,612	4,612	34,040,960	39,245,317	39,245,317
3	Miscrosurfacing	sqm	176	176		153,718	153,718	-	26,998,474	26,998,474
								-	-	-
E	**Other Works**							-	-	-
1	Replacement of Road Studs							-	-	-
	Road Studs	Nos	220	220		-	-	-	-	-
	Solar Studs	Nos	1,647	1,647				-	-	-
								-	-	-
2	Road Marking	Sqm	439	439	75,855	75,855	75,855	33,307,039	33,307,039	33,307,039
3	Maintenance of Earthen Shoulder	cum	307	307	4,905	4,905	4,905	1,507,706	1,507,706	1,507,706
H	**Contingency - 2 % above amount**							-	-	-
A	**Major Maintenance Cost excl. GST (INR)**							395,500,283	551,886,184	552,355,355
B	**GST (12% of A)**							47,460,034	66,226,342	66,282,643
	Major Maintenance Cost incl. GST (INR) as of Mar 2022							442,960,317	618,112,526	618,637,998
	Escalation Factor							1.047	1.294	1.601
	Esclated Amount keping Bitumen Component w/o Escalation							459,922,988	737,558,253	863,003,921

5. OPERATION AND MAINTENANCE COST

5.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 18 – Operation &Maintenance & Schedule – L Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 18 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)
6. Major Maintenance (Functional Overlay and Strengthening Layer)

5.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2018, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	NSV Survey
3	Roughness Value (IRI), Rutting	NSV Survey
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	ATMS (ECB)	As per manufacturer's / suppliers recommendation
10	TMS	As per manufacturer's / suppliers recommendation

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each item.

5.3 Requirement of CA (Schedule L and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-L (the "Maintenance Requirements").

5.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine and preventive maintenance covers maintenance of following assets:

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 19,812 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 12,820 / km / month excluding GST

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 72 Watts at Side 92 watts at Median and 250 watts at high mast, LED light will be operated for 10 hours a day round the year
b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 11 Rs / Kwh.

The calculated electricity cost for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	KM	20.00	125,000	2,500,000
2	Highway Lighting Electricity Charge	Kwh	342,691	11.00	3,769,603
3	Operation and Maintenance of DG Set	Nos	2	127,750	255,500
4	Solar Blinker	Nos	78	3,000	234,000
5	Office Building Electricity Charge	LS			
	Total				10,969,245*

*10% additional to update cost of April 2022

5.6 TMS Cost and ATMS

Following consideration has made during calculation of O & M cost for TMS and ATMS:

a) AMC cost towards TMS is considered 1.5 lakh per lane per year
b) 70 % of equipment shall be replaced in every 7 year interval.

Year wise O and M cost including replacement cost of equipment is Rs. 1.14 Crore Per Year and Rs. 9.18 Crores considered for replacement of TMS Equipment's for every 7 year.

5.1 Corridor Management

The following equipments along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT
b) Traffic Aid Post with 2 nos of route patrol vehicle
c) 2 nos of Ambulance

O & M Cost estimated towards incident management with operation manpower is Rs. 2.8 crore per year including GST.

5.2 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1. Management, Administration / HR and Supervision Staff: in-house manpower
2. Toll Operation Manpower: outsource for providing 24 hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as Rs. 6.69 core for FY 2021 and Rs.5.56 Crores per year FY 2022 onwards.

5.3 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 2.83 crore per year. Year wise O & M Cost (OPEX) is presented in next page.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021										-
2	2022	7,568,013	21,371,894	10,969,245	42,036,359	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	200,768,401
3	2023	10,340,788	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	172,924,812
4	2024	13,305,144	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	175,889,168
5	2025	15,333,658	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	177,917,682
6	2026	17,205,634	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	179,789,657
7	2027	7,568,013	21,371,894	10,969,245	42,036,359	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	200,768,401
8	2028	10,340,788	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	172,924,812
9	2029	13,305,144	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	175,889,168
10	2030	15,333,658	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	177,917,682
11	2031	17,205,634	21,371,894	10,969,245	11,419,995	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	179,789,657
12	2032	7,568,013	21,371,894	10,969,245	42,036,359	28,141,544	1,778,318	55,612,261	4,610,455	28,680,312	200,768,401
	Total	135,074,487	235,090,829	120,661,698	217,469,041	309,556,985	19,561,498	611,734,870	50,715,000	315,483,431	2,015,347,841
Total Cost in		13.51	23.51	12.07	21.75	30.96	1.96	61.17	5.07	31.55	201.54

6. PROJECT ROAD ANALYSIS

6.1 Reconnaissance Survey

This project road starts from NH-4 at Nelamangala Junction to Devihalli at NH-48 Bangalore-Mangalore Section of NH-48 in the state of Karnataka. Project road starts from Km 28+200 (Design Ch. 28+200) at Nelamangala to Km 110+000 (Design Ch. 108+463) at Devihalli located in Plain terrain. The Total Length of the Project road is 80.273 Km. The project road has been visited by Consultant's team of Engineers in the month of December 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretch and length is given as below:

Detail of Project Stretch

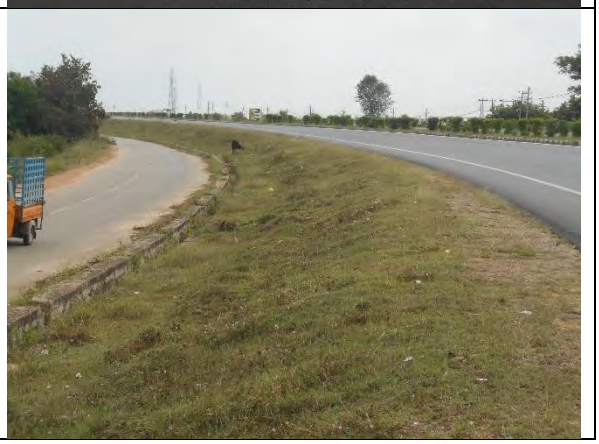
Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Four laning of Nelamangal Junction-Devihalli (Km 28.200-110.000) of NH-48 on BOT Basis	Km 28+200 (D.Ch. 28+200)	Km 110+000 (D.Ch. 108+463)	80.273	

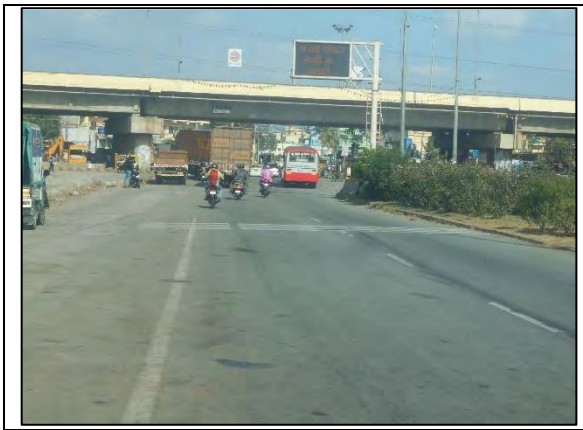
6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and cross road details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.





Start Point of Project Road at Km 62+350

End Point of Project Road at Km 119+600

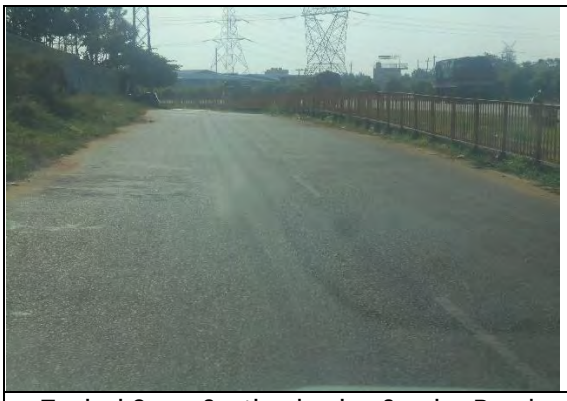
Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 28+200 Nelamangala Junction	Km 28+200 Nelamangala Junction	
2	Project Road End	Km 110+000 Devihalli	Km 110+000 Devihalli	
3	Project Length	80.273 Km	80.273 Km	As per Toll Receipts toll being collected for a length of 79.2 km
6	Carriageway	4 lane highway with paved width 7.0 m on either side with 1.5m Paved Shoulder	4 lane highway with paved width 7.0 m on either side with 1.5m Paved Shoulder	
7	Shoulders	1.5m Paved Shoulder and 2m Earthen Shoulder	1.5m Paved Shoulder and 2m Earthen Shoulder	
8	Median	4.5 m raised median along the project road (1.2m at Median Opening)	4.5 m raised median along the project road (1.2m at Median Opening)	
9	Service Roads	43.606Km Cart Track from 65+600 to 79+500	Service road/slip road -44.17 Km Cart track-27.92 Km	Cart track at 65+500 to 65+560 BHS and 68+300 to 68+400 BHS pending
10	Major Bridge	2 No.	2 No.	
11	Minor Bridge	23 Nos.	25 Nos and 3 under construction	
12	Pipe, Box & Slab Culverts	103 Nos	103 Nos	
13	Major/Minor Junctions	9 Major Junction and 29 Minor junctions	9 Major Junction and 29 Minor Junction	
14	Underpass	PUP (Subway)-6 Nos CUP-8 Nos	PUP-9 Nos Subway-3 Nos CUP-3 Nos	
15	Grade Separator	VUP-9 Nos	VUP -10 Nos	
15	ROB/RUB	1 No.	2 No.	
16	Toll Plazas	2 Nos.	2 Nos.	
17	Truck Lay-byes/Truck Parking	6 Nos.	6 Nos	
18	Bus bays/Bus Stops	32 Nos Busbay and 64 Bus shelter	32 us bays and 43 Bus Shelter	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

	
Typical Cross Section having Service Road	Typical Section of Approach
Typical Rural Section	Toll Plaza

7 type of TCS has been proposed in Schedule-B of CA and same has adhered along project road.

6.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at two Toll Plazas where Rigid Pavement has been provided. Pavement condition is generally Good to fair throughout the project corridor.

6.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

Comparison of Service Road Location between Schedule B and as per Site

Sl No	Location		Length (m) LHS	Length (m) RHS	Width
	From	To			
1	28+200	30+309	2109	2109	7
2	30+309	31+963	1654	1654	7
3	33+373	35+173		1800	7
4	36+356	38+148	1792	1792	7
5	42+536	43+920	1384	1384	7
6	45+230	47+616	2386	2386	7
7	50+101	51+292	1191	1191	7
8	53+338	54+838	1500	1500	7
9	55+380	56+062	682	682	7
10	80+800	81+700	900	900	7
11	85+951	87+229	1278	1278	7
12	89+403	90+807	1404	1404	7
13	91+401	92+163	762	762	7
14	102+929	106+790	3861	3861	7
		Sub Total	20903	22703	
		Total	43606		
Cart track					
1	65+600	79+500			5.5m

Sn	Location		Side	Length (m)	Width(m)
	From	To			
	Service Road/ Slip Road				
1	28+200	30+200	LHS	2000	7
2	33+300	35+180	LHS	1880	7
3	36+350	38+100	LHS	1750	7.2
4	42+500	43+900	LHS	1400	7
5	45+230	47+250	LHS	2020	7.2
6	50+100	51+100	LHS	1000	7.5
7	53+850	54+390	LHS	540	6.7
8	55+380	56+050	LHS	670	6.6
11	79+800	81+000	LHS	1200	5.5
12	81+500	82+320	LHS	820	7
13	85+500	87+700	LHS	2200	7
14	90+220	91+630	LHS	1410	7
15	92+200	93+000	LHS	800	7
16	103+620	107+500	LHS	3880	7
1	28+200	32+000	RHS	3800	5.5
2	33+350	35+300	RHS	1950	5.5
3	36+580	37+900	RHS	1320	5.5

4	42+550	43+730	RHS	1180	7
5	45+120	47+320	RHS	2200	5.5
6	50+080	51+300	RHS	1220	5.5
7	53+800	54+420	RHS	620	7
8	55+170	56+020	RHS	850	5.5
9	81+390	82+430	RHS	1040	7
10	85+480	87+780	RHS	2300	7
11	90+240	91+630	RHS	1390	7
12	92+150	93+000	RHS	850	7
13	103+620	104+400	RHS	780	5.5
14	104+400	107+500	RHS	3100	7
			Total	44170m	
Cart Track					
1	65+050	68+200	LHS	3150	7.5
2	68+450	79+600	LHS	11150	3.7
3	65+600	66+600	RHS	1000	3.7
4	66+900	79+520	RHS	12620	3.7
			Total	27920m	

6.2.4 Median

Median width of 4.5 m was observed in the Rural and 1.2m Median Openings respectively. Plantation has provided along entire median in good condition.

Median with Shurbs

Median with Shrubs

39 nos of Median Openings are found along project road. Most of median openings having shelter lane and blinkers. List of median openings is tabled below:

SN	Chainage	Median Width (m)	Length (m)	Type		Details			Remarks
				Authorised Opening	Un authorized Opening	Reserve Lane	Delineators	Solar Blinkers	
1	29+510	4.5	20	Y		Y		2 Nos	
2	30+590	4.5	20	Y		Y		2 Nos	
3	34+220	4.5	20	Y		Y		2 Nos	
4	36+250	4.5	20	Y		Y		2 Nos	
5	37+400	4.5	20	Y		Y		2 Nos	
6	39+050	4.5	20	Y		Y		2 Nos	
7	39+950	4.5	20	Y		Y		2 Nos	
8	40+800	4.5	20	Y		Y		2 Nos	
9	44+650	4.5	20	Y		Y		2 Nos	
10	45+950	4.5	20	Y		Y		2 Nos	
11	46+600	4.5	20	Y		Y		2 Nos	
12	48+400	4.5	20	Y		Y		2 Nos	
13	49+700	4.5	20	Y		Y		2 Nos	1 is not working
14	51+150	4.5	20	Y		Y		2 Nos	
15	53+100	4.5	20	Y		Y		2 Nos	
16	53+850	4.5	20	Y		Y		2 Nos	1 is not working

SN	Chainage	Median Width (m)	Length (m)	Type		Details			Remarks
				Authorised Opening	Un authorized Opening	Reserve Lane	Delineators	Solar Blinkers	
17	55+680	4.5	20	Y		Y		2 Nos	
18	57+480	4.5	20	Y		Y		2 Nos	
19	59+900	4.5	20	Y		Y		2 Nos	
20	61+450	4.5	20	Y		Y		2 Nos	
21	63+500	4.5	20	Y		Y		2 Nos	
22	64+650	4.5	20	Y		Y		2 Nos	
23	71+250	4.5	20	Y		Y		2 Nos	
24	73+200	4.5	20	Y		Y		2 Nos	
25	75+350	4.5	20	Y		Y		2 Nos	
26	77+230	4.5	20	Y		Y		2 Nos	
27	81+150	4.5	20	Y		Y		2 Nos	
28	82+120	4.5	20	Y		Y		2 Nos	
29	84+250	4.5	20	Y		Y		2 Nos	
30	86+100	4.5	20	Y		Y		2 Nos	
31	86+800	4.5	20	Y		Y		2 Nos	
32	95+250	4.5	20	Y		Y		2 Nos	
33	97+580	4.5	20	Y		Y		2 Nos	
34	100+300	4.5	20	Y		Y		2 Nos	
35	101+900	4.5	20	Y		Y		2 Nos	
36	105+030	4.5	20	Y		Y		2 Nos	
37	105+700	4.5	20	Y		Y		2 Nos	
38	107+550	4.5	20	Y		Y		2 Nos	1 is not working
39	108+600	4.5	20	Y		Y		2 Nos	

Medain Opening with Solar Blinker

6.2.5 Road Side Drains

Drains are to be constructed at the project road to have a good drainage system. Lined drains are provided Between Main Carriageway and Service road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order except in some stretches where median drain flow level is lower than Carriageway level due to over lay. Location and type of drain as provided is presented below:

Location of Drain

S.N.	Chainage		Side	Length (m)
	From	To		
1	28+200	30+200	LHS	2000
2	28+340	31+985	RHS	3645
3	33+370	35+270	RHS	1900
4	33+400	35+180	LHS	1780
5	36+360	38+800	LHS	2440
6	36+600	37+880	RHS	1280
7	37+400	37+890	RHS	490
8	42+600	43+800	LHS	1200
9	42+700	43+700	RHS	1000
10	43+200	43+680	RHS	480
11	45+130	47+290	RHS	2160
12	45+240	47+251	LHS	2011
13	50+100	51+250	RHS	1150
14	50+120	51+100	LHS	980
15	53+820	54+400	RHS	580
16	53+850	54+390	LHS	540
17	55+180	56+015	RHS	835
18	55+400	56+050	LHS	650
19	65+050	65+500	LHS	450
20	65+500	65+650	LHS	150
21	68+500	68+600	LHS	100
22	68+530	69+000		470
23	69+300	69+500	LHS	200
24	69+550	69+770	LHS	220
25	70+070	70+350	LHS	280
26	73+150	73+550	LHS	400
27	74+350	74+440	RHS	90
28	74+360	74+480	LHS	120
29	75+610	75+740	LHS	130
30	75+640	75+720	RHS	80
31	76+400	76+500	LHS	100
32	77+090	77+180	RHS	90
33	79+030	79+500	RHS	470
34	79+800	80+850	LHS	1050

S.N.	Chainage		Side	Length (m)
	From	To		
35	81+395	82+415	RHS	1020
36	81+500	82+450	LHS	950
37	84+300	84+600	RHS	300
38	85+480	87+650	RHS	2170
39	85+500	87+550	LHS	2050
40	90+300	91+020	LHS	720
41	90+300	90+650	RHS	350
42	91+030	91+610	LHS	580
43	91+040	91+600	RHS	560
44	92+200	92+960	LHS	760
45	92+320	92+960	RHS	640
46	100+820	101+290	LHS	470
47	100+820	101+100	RHS	280
48	103+700	104+620	LHS	920
49	104+020	104+070	RHS	50
50	104+420	105+650	RHS	1230
51	104+630	105+920	LHS	1290
52	105+660	106+650	RHS	990
53	105+930	106+780	LHS	850
54	106+800	107+500	LHS	700
55	107+450	107+760	RHS	310

Location of Median Cut Drain

SN	Existing Chainage		Length (m)
	From	To	
1	58+350	59+300	950
2	28+800	29+060	260
3	30+600	31+050	450
4	36+700	37+500	800
5	38+050	38+700	650
6	40+700	41+300	600
7	47+500	47+900	400
8	48+700	49+500	800
9	55+750	56+260	510
10	57+400	57+900	500
11	60+050	60+100	50

SN	Existing Chainage		Length (m)
	From	To	
12	60+800	62+100	1300
13	63+300	64+500	1200
14	72+100	73+500	1400
15	72+400	77+600	5200
16	81+300	83+100	1800
17	97+500	99+800	2300
18	101+700	102+200	500
19	104+900	105+400	500
20	106+200	106+800	600
21	107+300	107+750	450
22	107+950	108+500	550

Median Drain, Drain B/w MCW &SR and Median Cut along the project road

6.2.6 Major and Minor Junctions

As per the site inventory, 3 major and 36 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	9	9
Minor Junctions	29	29

Major Junction at 28th KM

Minor Junction at 43rd KM

Details of Major and Minor Junctions along the project are presented in the table below:

Details of Major Junctions

Sn	Existing Chainage	Type of Junction	Place Identification
1	43+180	+	Gudemaranahalli hand post
2	65+400	Y	Kunigal bypass take off
3	69+500	+	Rajakere road junction
4	72+540	+	Mysore road junction
5	73+590	+	Yagavana hills road junction
6	80+300	Y	End of Kunigal bypass
7	89+775	+	Yediyuru road junction
8	91+780	Y	Tiptur road junction
9	103+300	Y	Belluru cross junction

Details of Minor Junctions

Sn	Existing Chainage	Type of Junction	LHS	RHS
			Cross Road Leading to	Cross Road Leading to
1	29+570	T	Bhawikere road junction	
2	30+580	T		Mallara bandvadi road junction
3	32+120	Y		
4	33+220	Y		
5	34+300	T	Yantaganahalli	
6	37+430	T		
7	39+930	+		
8	40+820	Y	Bhatrapura road	
9	44+670	+	Solur	Gudemaranahalli
10	45+890	T	solur road bus stand	
11	46+580	T		Magadi road
12	49+700	+		
13	51+130	T	kansandra road	
14	53+110	T	Honspalya road	
15	53+810	T		
16	55+720	+	Kodur road	Magadi junction
17	59+815	+		
18	63+570	+		Magadi junction
19	64+670	Y		Kalnakanahalli road
20	81+350	+	Kaggare	siddapura road
21	83+530	T		
22	86+035	T		Koppa village
23	87+600	+	Lalanakere road junction	Manvinakere
24	92+850	T		MDR-17
25	95+460	T		
26	97+800	T	Battadakotae road	
27	101+140	+		
28	104+980	T		Sri adichunagiri
29	106+860	+		

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	36.525
Pedestrian Guard Rail	Carriageway Edge	21.355

PGR and W-Beam present on the project road

As per Inventory and condition survey it is found that 986 m of Pedestrian Guard Rail are required to repair / reinstall.

6.2.8 Toll Plaza and Other Facilities

As per Schedule-C; maximum number of two toll plazas are proposed. The Concessionaire has provided 2 toll plazas in the project corridor at Km41+125, Km 110+200 and Km 168+200

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

The locations of three Toll Plaza are as mentioned below: -

Doddakarenahalli Toll Plaza TP1 at km.32+500.

Karabylu Toll plaza TP2 at km 100+950.

Doddakarenahalli Toll Plaza at Km 31+200	Karabylu Toll Plaza at Km 100+950

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and at flyover (interchange) as per Schedule C. Additionally, High Mast has provided at Toll Plaza, major junction, ROBs and flyover confirming Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

SN	Existing Chainage		Length (mts)	Side	Nos.	Type
	From	To				
1	28+200	28+250	50	LHS	1	High mast
2	32+200	32+650	450	LHS & RHS	5	High mast
3	100+750	101+200	550	LHS & RHS	6	High mast
4	43+550	44+790	1240	Median	31	Double Arm
5	55+700	55+860	160	Median	4	Double Arm
6	69+500	70+380	880	Median	22	Double Arm
7	73+200	74+400	1200	Median	30	Double Arm
8	73+700	74+340	640	Median	16	Double Arm
9	79+800	80+520	720	Median	18	Double Arm
10	104+200	105+240	1040	Median	26	Double Arm
		0+000				
11	34+400	34+640	240	LHS & RHS	6	Single Arm
12	37+030	37+270	240	LHS & RHS	6	Single Arm
13	46+000	46+080	80	LHS & RHS	2	Single Arm
14	54+100	54+340	240	LHS & RHS	6	Single Arm
15	79+650	79+970	320	LHS & RHS	8	Single Arm
16	106+100	106+340	240	LHS & RHS	6	Single Arm

Highway Lighting at 79+700 ROB

Highway Lighting at 74+000

High mast at toll plaza Km 100+950

As per requirement of Schedule C, highway lighting is to be provided at approach (additional 50m on either side of the approaches) of Flyover, Underpasses, Major Bridges, Toll plaza, Traffic aid posts and Main administrative Base camp. Lighting at Major bridges has provided only for new bridge; no lighting at retained old bridge.

6.2.10 Bus Bays and Bus Shelter

There are 12 Bus bays along the project road. 9 No bus shelters present in the project road are in good condition

Bus Shelter at Km 45+150	Bus Shelter at Km 28+400

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S. No	Chainage	Side	Detail	Remarks
			Pavement	
1	28+400	LHS	BT	Bus Shelter
2	34+150	LHS	BT	Bus Shelter
3	40+000	LHS	BT	Bus Shelter with Bus Bay
4	44+800	LHS	BT	Bus Shelter
5	49+800	LHS	BT	Bus Shelter
6	50+700	LHS	BT	Bus Shelter
7	52+800	LHS	BT	Bus Shelter with Bus Bay
8	54+060	LHS	BT	Bus Shelter
9	55+700	LHS	BT	Bus Shelter
10	56+900	LHS	BT	Bus Shelter with Bus Bay
11	57+300	LHS	BT	Bus Shelter with Bus Bay
12	61+700	LHS	BT	Bus Shelter with Bus Bay
13	63+420	LHS	BT	Bus Shelter with Bus Bay
14	64+850	LHS	BT	Bus Shelter
15	84+380	LHS	BT	Bus Shelter with Bus Bay
16	88+400	LHS	BT	Bus Shelter
17	96+900	LHS	BT	Bus Shelter with Bus Bay
18	101+650	LHS	BT	Bus Shelter with Bus Bay
19	107+700	LHS	BT	Bus Shelter with Bus Bay

S. No	Chainage	Side	Detail	Remarks
			Pavement	
20	29+850	RHS	BT	Bus Shelter with Bus Bay
21	34+150	RHS	BT	Bus Shelter with Bus Bay
22	37+250	RHS	BT	Bus Shelter with Bus Bay
23	40+050	RHS	BT	Bus Shelter with Bus Bay
24	42+450	RHS	BT	Bus Shelter with Bus Bay
25	44+900	RHS	BT	Bus Shelter with Bus Bay
26	45+750	RHS	BT	Bus Shelter
27	47+100	RHS	BT	Bus Shelter with Bus Bay
28	49+850	RHS	BT	Bus Shelter with Bus Bay
29	52+900	RHS	BT	Bus Shelter with Bus Bay
30	55+552	RHS	BT	Bus Shelter with Bus Bay
31	57+850	RHS	BT	Bus Shelter with Bus Bay
32	58+350	RHS	BT	Bus Shelter with Bus Bay
33	60+950	RHS	BT	Bus Shelter with Bus Bay
34	62+750	RHS	BT	Bus Shelter with Bus Bay
35	64+450	RHS	BT	Bus Shelter with Bus Bay
36	65+950	RHS	BT	Bus Shelter
37	85+400	RHS	BT	Bus Shelter with Bus Bay
38	89+760	RHS	BT	Bus Shelter with Bus Bay
39	90+900	RHS	BT	Bus Shelter with Bus Bay
40	91+000	RHS	BT	Bus Shelter with Bus Bay
41	93+900	RHS	BT	Bus Shelter with Bus Bay
42	97+750	RHS	BT	Bus Shelter with Bus Bay
43	102+600	RHS	BT	Bus Shelter with Bus Bay

6.2.11 Truck Lay Byes

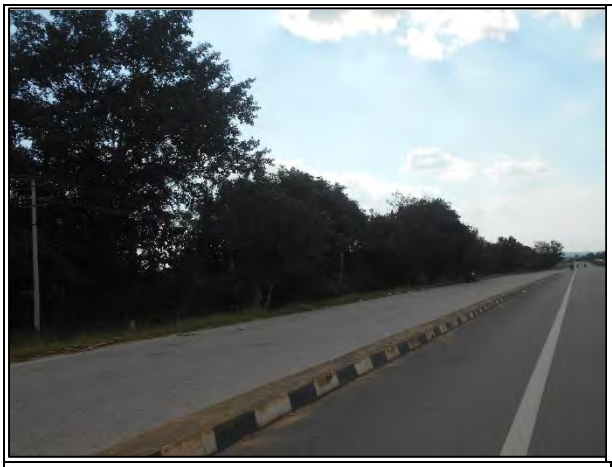
Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay byes

S. No	Chainage	Side	Pavement Type

1	31+980	LHS	BT
2	64+500	LHS	BT
3	88+800	LHS	BT
4	39+100	RHS	BT
5	64+500	RHS	BT
6	88+650	RHS	BT

As per Schedule C, total six numbers is to be provided.



Truck lay bye at Km 88+800 LHS

Truck Lay bye at Km 88+650 RHS

6.2.12 Signage and Marking

Road Signs

633 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Direction Sign on the Project Road

Sign Boards fixed at Junction

Summary of different sign board found along the project road is presented below

Type of Sign Board	Nos
Keep Left	4
Curve Ahead	85
School Zone	8
Go Slow	24
Speed Limit (80 Kmph)	44
Speed Limit (50 Kmph)	8
Speed Limit (40 Kmph)	1
Petrol Pump	7
Accident Zoon	6
Sr Merging	20
Emergency Call No.	14
Village Road	54

Type of Sign Board	Nos
X – Road	18
Road Marker	5
Hospital	2
Cantilever Gantry	16
Gantry Full Width	2
Median Opening	76
Pedestrian Crossing	73
T/Y Junction	44
Bus Stop	19
U – Turn	9
Hazard Marker	96

6.2.13 Road Marking

Road Marking along the project corridor was found to be in fair condition; stretches where major maintenance is completed the marking is pending till now and in the rest of the stretches most of the marking I worn out or reflectiveness reduced at night time.

Road marking at the junction

Road marking along the carraigeway

6.2.14 Landscaping and Tree Plantation

Median plantation has provided at 1.5 m median and narrow median. The plantation is not provided at 4.5m median till now. Avenue plantation has provided within available ROW.

Plantation at Median	Plantation at 4.5 m Median

6.2.15 Solar Blinkers

78 Nos of Solar blinkers have been provided at median openings/ junctions.

Solar blinker at Km 35+000	Solar Blinker at Medina Opening at 37+000

8.1 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 2 no of Major Bridge having total length varies from 68 m to 90 m are generally found in good condition.
- 25 nos. of Minor bridges having total length varies from 6 m to 42 m are generally found in good condition.
- 10 nos. of Vehicular Underpass having span arrangement of 1 x 10.5 m, 1 x 7 m, 2 x 9.3 m, 2 x 9.6 m and 2 x 9.5 m are found in good condition.
- 9 nos. of Pedestrian Underpass, 3 nos. of Subway and 3 no. of Cattle underpass are present along project corridor and are generally found in good condition.
- 2 no. of Railway over Bridge having span arrangement of 2 x 24.5+1 x 14 m and 1 x 11 m are found in good condition.
- 103 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

1. Major bridge

Salient features of the 02 Major bridges are discussed here

(a) Major bridge – CH. 91+892

It consists of Major Bridge on both the carriageways. It has span arrangement of 5 x 17 m on LHS & 5 x 18 m on RHS. The super structure comprises of RCC T-Beam and slab on LHS and RHS. Foundation is Not Visible on LHS & RHS. Elastomeric bearings are adopted on LHS and RHS for resting of superstructure on RCC wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

LHS View

RHS View

Major Bridge at Ch. 91+892

(b) Major bridge – CH. 103+577

It consists of Major Bridge on LHS and RHS. It has span arrangement of 4 x 17 m on LHS & RHS. The super structure comprises of RCC T-Beam and slab on LHS and RHS. Foundation is Not Visible on LHS & RHS. Elastomeric bearings are adopted on LHS for resting of superstructure on RCC wall type abutment and pier. Thermocol are adopted on RHS for resting of superstructure on RCC wall type abutment and pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. Few pictures to ascertain the conditions of Major Bridge are presented as follows:

LHS View

RHS View

Major Bridge at Ch. 103+577

2. Minor bridge

Salient features of the 25 Minor bridges are discussed here

i. Minor Bridge – CH.35+840

The Bridge has a span arrangement of 2 x 16.1 m on LHS and RHS. The super structure comprises of RCC T-Beam and slab on LHS and RHS. Foundation is Not Visible on LHS & RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment and pier. Thermocol are adopted on RHS for resting of superstructure on RCC wall type abutment and circular pier.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 35+840

ii. Minor Bridge – CH.43+743

It consists of Slab bridge on LHS and Box bridge on RHS. The Bridge has a span arrangement of 1 x 8 m on LHS & RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 43+743

iii. Minor Bridge – CH.49+526

It consists of Slab bridge on LHS and Box bridge on RHS. The Bridge has a span arrangement of 1 x 8 m on LHS & RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 49+526

iv. Minor Bridge – CH.53+300

The Bridge has a span arrangement of 1 x 10 m on LHS and RHS. The super structure comprises of RCC T-Beam and slab on LHS and RCC Box on RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment. Foundation is Not Visible.

The general condition of the bridge on LHS is good and bridge on RHS is fair. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 53+300

v. Minor Bridge – CH.54+610

It consists of Slab bridge on LHS and Box bridge on RHS. The Bridge has a span arrangement of 1 x 6 m on LHS & RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS Carriageway

RHS View

Minor Bridge at Ch. 54+610

vi. Minor Bridge – CH.58+735

It consists of Slab bridge on LHS and Box bridge on RHS. The Bridge has a span arrangement of 3 x 8.6 m on LHS & RHS. The super structure comprises of RCC Solid Slab on LHS and RCC Box on RHS. Tarpaper bearings are adopted on LHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 58+735

vii. Minor Bridge – CH.61+930

It consists of Box bridge on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 1 x 7.5 m on LHS & RHS. The super structure comprises of RCC Box on LHS and RCC Solid Slab on RHS. Tarpaper bearings are adopted on RHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 61+930

viii. Minor Bridge – CH.62+350

It consists of Box bridge on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 1 x 8 m on LHS and 1 x 6 m on RHS. The super structure comprises of RCC Box on LHS and RCC Solid Slab on RHS. Tarpaper bearings are adopted on RHS for resting of superstructure on RCC wall type abutment. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 62+350

ix. Minor Bridge – CH.67+330

It consists of Box bridge on Main carriageway & Service road on LHS and RHS. The Bridge has a span arrangement of 1 x 12 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible. No bearings are adopted.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS SR View

Minor Bridge at Ch. 67+330

x. Minor Bridge – CH.68+913

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 7 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible. One span of the bridge is using as Pedestrian Underpass.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

View of Median

Minor Bridge at Ch. 68+913

xi. Minor Bridge – CH.70+063

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 7.5 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 70+063

xii. Minor Bridge – CH.75+688

It consists of Box bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 5.5m on LHS and RHS. The super structure comprises of RCC Box on LHS and RHS. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Median View

RHS View

Minor Bridge at Ch. 75+688

xiii. Minor Bridge – CH.76+033

It consists of Box Bridge on LHS and RHS. The Bridge has a span arrangement of 4 x 8.75 m on LHS and RHS. The super structure comprises of RCC Box on LHS and RHS. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

Median View

Minor Bridge at Ch. 76+033

xiv. Minor Bridge – CH.76+473

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 2 x 5.5 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible. One span of the bridge is using as Cattle Underpass.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 76+473

xv. Minor Bridge – CH.78+707

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 4 x 8.75 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

Inside View

Minor Bridge at Ch. 78+707

xvi. Minor Bridge – CH.80+494

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 1 x 6 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

Inside View

Minor Bridge at Ch. 80+494

xvii. Minor Bridge – CH.85+777

It consists of Slab bridge on LHS and RCC Box bridge on RHS. The Bridge has a span arrangement of 3 x 8.8 m on LHS and RHS. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

Median View

Minor Bridge at Ch. 85+777

xviii. Minor Bridge – CH.90+202

It consists of RCC Box bridge on LHS and Slab bridge on RHS. The Bridge has a span arrangement of 2 x 6.4 m on LHS and RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 90+202

xix. Minor Bridge – CH.95+487

It consists of Slab bridge on LHS and RCC Box bridge on RHS. The Bridge has a span arrangement of 1 x 9 m on LHS and RHS. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 95+487

xx. Minor Bridge – CH.96+859

It consists of Slab bridge on LHS and RCC Box bridge on RHS. The Bridge has a span arrangement of 2 x 6.2 m on LHS and RHS. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 96+859

xxi. Minor Bridge – CH.100+212

It consists of RCC Box bridge on LHS and RHS. The Bridge has a span arrangement of 1 x 10 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 100+212

xxii. Minor Bridge – CH.101+300

It consists of Slab bridge on LHS and RCC Box bridge on RHS. The Bridge has a span arrangement of 1 x 7 m on LHS and RHS. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Median View

RHS View

Minor Bridge at Ch. 101+300

xxiii. Minor Bridge – CH.102+222

It consists of Slab bridge on LHS and RCC Box bridge on RHS. The Bridge has a span arrangement of 2 x 5.8 m on LHS and RHS. The super structure comprises of RCC solid slab on LHS and RCC Box on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on LHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 102+222

xxiv. Minor Bridge – CH.107+977

It consists of Hume Pipe on LHS and RHS. The Bridge has a span arrangement of 28 x 1.5 dia. The structure comprises of Hume Pipe.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of Parapet, repairing of stone pitching etc. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 107+977

xxv. Minor Bridge – CH.108+133

It consists of RCC Box bridge on LHS and RCC Slab bridge on RHS. The Bridge has a span arrangement of 1 x 10 m on LHS and RHS. The super structure comprises of RCC Box on LHS and RCC solid slab on RHS. Foundation is not visible. Tarpaper bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier on RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of filler joint is required after 15 years from date of construction. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

LHS View

RHS View

Minor Bridge at Ch. 108+133

3. Vehicular Under-Passes (VUPs)

There are total of 10 VUPs in the entire project road. VUPs are with vertical clearance of minimum 5.5m. The clear span arrangement for VUPs at Ch. 43+180, 69+500 & 92+557 are 1 x 10.5 m , at Ch.72+540, 73+590 & 80+125 are 2 x 9.6 m, at Ch.104+077 is 2 x 9.5 m, at Ch.65+400 & 90+557 are 2 x 9.3 m and at Ch.79+300 is 1 x 7 m.

VUPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of VUPs are presented as follows:

LHS View Inside View

VUP at Ch. 43+180

LHS View Inside View

VUP at Ch. 65+400

LHS View

RHS View

VUP at Ch. 69+513

LHS View

RHS View

VUP at Ch. 72+553

LHS View

Inside View

VUP at Ch. 73+603

LHS View

RHS View

VUP at Ch. 79+300

LHS View

RHS View

VUP at Ch. 80+138

LHS View

RHS View

VUP at Ch. 90+557

LHS Carriageway

RHS View

VUP at Ch. 92+557

LHS View

RHS View

VUP at Ch. 104+077

4. Subway, Pedestrian and Cattle Under-Passes (PUPs and CUPs)

There are total of 3 nos. of Subways, 9 nos. of PUPs and 3 no. of CUPs in the entire project road. The clear span arrangement for Subways at Ch. 28+250, 46+000 & 54+120 are 1 x 7 m. The clear span arrangement for PUPs at Ch. 37+150 is 1 x 9 m, at Ch.34+425 is 1 x 7.5 m, at Ch.66+980, 74+413, 76+957, 77+955 & 106+067 are 1 x 7 m, at Ch.67+950 is 1 x 6 m and at Ch.78+784 is 1 x 7 + 1 x 4 m. The clear span arrangement for CUP at Ch. 51+912 is 1 x 3.5 m, at Ch.72+053 is 1 x 5.5 m and at Ch.78+250 is 1 x 7 + 1 x 4 m.

Subway, PUPs and CUPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of Subway, PUPs and CUPs are presented as follows:

Inside View | Median View

Subway at Ch. 28+250

LHS View | Inside View

PUP at Ch. 34+425

LHS View

Inside View

PUP at Ch. 37+150

Median View

Inside View

Subway at Ch. 46+000

LHS View

Inside View

CUP at Ch. 51+912

Carriageway View

Inside View

Subway at Ch. 54+120

LHS View

RHS View

PUP at Ch. 66+980

LHS View

RHS View

PUP at Ch. 67+950

LHS View

RHS View

CUP at Ch. 72+053

LHS View

RHS View

PUP at Ch. 74+413

LHS View

Slip road View

PUP at Ch. 76+957

LHS View

Slip road View

PUP at Ch. 77+955

LHS View

RHS View

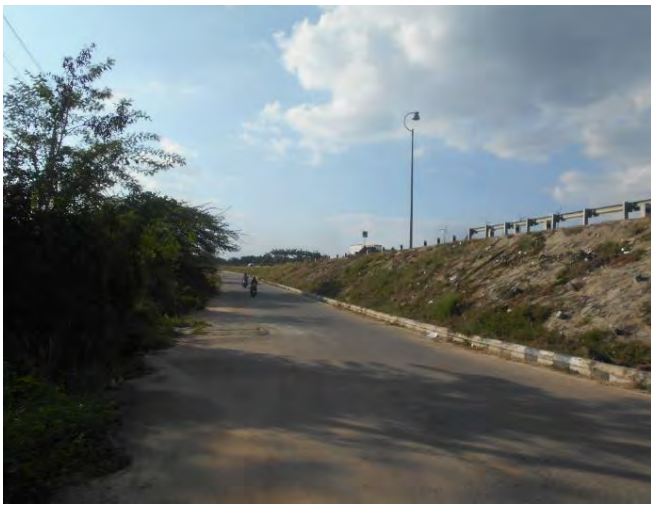
CUP at Ch. 78+250

LHS View

RHS View

PUP at Ch. 78+784

LHS View



Slip road View

PUP at Ch. 106+067

5. Railway Over Bridge (ROBs)

Salient features of the 2 ROBs are discussed here

i. ROB at Ch. 79+703

It consists of RCC girder bridge on LHS and RHS. The bridge has a span arrangement of 1 x 24.5 + 1 x 14 + 1 x 24.5 m on LHS and RHS. The super structure comprises of RCC Girder. Foundation is not visible. Elastomeric and POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & column pier on LHS and RHS.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. As periodic maintenance, replacement of elastomeric strip seal is required after 15 years from date of construction. Few pictures to ascertain the conditions of ROB are presented as follows:

LHS View

View of Girder and Sub-Structure

ROB at Ch. 79+703

ii. ROB at Ch. 99+600

It consists of RCC Box bridge on LHS and RHS. The bridge has a span arrangement of 1 x 11 m on LHS and RHS. The super structure comprises of RCC Box. Foundation is not visible.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts, repairing of stone pitching etc. Few pictures to ascertain the conditions of ROB are presented as follows:

LHS View

RHS View

ROB at Ch. 99+600

6. Culverts

There are 103 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection and cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box/Pipe Culverts are presented as follows:

Pipe Culvert at Ch. 33+790

Pipe Culvert at Ch. 34+620

Pipe Culvert at Ch. 53+700

Box Culvert at Ch. 56+790

Pipe Culvert at Ch. 62+328

Pipe Culvert at Ch. 66+460

Pipe culvert at Ch. 75+360

Slab Culvert at Ch. 95+002

Slab Culvert at Ch. 98+767

Slab Culvert at Ch. 101+952

Slab /Box /Pipe Culverts

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Structure Type	Sn	Chainage	Type of Structure	Side	Span	Overall Width (m)	Sufficiency of water way (Y / N)	Existing Structure Condition										Projected Overall Stability of Structure till the end of Concession period	Remarks
								Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers (Crash Barrier/Hand Rail)	Wearing Coat	Approaches including approach slab	Drainage Spouts		
Major Bridge	1	91+892	MJB	LHS	5 x 17	11.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	5 x 18	13.5		●	●	●	●	●	●	●	●	●	●	Stable	
	2	103+577	MJB	LHS	4 x 17	11.5	Y	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	4 x 17	13.5		●	●	●	●	●	●	●	●	●	●	Stable	

Minor Bridge	3	35+840	MNB	LHS	2 x 16.1	11.5	Y	●	●	●	●	●	●	●	●	●	-	Stable	
				RHS	2 x 16.1	12		●	●	●	●	●	●	●	●	●	●	Stable	
	4	43+743	MNB	LHS	1 x 8	11.5	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 8	12		●	●	●	-	-	●	●	●	●	●	Stable	
	5	49+526	MNB	LHS	1 x 8	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 8	12		●	●	●	-	-	●	●	●	●	-	Stable	
	6	53+300	MNB	LHS	1 x 10	11.5	Y	●	●	●	●	-	●	●	●	●	-	Stable	
				RHS	1 x 10	12		●	●	●	-	-	●	●	●	●	-	Stable	
	7	54+610	MNB	LHS	1 x 6	11.5	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	h	12		●	●	●	-	-	●	●	●	●	●	Stable	
	8	58+735	MNB	LHS	3 x 8.6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3 x 8.6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	9	61+930	MNB	LHS	1 x 7.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	10	62+350	MNB	LHS	1 x 8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 6	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	11	67+330	MNB	LHS	1 x 12	13.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 12	13.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				SR-LHS	1 x 12	6.5	Y	●	●	●	-	-	●	●	-	●	-	Stable	
				SR-RHS	1 x 12	6.5	Y	●	●	●	-	-	●	●	-	●	-	Stable	
	12	68+913	MNB & PUP	LHS	2 x 7	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	

				RHS	2 x 7	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	13	70+063	MNB	LHS	2 x 7.5	12.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 7.5	12.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	14	75+688	MNB	LHS	2 x 5.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 5.5	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	15	76+033	MNB	LHS	4 x 8.75	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4 x 8.75	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	16	76+473	MNB & CUP	LHS	2 x 5.5	27	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 5.5		Y	●	●	●	-	-	●	●	●	●	●	Stable	
	17	78+707	MNB	LHS	4 x 8.75	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	4 x 8.75	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	18	80+494	MNB	LHS	1 x 6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 6	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	19	85+777	MNB	LHS	3 x 8.8	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	3 x 8.8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	20	90+202	MNB	LHS	2 x 6.4	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 6.4	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	21	95+487	MNB	LHS	1 x 9	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 9	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	22	96+859	MNB	LHS	2 x 6.2	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 6.2	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	

	23	100+212	MNB	LHS	1 x 10	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 10	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	24	101+300	MNB	LHS	1 x 7	12	Y	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 7	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	25	102+222	MNB	LHS	2 x 5.8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 5.8	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
	26	107+977	MNB	-	28 x 1.5 Ø	36	Y	●	-	●	-	-	●	●	●	-	-	Stable	
	27	108+133	MNB	LHS	1 x 10	12	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 10	11.5	Y	●	●	●	-	-	●	●	●	●	●	Stable	
Vehicular Underpass	28	43+180	VUP	LHS	1 x 10.5 x 5.5	13.5	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 10.5 x 5.5	13.5	-	●	●	●	-	-	●	●	●	●	●	Stable	
	29	65+400	VUP	LHS	2 x 9.3 x 5.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.3 x 5.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	30	69+513	VUP	LHS	1 x 10.5 x 5.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 10.5 x 5.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	31	72+553	VUP	LHS	2 x 9.6	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.6		-	●	●	●		-	●	●	●	●	●	Stable	
	32	73+603	VUP	LHS	2 x 9.6	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.6		-	●	●	●	-	-	●	●	●	●	-	Stable	
	33	79+300	VUP	LHS	1 x 7 x 5.5	27	-	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 7 x 5.5		-	●	●	●	-	-	●	●	●	●	●	Stable	

	34	80+138	VUP	LHS	2 x 9.6	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.6		-	●	●	●	-	-	●	●	●	●	-	Stable	
	35	90+557	VUP	LHS	2 x 9.3 x 5.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.3 x 5.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	36	92+557	VUP	RHS	1 x 10.5 x 5.5	12	-	●	●	●	-	-	●	●	●	●	●	Stable	
	37	104+077	VUP	LHS	2 x 9.5	12	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	2 x 9.5	12	-	●	●	●	-	-	●	●	●	●	●	Stable	
Subway, Pedestrian and Cattle Underpass	38	28+250	PUP (Subway)	LHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	
				RHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	
	39	34+425	PUP	LHS	1 x 7.5 x 3.5	27	-	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 7.5 x 3.5		-	●	●	●	-	-	●	●	●	●	-	Stable	
	40	37+150	PUP	LHS	1 x 9 x 3.5	27	-	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 9 x 3.5		-	●	●	●	-	-	●	●	●	●	-	Stable	
	41	46+000	PUP (Subway)	LHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	Closed, Not in working
				RHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	Closed, Not in working
	42	51+912	CUP	-	1 x 3.5 x 3.5	45	-	●	●	●	-	-	●	●	●	●	-	Stable	
	43	54+120	PUP (Subway)	LHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	Closed, Not in working
				RHS	1 x 7 x 3.5	22.5	-	●	●	●	-	-	-	-	●	●	-	Stable	Closed, Not in working

	44	66+980	PUP	LHS	1 x 7 x 3.5	27	-	●	●	●	-	-	●	●	●	●	-	Stable	
				RHS	1 x 7 x 3.5		-	●	●	●	-	-	●	●	●	●	-	Stable	
	45	67+950	PUP	LHS	1 x 6 x 3.5	12	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 6 x 3.5	12	-	●	●	●	-	-	●	●	●	●	●	Stable	
	46	72+053	CUP	LHS	1 x 5.5 x 3.5	31	-	●	●	●	-	-	●	-	●	●	-	Stable	
				RHS	1 x 5.5 x 3.5		-	●	●	●	-	-	●	-	●	●	-	Stable	
	47	74+413	PUP	LHS	1 x 7 x 3.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 x 3.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	48	76+957	PUP	LHS	1 x 7 x 3.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 x 3.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	49	77+955	PUP	LHS	1 x 7 x 3.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 x 3.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
	50	78+250	CUP	LHS	1 x 7 + 1 x 4	27	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 + 1 x 4		Y	●	●	●	-	-	●	●	●	●	●	Stable	
	51	78+784	PUP	LHS	1 x 7 + 1 x 4	27	Y	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 + 1 x 4		Y	●	●	●	-	-	●	●	●	●	●	Stable	
	52	106+067	PUP	LHS	1 x 7 x 3.5	27	-	●	●	●	-	-	●	●	●	●	●	Stable	
				RHS	1 x 7 x 3.5		-	●	●	●	-	-	●	●	●	●	●	Stable	
Railway	53	79+703	ROB	LHS	1 x 24.5 + 1 x 14 + 1 x 24.5	14	-	●	●	●	●	●	●	●	●	●	●	Stable	
				RHS	1 x 24.5 + 1 x 14 + 1 x 24.5	14	-	●	●	●	●	●	●	●	●	●	●	Stable	

	54	99+600	ROB	LHS	1 x 11	60	-	●	●	●	-	-	●	-	●	●	-	Stable	
				RHS	1 x 11		-	●	●	●	-	-	●	●	●	●	-	Stable	

Condition Summary of Culverts based on Visual Observation is presented below:

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
1	28+325	HPC	2 x 1.0 Ø		●	●				●	Yes	No		√		
2	30+022	HPC	2 x 1.0 Ø		●	●				●	No	No	√	√		On RHS service road, Head wall is of stone masonry and need to be repaired
3	33+790	HPC	1 x 1.0 Ø		●	●					No	No	√			LHS Parapet shall be provided
4	34+620	HPC	2 x 1.0 Ø		●	●					No	No	√			
5	35+190	HPC	1 x 1.0 Ø		●	●				●	No	No	√	√		Present on LHS Service road

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
6	35+240	HPC	2 x 1.0 Ø		●	●				●	No	No	√	√		
7	35+270	HPC	1 x 1.0 Ø		●	●				●	No	No	√	√		Present on RHS Service road
8	36+988	HPC	4 x 1.0 Ø		●	●					No	No	√			
9	37+620	HPC	1 x 1.0 Ø		●	●					No	No	√	√		Service road structure is of stone masonry
10	38+125	HPC	5 x 1.0 Ø		●	●					No	No	√			
11	38+542	HPC	2 x 1.0 Ø		●	●					No	No	√			
12	39+097	HPC	2 x 1.0 Ø		●	●					No	No	√			
13	39+355	HPC	3 x 1.0 Ø		●	●					No	No	√	√		
14	40+194	HPC	2 x 1.0 Ø		●	●					No	No	√			
15	40+525	HPC	4 x 1.0 Ø		●	●				●	No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
16	41+550	HPC	2 x 1.0 Ø		●	●				●	No	No	√			
17	42+282	HPC	2 x 1.0 Ø		●	●					No	No	√	√		
18	42+730	HPC	1 x 1.0 Ø		●	●				●	Yes	No	√	√		
19	43+370	HPC	3 x 1.0 Ø		●	●					No	No	√	√		
20	46+650	HPC	1 x 1.0 Ø		●	●					No	No	√			
21	47+950	HPC	2 x 1.0 Ø		●	●					No	No	√	√		
22	48+500	HPC	2 x 1.0 Ø		●	●					No	No	√	√		
23	50+164	HPC	2 x 1.0 Ø		●	●					No	No	√	√		
24	50+480	HPC	2 x 1.0 Ø		●	●					No	No	√	√		
25	50+800	HPC	1 x 1.0 Ø		●	●					No	No	√	√		

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
26	51+075	HPC	7 x 1.0 Ø		●	●					No	No	√	√		
27	51+300	HPC	3 x 1.0 Ø		●	●					No	No	√	√		
28	51+680	HPC	1 x 1.0 Ø		●	●					No	No	√	√		
29	53+368	HPC	1 x 1.0 Ø		●	●					No	No	√			
30	53+576	HPC	1 x 1.0 Ø		●	●				●	No	No	√			Headwall & Parapet is of stone masonry
31	53+700	HPC	6 x 1.2 Ø		●	●					No	No	√	√		
32	55+380	HPC	1 x 1.0 Ø		●	●				●	Yes	No	√	√		Present on LHS Service road
33	55+482	HPC	5 x 1.0 Ø		●	●				●	No	No	√			
34	56+790	Box	3 x 1.4	●	●	□		●		●	No	No				
35	57+580	HPC	3 x 1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
36	58+850	HPC	3 x 1.0 Ø		●	●					No	No	√			
37	60+950	HPC	1 x 1.0 Ø		●	●					No	No	√			
38	61+378	HPC	1 x 1.0 Ø		●	●					No	No	√			
39	62+250	Box	1 x 5	●	●			●	●	●	No	No	√			
40	62+328	HPC	1 x 1.0 Ø		●	●				●	No	No	√			
41	63+895	HPC	3 x 1.0 Ø		●	●					No	No	√			
42	64+895	HPC	2 x 1.0 Ø		●	●					Yes	No	√	√		
43	65+495	HPC	3 x 1.2 Ø		●	●				●	No	No	√			
44	65+800	HPC	1 x 1.2 Ø		●	●					Yes	No	√	√		
45	66+200	HPC	1 x 1.2 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
46	66+460	HPC	1 x 1.2 Ø		●	●					No	No	√			
47	66+690	HPC	1 x 1.2 Ø		●	●					No	No	√			
48	66+900	HPC	1 x 1.2 Ø		●	●					No	No	√			
49	67+635	HPC	1 x 1.2 Ø		●	●					No	No	√			
50	68+545	HPC	1 x 1.2 Ø		●	●					No	No	√			
51	70+370	HPC	1 x 1.2 Ø		●	●					No	No	√			
52	70+900	HPC	1 x 1.2 Ø		●	●					No	No	√			
53	71+200	HPC	1 x 1.2 Ø		●	●					No	No	√			
54	71+260	HPC	1 x 1.2 Ø		●	●					No	No	√			
55	71+575	HPC	1 x 1.2 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
56	71+710	HPC	1 x 1.2 Ø		●	●					No	No	√			
57	71+980	HPC	1 x 1.2 Ø		●	●					No	No	√			
58	72+020	HPC	1 x 1.2 Ø		●	●					No	No	√			
59	73+120	HPC	1 x 1.2 Ø		●	●					No	No	√			
60	73+520	HPC	1 x 1.2 Ø		●	●					No	No	√			
61	74+000	HPC	1 x 1.2 Ø		●	●					No	No	√			
62	74+510	HPC	1 x 1.2 Ø		●	●					No	No	√			
63	74+850	HPC	1 x 1.2 Ø		●	●					No	No	√			
64	75+050	HPC	1 x 1.2 Ø		●	●					No	No	√			
65	75+272	HPC	1 x 1.2 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
66	75+360	HPC	1 x 1.2 Ø		●	●					No	No	√			
67	76+793	HPC	1 x 1.2 Ø		●	●					No	No	√			
68	77+025	HPC	2 x 1.2 Ø		●	●					No	No	√			
69	77+470	HPC	1 x 1.2 Ø		●	●				●	No	No	√			
70	78+450	HPC	1 x 1.2 Ø		●	●					No	No	√			
71	79+180	HPC	1 x 1.2 Ø		●	●					No	No	√			
72	81+761	HPC	9 x 1.2 Ø		●	●					No	No	√			
73	82+417	HPC	1 x 1.0 Ø		●	●					No	No	√			
74	82+768	HPC	3 x 1.0 Ø		●	●					No	No	√			
75	83+807	HPC	1 x 1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
76	85+220	HPC	1 x 1.2 Ø		●	●					Yes	No	√	√		
77	87+007	HPC	1 x 1.0 Ø		●	●				●	No	No	√			
78	87+472	HPC	3 x 1.0 Ø		●	●					No	No	√	√		
79	87+977	HPC	3 x 1.0 Ø		●	●					No	No	√			
80	89+017	HPC	5 x 1.2 Ø		●	●					No	No	√	√		
81	89+137	HPC	1 x 1.2 Ø		●	●					Yes	No	√	√		
82	89+613	HPC	1 x 1.0 Ø		●	●					No	No	√	√		
83	90+045	HPC	1 x 1.2 Ø		●	●					Yes	No	√	√		
84	93+460	HPC	2 x 1.0 Ø		●	●					No	No	√			
85	94+147	HPC	1 x 1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
86	95+002	Slab	1 x 1.65	●	●					●	No	No				
87	96+137	Slab	1 x 2.8	●	●			●		●	No	No				
88	97+107	HPC	3 x 1.0 Ø		●	●					No	No	√			
89	97+209	HPC	2 x 1.0 Ø		●	●					No	No	√			
90	97+722	Slab	1 x 4.2	●	●			●	●	●	No	No	√			
91	98+344	HPC	1 x 1.2 Ø		●	●					No	No	√			
92	98+767	Slab	1 x 4.45	●	●			●	●	●	Yes	No	√	√		
93	99+307	HPC	1 x 1.0 Ø		●	●					No	No	√			
94	99+537	HPC	1 x 1.0 Ø		●	●					Yes	No	√	√		
95	100+007	HPC	1 x 1.0 Ø		●	●					No	No	√			

Sn	Chainage	Type of culvert	Span	Existing Condition									Suggested Additional Repair/Maintenance Works			Additional Remarks
				Substructure	Slab/Pipe/Box	Head Wall	Wing Wall	Return Wall	Protection works (Rigid/Flexible Apron)	Parapet /Hand rail	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching	
96	100+395	HPC	1 x 1.0 Ø		●	●					No	No	√			
97	100+632	HPC	1 x 1.2 Ø		●	●					No	No	√			
98	100+817	HPC	1 x 1.0 Ø		●	●				●	No	No	√			
99	101+952	Slab	1 x 3.2	●	●			●			No	No	√			
100	102+303	HPC	1 x 1.0 Ø		●	●					No	No	√			
101	102+447	HPC	1 x 1.2 Ø		●	●					No	No	√			
102	103+087	HPC	4 x 1.0 Ø		●	●					No	No	√			
103	106+957										Yes	No	√	√		Vegetation growth

TECHNICAL DUE DILIGENCE REPORT

Nanguneri - Kanyakumari Tollway Limited

Report Number:

ACM-60657056-TDD-NKTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Nanguneri Kanyakumari Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("Trust"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/ **Nanguneri Kanyakumari Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Nanguneri - Kanyakumari Tollway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset 5B,
Aerocity Hospitality District,IGI Airport
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 5

Project Background 5
Project Salient Features 5
Project Principle Participants 6
Project Operation and Maintenance Cost 6
Limitation of Scope 9

1. INTRODUCTION 10

1.1 Project Background 10
1.2 AECOM 13
1.3 Scope of Works 13
1.4 Site Visit and Key Points covered during Site Visit 14
1.5 Data Shared by the Company 15

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS 16

2.1 General 16
2.2 Estimation of Design Traffic 17
2.3 Test Pit 18
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 20
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 21
2.6 Roughness Survey using Network Survey Vehicle (NSV) 22
2.7 Determination of Pavement Major Maintenance 24
2.8 Base Year Pavement Rehabilitation Requirement 24
2.9 Future Maintenance Requirements 25

3. CAPEX REQUIREMENT 26

3.1 CAPEX needs 26
3.3 Unit Rate Analysis 29
3.4 Cost Estimate 30

4. MAJOR MAINTENANCE COST 31

4.1 Major Maintenance Cycle 31
4.2 Major Maintenance Quantity 31
4.3 Unit Rate Analysis 32
4.4 Cost Estimate 34

5. OPEATION AND MAINTEANCE COST - OPEX 36

5.1 O & M Requirement as per CA 36
5.2 O & M Strategy 39
5.3 Routine and Preventive Maintenance 39
5.4 Highway Lighting 40
5.5 ATMS and TMS Cost 40
5.6 Incident Management 41
5.7 Manpower Cost 41
5.8 Office Expenses 41

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT 43

6.1 Reconnaissance Survey 43
6.2 Road Inventory and Condition Survey 43
6.3 Inventory and Condition Survey of Structures 56

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge
MNB	Minor Bridge

MoRT&H	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NKTL	Nanguneri Kanyakumari Tollway Limited
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Nanguneri Kanyakumari Tollway Limited ("NKTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and NKTL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Madurai – Kanyakumari Section from Km 180+000 to Km 243+470 of NH 44 (Old NH-7) in the State of Tamilnadu (Package-3) is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Madurai to Kanyakumari section from KM 180+000 to Km 243+470 Package-4 on NH-44 (Old NH-7) in the state of Tamilnadu.
Project Length	63.47 Km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Nanguneri Kanyakumari Tollway Limited
Signing of Agreement	27th December 2019
Appointed Date	20 Oct 2020
Concession Period	30 years
End of Concession Period	21 Oct 2050

Likely End of Concession Period	Oct 2050
Six Lanning under EPC by NHAI	To be completed by 2042/43
Number of Toll Plaza	1 nos, Toll Plaza having 10 Hybrid lanes including Extra wide Lane

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Nanguneri Kanyakumari Tollway Limited
3	Independent Engineer	Bloom Companies LLC
4	Maintenance Contractor	1) Toll Operation (TBR Infra Pvt Ltd., Hyderabad), 2) Incident Management (Markolines Traffic Controls Private Limited) 3) G4S Security Solutions India Pvt Ltd., For Security 4) Routine Maintenance- M/s Racy Projects
5	EPC Contractor for Schedule-B work	Yet to be determined.

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 12 months.

- Maintenance and rehabilitation of Pavement
- Construction of New Service Road & Structures
- Repair and Rehabilitation of Structures and Cross Drainage Works
- Minor Junction Improvement
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

- The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is **Rs. 26.63** crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2028/29	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**67.83**
2.	2035/36	30 mm BC in Main Carriageway for 100% Length and 50mm DBM in 20% Length. 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**110.75**
3.	2042/43	Expected to complete 6 laning under EPC Contract	-
4.	2049/50	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**194.59**

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement.

c) Operation and Maintenance (OpEX)

As per Schedule F, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each

year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2021/21 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	1,07,00,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	1,43,61,781
3	Security Services	Includes manpower associated with security services.	74,10,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	1,51,72,269
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	1,49,27,105
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	4,75,122
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	44,03,446
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	30,61,481
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	26,34,545
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	59,84,772
11	Community Development	Includes CSR related expenses.	10,00,000
12	Communication Expenses	Includes phone charges.	3,01,875
13	Conveyance Expenses	Includes boarding & lodging expense.	3,29,318
14	Project Insurance Expenses	Includes project insurance expenses.	1,14,16,364
15	IE Fees	Includes IE fees.	38,42,045
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon	1,23,72,910

Sl. No.	Description	Remarks	Amount (in INR)
		cleaning	
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	33,15,248
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	1722560
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	364999
		O & M Cost for Year 2022-23	**11,37,97,027**

A total of Rs. **11.38** crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

1.1 Project Background

Nanguneri Kanyakumari Tollway Limited (hereinafter referred to as NKTL or the Concessionaire), is a company promoted by Cube Mobility Investments Pte. Ltd. (herein after refer as Cube Highways or the Company) to undertake Tolling, Operation, Maintenance & Transfer (**TOT Model**) of Madurai Kanyakumari Section of NH-44(Old NH-7) from Km 180+000 at Munanthurai to Km 243+470 in the State of Tamilnadu is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI).

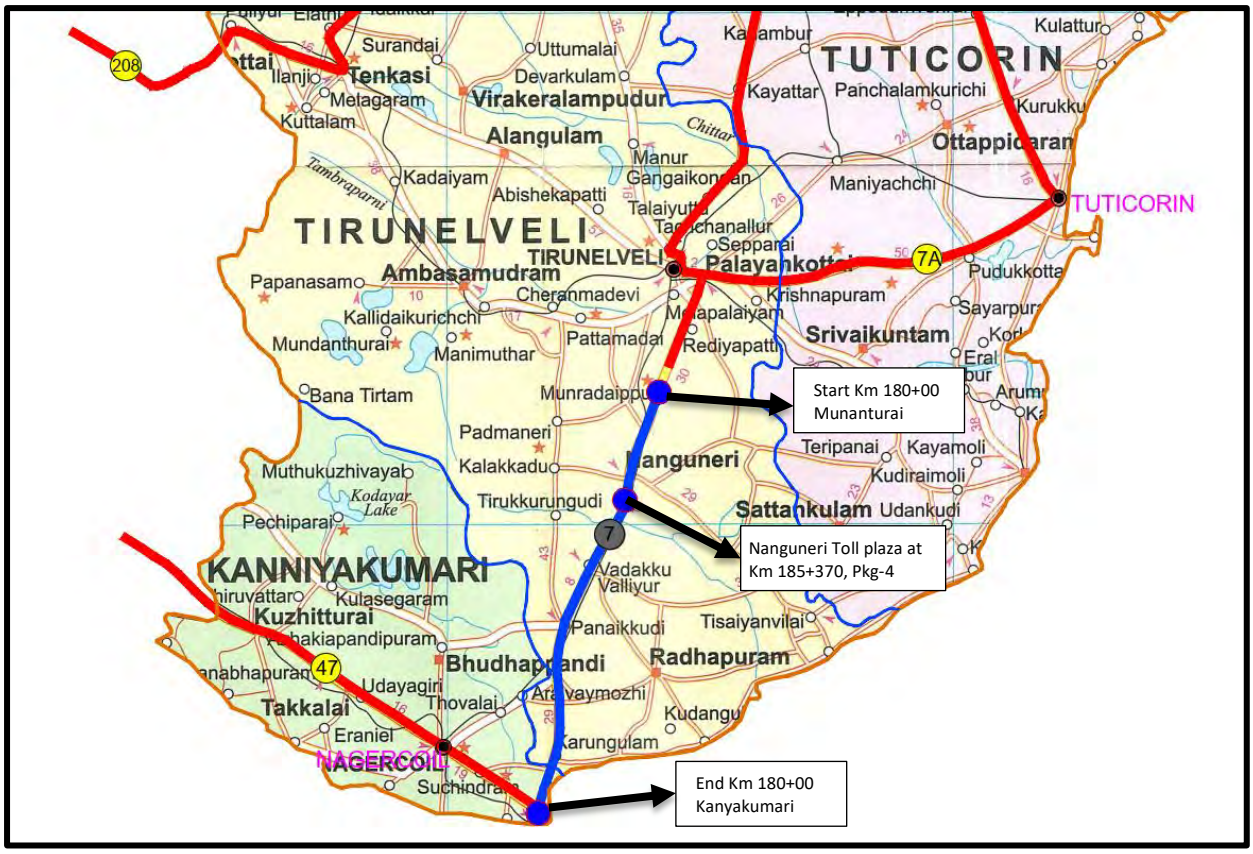
In this context, **M/s AECOM India Pvt. Ltd** is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 21 Oct 2050.
The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 44 start from Km 180+000 at Munanthurai and ends at Kanyakumari Km 243+470. NH 44, National Highway 44 (NH 44) is a major north–south National Highway in India, the longest in the country. It passes through the Union Territory of Jammu and Kashmir, in addition to the states of Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.

It came into being by merging seven national highways, in full or part, starting with the Jammu-Srinagar National Highway (former NH 1A) from Srinagar in Jammu and Kashmir, former NH 1 in Punjab and Haryana ending at Delhi, part of former NH 2 starting from Delhi and ending at Agra, former NH 3 (popularly known as Agra-Bombay National Highway) from Agra to Gwalior, former NH 75 and former NH 26 to Jhansi, and former NH 7 via Lakhnadon, Seoni, Nagpur, Adilabad, Nirmal, Hyderabad, Kurnool, Anantapur,[2] Bangalore, Hosur, Krishnagiri, Dharmapuri, Salem, Namakkal, Karur, Dindigul, Madurai, Virudhunagar and Tirunelveli terminating at Kanyakumari. The project corridor is shown in map below.



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	63.47 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1 m to 2 m earthen for MCW at Rural Area
Service Road / Slip Road	39.858 km one side length having width of varying from 5.5 to 7.0m
Major / Minor Junction	05 Major & 15 Minor

Description	Project Features
RCC Drain	Covered/open drain at Urban Section and between MCW and SR of length of 5.415 Km
Median Opening	56 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	3 Truck Lay byes
Bus Bays with shelter	12 Bus Bay & Shelter and 34 Bus Shelter
Highway Lighting	12 Nos. Double Arm ,650 Nos as per Sch-B
High Mast	12 nos
Highway Patrol	1 nos
Ambulance	1 nos
Crane	1 nos

b) Structure

Description	Project Features
Major Bridge	2 No
Minor Bridge	31 Nos
ROB and RUB	2 No ROB
VUP	6 VUP
Culverts	148 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With **approximately 1,00,000 employees** (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in **more than 150 countries** around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments**.**

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of **AECOM** based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) **Desk Study**: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) **Site Visit**: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) **CAPEX and OPEX:** calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass, and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

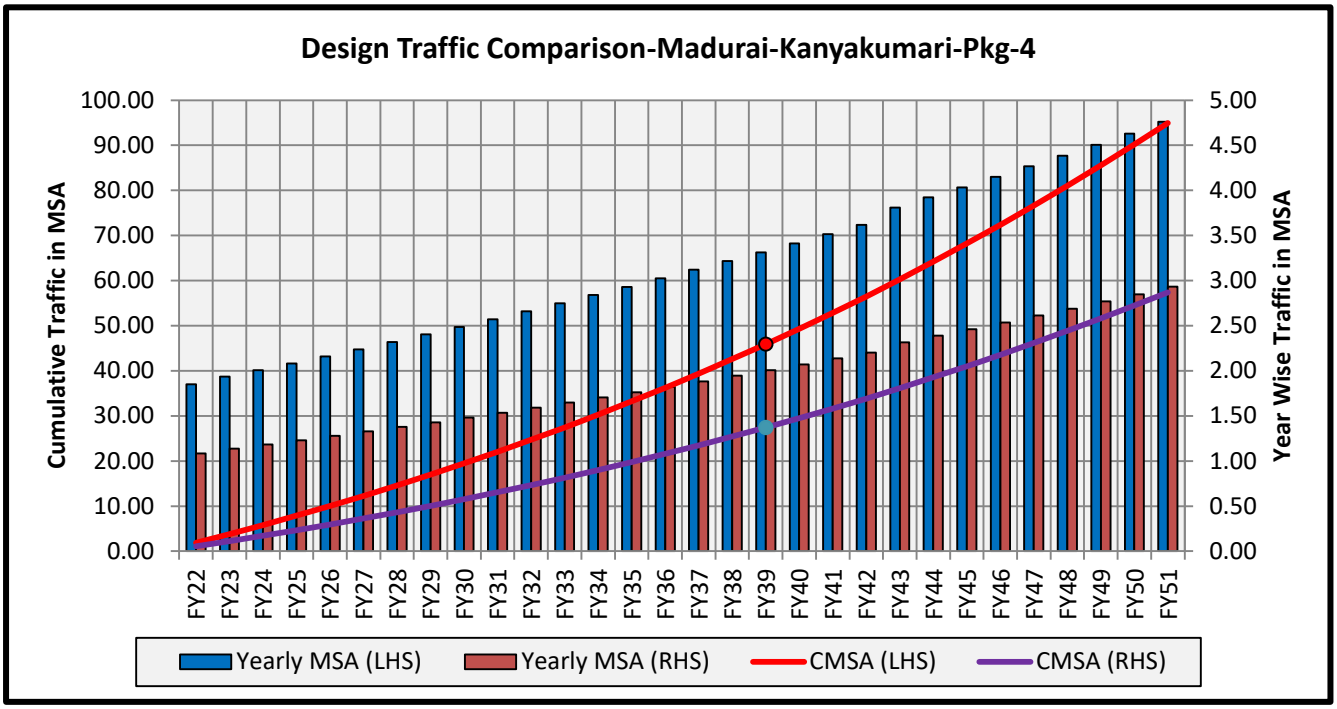
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till FY31 for 1st Cycle of MM design period for LHS (MK) 22.05 MSA and RHS (KM) 13.07 MSA whereas cumulative MSA upto FY51 is 94.92 MSA for LHS (MK) and 57.40 MSA for RHS (KM). Year wise and cumulative MSA is presented in graph below:



MK – Madurai Kanyakumari (Munanthurai to Kanyakumari) direction

KM –Kanyakumari Madurai (Kanyakumari to Munanthurai) direction

2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S. No	Existing Chainage (km)	Side	DCP-CBR	4 Days Soaked CBR
1	182+200	RHS	13.0	11.5
2	184+800	LHS	10.6	10.1
3	187+500	RHS	12.4	8.7
4	192+400	LHS	28.0	13.7
5	192+400	RHS	14.6	14.3
6	194+800	LHS	13.8	9.6
7	197+300	RHS	11.4	12.7
8	199+750	LHS	20.6	23.6
9	202+600	RHS	16.4	13.8
10	205+000	LHS	15.4	12.0
11	207+500	RHS	17.8	8.6
12	210+000	LHS	16.0	13.2
13	212+500	RHS	14.4	15.2
14	215+000	LHS	13.0	17.3
15	217+150	RHS	17.2	18.2
16	220+000	LHS	19.8	10.3
17	222+200	RHS	12.9	9.3
18	225+000	LHS	12.1	8.7
19	227+500	RHS	14.0	9.5
20	230+000	LHS	17.8	11.3
21	235+000	LHS	12.8	9.0
22	237+400	RHS	9.1	8.7
23	241+000	LHS	16.5	14.3
24	242+600	RHS	14.0	16.4
Average DCP CBR			**15.1%**	

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from **130 mm to 220 mm** and granular layer thickness varies from **390 mm to 780 mm**.

The Samples were also collected at Existing Ground also and the test results are as below.

S:No	Location (Km.)	Side (LHS/RHS)	Soil Classification as per IS: 1498	Gradation: Percent by weight passing through the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS :2720-Pt-V]			Modified Proctor Test (IS:2720-Pt-VIII)		4-Days Soaked CBR (%)	Free Swell Index (%)
				19.0 mm	10.0 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. dry density (gm/cc)	OMC (%)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	212+600	LHS	SM-SC	100.0	98.5	85.2	66.8	51.2	45.2	45.2	25	20	5	2.02	9.2	11.1	10.0
2	214+900	LHS	SC	100.0	100.0	98.5	90.2	78.5	62.1	40.1	32	22	10	1.98	10.8	10.3	25.0
3	235+450	LHS	MI	100.0	100.0	99.5	80.2	60.5	55.1	55.1	36	25	11	1.92	10.1	7.4	25.0
4	235+500	RHS	CL	100.0	100.0	90.5	88.1	78.5	66.2	60.2	30	22	8	1.88	10.7	6.3	20.0

The samples are also collected for granular layers and the test results are as below

S:No	Location (Km.)	Side (LHS/RHS)	Soil Classification as per IS: 1498	Gradation: Percent by weight passing through the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS :2720-Pt-V]			Modified Proctor Test (IS:2720-Pt-VIII)		4-Days Soaked CBR (%)	Free Swell Index (%)
				19.0 mm	10.0 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. dry density (gm/cc)	OMC (%)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	212+600	LHS	SM-SC	100.0	98.5	85.2	66.8	51.2	45.2	45.2	25	20	5	2.02	9.2	11.1	10.0
2	214+900	LHS	SC	100.0	100.0	98.5	90.2	78.5	62.1	40.1	32	22	10	1.98	10.8	10.3	25.0
3	235+450	LHS	MI	100.0	100.0	99.5	80.2	60.5	55.1	55.1	36	25	11	1.92	10.1	7.4	25.0
4	235+500	RHS	CL	100.0	100.0	90.5	88.1	78.5	66.2	60.2	30	22	8	1.88	10.7	6.3	20.0

All the Test Results data provided by the client.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	Length in km	
	LHS	RHS
Length of Road where MSA is less than 10-year design MSA i.e. 22.05 MSA in LHS and 13.07 MSA in RHS. 30-year Design MSA is 94.92 for LHS and 57.40 for RHS.	-	-
Less than 93 MSA in LHS and 58 MSA in RHS	14.0	11.0
From 93 MSA to 200 MSA in LHS and 58MSA to 150 MSA in RHS	17.0	23.0
Greater than 200 MSA in LHS and 150 MSA in RHS	32.47	29.47
Total Length	63.47*	63.47*

*Total Length 63.47 Km

Based on remaining life of pavement, structural overlay is not required till end of concession period.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium, and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	**Cracks**	- **Type:** Longitudinal, Transverse, Block, Alligator - **Extent: %** of Pavement Area Influenced by distress - **Severity:** High (> 3mm wide), Low (<3mm wide)
2	**Pothole**	- **Extent: %** of Pavement Area Influenced by distress - **No. of Potholes** - **Depth Severity:** Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	**Raveling**	- **Extent: %** of Pavement Area Influenced by distress - **Severity:** Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	**Patching**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	**Shoving**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<15mm), High (>15mm)
6	**Flushing/Bleeding**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	**Depression**	- **Extent: %** of Pavement Area Influence by distress - **Severity**
8	**Delamination**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<1 sq.m area), High (>1 sq.m area)
9	**Edge Break**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	**Pavement Missing**	- **Extent: %** of Pavement Area Missing
11	**Rutting**	- **Rut Depth**

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

IRI = International Roughness Index

Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

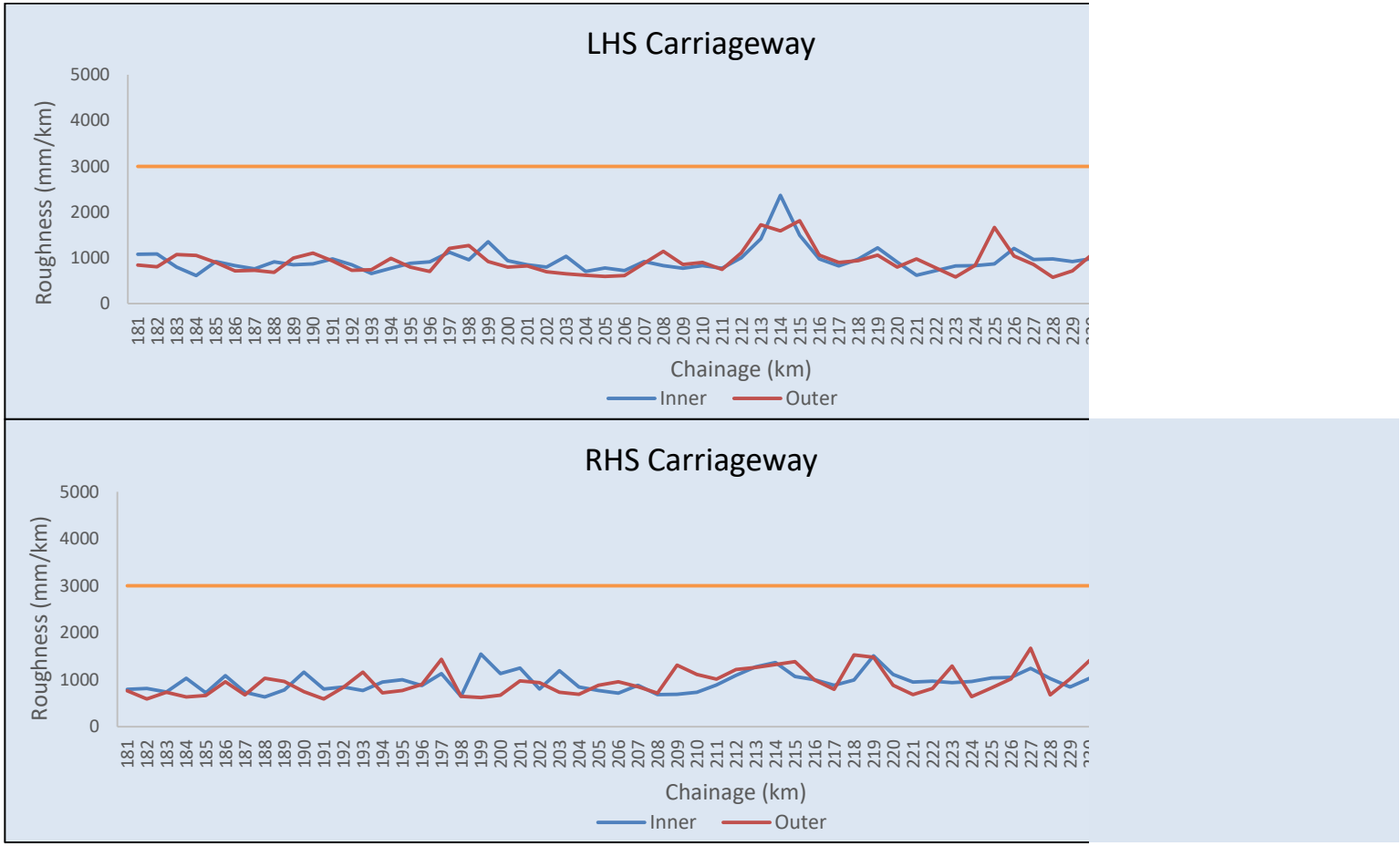
Ratings	Roughness Value (mm/km)	LHS in km	RHS in km
Good	<2000	62.47	63.47
Fair	2000 - 3000	1	0
Poor	>3000	0	0

***- Source of Information**: Based on NSV Survey Carried out by M/s V R Techniche Private Limited in the month of **April 2022**.

Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.

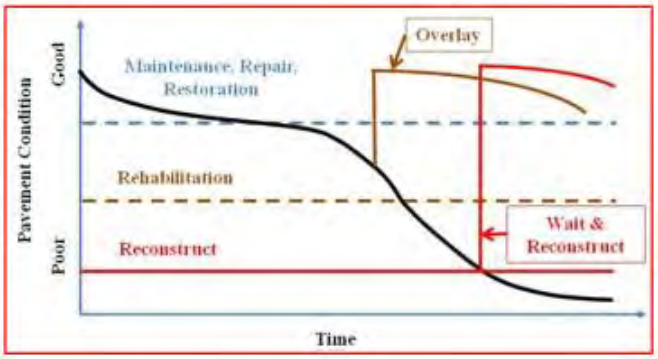
Graphical presentation showing pavement condition is appended as below:

Graph Showing km wise



2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is not required however functional overlay is required to bring down roughness value less than 2000 mm / km and to maintain performance requirement till next MM cycle. Also, as per Concession agreement, minimum overlay is to be provided at location as specified in Section 3.1 of Schedule B. The combined overlay location to be provide in FY 2021/22 based on pavement condition survey caried out and as specified in Schedule B is as below:

LHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	180+000	243+470	63.47	30	Full Width	BC Overlay

RHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	180+000	243+470	63.47	30	Full Width	BC Overlay

In addition to above, additional area for milling and overlay by BC also considered.

2.9 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. The Concession agreement do not clearly mention whether overlay on existing four lane shall be executed by the Authority during six laning under EPC or not. However, providing top layer in one go is required and providing one layer of overlay during six laning is considered to be executed by the Authority. In view of above major maintenance cycle is considered as follows:

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
2	2035/36	Functional Overlay	30 mm BC in entire length+ DBM 50 mm in 20 % Length	50% Micro-surfacing+ 50% 30mm BC
3	2042/43	6 Laning BY EPC Contractor	6L under EPC by NHAI	
4	2042/43	Functional Overlay	30 mm BC in entire length 6L	50% Micro-surfacing+ 50% 30mm BC
5	2049/50	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 1300 m having width of 7.0 including tapering location
2. 2 Nos Slab Culvert, Widening of Pipe Culvert– 4 Nos, 3 Nos Pipe Culvert and
3. Rehabilitation of Pavement – 40 mm BC in 3.7 km 2 Lane and 62.4+60.5 Km=122.9Km 30mm BC 2 Lane.
4. Minor Repair of Structures – Major Bridge 2nos, Minor Bridge 31 nos, Culverts – 148 nos, ROB – 2 nos, VUP – 06 nos.
5. Junction Improvement – 5 major junctions and 15 Minor Junctions.
6. Road Furnitures – Solar Blinker 21 nos, Transverse Marking 63.47 km, W Beam 3408 m, Rigid concrete barrier, Pedestrian Guard Rails12243m Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
7. Landscaping and tree plantation
8. Way Side Amenities: to be constructed by NHAI
9. Incident Management – Highway Patrol, Ambulance, Crane
10. Advance Traffic Management System
11. Rainwater Harvesting
12. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from Appointed Date
4	Repair and Rehabilitation of Structure	12 months from Appointed Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from Appointed Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in **Schedule C**, Engineering and Safety Improvements along the Project Highways shall confirm to **IRC: SP: 84 -2014**, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. **Construction of new / widening of Service road /Slip road**
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. **Reconstruction of existing Service road /Slip road**
   No existing service roads in this package.
3. **Construction of new / widening of culverts / bridges / Grade separated structures**
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. **Repair / Rehabilitation of pavement (overlay)**
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.
5. **Repair / Rehabilitation of structures**
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
6. **Junction improvement**
   A list of improvements to be carried out at Major / Minor junction has provided in Schedule B. Consultant has prepared Typical Layout Plan for junction development based on IRC SP 84-2014 and quantity calculation arrived accordingly. Pavement thickness for Junction is as follows:
   a) Junction having Flexible Pavement
      Area adjoining to MCW: BC – 40 mm, DBM -60 mm, WMM – 250 mm, GSB – 200 mm.
      Area adjoining to Cross Road - BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm.
   b) Junction having Rigid Pavement: PQC – Not appliable
7. **Construction of new drain**
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. **Road furniture**
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement

i) Road marking – quantity considered along entire length of project road
j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. **Construction of Toll plaza Taper Portion as Rigid Pavement**
   The existing toll plaza is having flexible pavement on tapper and rigid pavement in central portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.
10. **Landscaping and tree plantation**
    The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.
11. **Highway Patrol vehicles, Ambulance, Cranes**
    Two numbers at each toll location has been considered.
12. **ATMS / TMS**
    Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.
13. **Slope protection**
    As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen	IOCL Chennai		
	Base Price	Discount	Ex MI price
VG30	51752	5100	46652
VG40	55232	3800	51432

ii) Aggregates rates as per local market rates
iii) Equipment hire cost as per Standard Data Books published by MORTH
iv) Labour rates as per minimum wages applicable.
v) ATMS, TMS cost is based on offer from vendor.
vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.
vii) Items has breakdown in such a way that cost estimate can be easily established
viii) Computation of quantities for all items covering all the works to be carried out
ix) Calculation of repair and rehabilitation required for structure based on site condition.
x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.
xi) Unit Rate Analysis is based on Year 2021.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	441
2	Granular Subbase	Cum	1,303
3	Wet mix macadam	Cum	1,644
4	Dense Bituminous Macadam	Cum	10,213
5	Bituminous Concrete	Cum	11,269
6	Pavement Quality Concrete (PQC)	Cum	6,188
12	RCC M 20 for Drain	Cum	6,156
13	Reinforcement Steel	MT	1,06,922
14	Metal "W" Beam crash barrier	Rm	4,297

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs	Remarks
1	Cost of Strengthening of existing carriageway	0	
2	Cost of new construction of LVUP approaches (Road Portion)	34,550,730	COS Awaited
3	Cost of Service/Slip road	25,035,023	COS Awaited
4	Cost of Road Furniture	48,750,000	COS Awaited
5	Cost of Miscellaneous works	0	
6	Cost of LVUP including RE Wall	73,837,101	COS Awaited
7	Cost of Structure (BOX Culvert and Pipe culvert)	19,470,147	COS Awaited
8	Cost of repairs of existing structures	0	
9	Cost of Toll plaza Improvement	29,390,419	WO Construction Awaited
10	Cost of ATMS	67,990,200	Data Awaited
11	Cost of Hybrid ETC	0	
12	Additional Requirement as per Site condition		
	Total	**237,832,441**	
	Add 12% for GST	**28,539,893**	
	Total including GST	**266,372,333**	

Total CAPEX – Rs. 26.63 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
2	2035/36	Functional Overlay	30 mm BC in entire length+ DBM 50 mm in 20 % Length	50% Micro-surfacing+ 50% 30mm BC
3	2042/43	6 Laning BY EPC Contractor	6L under EPC by NHAI	
4	2042/43	Functional Overlay	30 mm BC in entire length 6L	50% Micro-surfacing+ 50% 30mm BC
5	2049/50	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

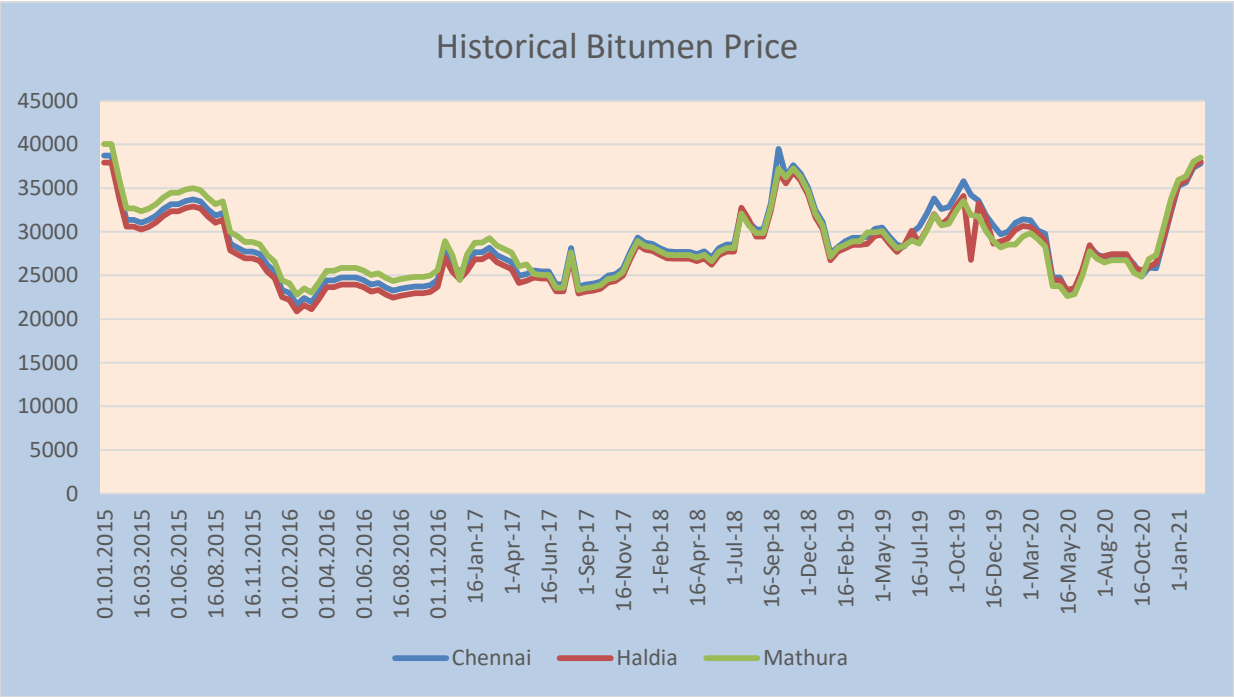
- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation. Except Bitumen rates is adopted as per Company forecast of Bitumen after 2024.

ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen Price @ 16 March 2022	IOCL Chennai		
Bitumen	**Base Price**	**Discount**	**Ex MI price**
VG30	31835	5100	26735
VG40	35315	3800	31515

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM

costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company (Escalation factor applied only on Major Maintenance Cost).

Year	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	7,662
2	Bituminous Concrete	Cum	8,893
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1,647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented below:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Qu	
			2028/29	2035/36
	Main Carriageway - Flexible Pavement			
1	Tack Coat	Sqm	11,72,402	14,06,88
2	Bituminous Concrete - VG 40 / CRMB	Cum	35,172	35,17
3	Dense Bituminous Macadam - VG 40	Cum		11,72
	Main Carriageway - Rigid			
1	Joint sealant replacement every 5th Year (5 %)	m	1,676	1,67
	Service Road			
1	Tack Coat	Sqm	1,48,371	1,48,37
2	BC - VG 30	Cum	4,451	4,45
3	Microsurfacing	Sqm	1,48,371	1,48,37
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)			
1	Tack Coat	Sqm	31141	3114
2	Bituminous Concrete - VG 40 / CRMB	Cum	934	124
3	Dense Bituminous Macadam VG-40	Cum		
4	Milling of existing Wearing Coat	Sqm	31141	3114
5	Painting of Crash Barrier	sqm	8281	828
6	Microsurfacing	Sqm		
	Other Works			
1	Raising of Road Kerb	m		1,20,82
2	Replacement of Road Studs			
	Road Studs	Nos	64,116	64,11
	Solar Studs	Nos	584	58
3	Painting of Road Kerb	Sqm	45,309	45,30
4	Road Marking - MCW	Sqm	62143	6214
5	Shoulder Filling (40 to 50 mm)	Sqm	126940	12694
6	Median Filling	Cum	7616.4	7616.
7	Cost for fixing Other CA Issue at Handback Time	LS		
8	PMC Cost for Overlay @ 20 lakh per month	Month	8	
	Major Maintenance Cost Per Year			
	Major Maintenance Cost Per Year with GST			
	Escalation Factor			
	Esclated Amount keping Bitumen Component w/o Escalation			

5. OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the “Maintenance Requirements”). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimized staff requirement at

Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 14,505/ km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 9285 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 11.10 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	2.21	104,284	230,468
2	Highway Lighting Electricity Charge	Kwh	1,312,978	11.10	14,577,863
3	Operation and Maintenance of DG Set	Nos	1	112,188	112,188
4	Solar Blinker	Nos	2	3,293	6,586
	Total				**1,49,27,105**

5.5 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is **0.68 crore** per year and additional cost of **27.32 crore** for replacement of equipment at every 7 (seven) years.

5.6 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is **Rs. 1.08 crore** per year including GST.

5.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of tolls. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.
3) The Toll manpower is considered based on the ETC payment collection. i.e. more than 90% FASTTAG.

The cost of manpower is estimated as **Rs. 3.06 core (FY 23)** per year.

5.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 2.58 crore (FY 23)** per year.

Year wise O & M Cost (OPEX) is presented in next pages.

Year in Nos	Year	OPEX - AECOM						
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Oper Manpov
1	2021-22							
2	2022-23	54,02,807	1,23,72,910	1,49,27,105	48,78,569	1,51,72,269	17,78,318	3,06,
3	2023-24	86,52,034	1,23,72,910	1,49,27,105	78,05,710	1,51,72,269	17,78,318	3,06,
4	2024-25	1,02,82,962	1,23,72,910	1,49,27,105	97,57,137	1,51,72,269	17,78,318	3,06,
5	2025-26	1,18,26,899	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
6	2026-27	1,24,18,244	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
7	2027-28	1,27,90,792	1,23,72,910	1,49,27,105	6,82,99,959	1,51,72,269	17,78,318	3,06,
8	2028-29	34,37,882	1,23,72,910	1,49,27,105	29,27,141	1,51,72,269	17,78,318	3,06,
9	2029-30	54,02,807	1,23,72,910	1,49,27,105	48,78,569	1,51,72,269	17,78,318	3,06,
10	2030-31	86,52,034	1,23,72,910	1,49,27,105	78,05,710	1,51,72,269	17,78,318	3,06,
11	2031-32	1,02,82,962	1,23,72,910	1,49,27,105	97,57,137	1,51,72,269	17,78,318	3,06,
12	2032-33	1,18,26,899	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
13	2033-34	1,24,18,244	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
14	2034-35	1,27,90,792	1,23,72,910	1,49,27,105	6,82,99,959	1,51,72,269	17,78,318	3,06,
15	2035-36	34,37,882	1,23,72,910	1,49,27,105	29,27,141	1,51,72,269	17,78,318	3,06,
16	2036-37	54,02,807	1,23,72,910	1,49,27,105	48,78,569	1,51,72,269	17,78,318	3,06,
17	2037-38	86,52,034	1,23,72,910	1,49,27,105	78,05,710	1,51,72,269	17,78,318	3,06,
18	2038-39	1,02,82,962	1,23,72,910	1,49,27,105	97,57,137	1,51,72,269	17,78,318	3,06,
19	2039-40	1,18,26,899	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
20	2040-41	1,24,18,244	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
21	2041-42	1,27,90,792	1,23,72,910	1,49,27,105	6,82,99,959	1,51,72,269	17,78,318	3,06,
22	2042-43	34,37,882	1,23,72,910	1,49,27,105	29,27,141	1,51,72,269	17,78,318	3,06,
23	2043-44	54,02,807	1,23,72,910	1,49,27,105	48,78,569	1,51,72,269	17,78,318	3,06,
24	2044-45	86,52,034	1,23,72,910	1,49,27,105	78,05,710	1,51,72,269	17,78,318	3,06,
25	2045-46	1,02,82,962	1,23,72,910	1,49,27,105	97,57,137	1,51,72,269	17,78,318	3,06,
26	2047-48	1,18,26,899	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
27	2048-49	1,24,18,244	1,23,72,910	1,49,27,105	1,17,08,564	1,51,72,269	17,78,318	3,06,
28	2049-50	34,37,882	1,23,72,910	1,49,27,105	6,82,99,959	1,51,72,269	17,78,318	3,06,
29	2050-51	54,02,807	1,23,72,910	1,49,27,105	29,27,141	1,51,72,269	17,78,318	3,06,
	Total	**25,18,58,500**	**34,64,41,477**	**41,79,58,946**	**46,83,42,578**	**42,48,23,521**	**4,97,92,904**	**85,94,**
Total Cost in Crore		**25.19**	**34.64**	**41.80**	**46.83**	**42.48**	**4.98**	

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Nanguneri to Kanyakumari section of NH 44 from Madurai to Kanyakumari. Project road starts from Km 180+000 at Munanthurai to Km 243+470 near Kanyakumari in the state of Tamilnadu. The total length of the project road is 63.47 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures, and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Madurai Kanyakumari Section of NH – 44 Package-4 on TOT Basis in the State of Tamilnadu	180+000	243+470	6370	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.

Start Point of Project Road at Km 180+000

End Point of Project Road at Km 243+470

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	**Project Road Start**	Km 180+000 at Munanthurai of NH-44 (Old NH-7)	Km 180+000 at Munanthurai of NH-44 (Old NH-7)
2	**Project Road End**	Km 243+470 at Kanyakumari of NH-44 (Old NH-7)	Km 243+470 at Kanyakumari of NH-44 (Old NH-7)
3	**Project Length**	63.47 Km	63.47 Km
6	**Carriageway**	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	**Shoulders**	1 m to 2 m earthen for MCW	1 m to 2 m earthen for MCW
8	**Median**	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	**Service Roads**	39.858 Km	LHS: 18.67 Km RHS: 19.00 Km
10	**Major Bridge**	2 No.	2 No.
11	**Minor Bridge**	31 Nos.	31 Nos.
12	**Pipe, Box & Slab Culverts**	148 Nos.	148 Nos.
13	**Major/Minor Junctions**	5 Major and 15 Minor	5 Major and 15 Minor
14	**Underpass**	6 VUP	6 VUP
15	**ROB/RUB**	2 No	2 No
16	**Toll Plazas**	1 No	1 No
17	**Truck Lay-byes/Truck Parking**	3 No	3 No
18	**Bus Shelter**	12 Bus Bay & Shelter and 34 Bus Shelter	12 Bus Bay & Shelter and 34 Bus Shelter

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length Km
	From	To	LHS	RHS	
1	180+000	185+385	BT	BT	5.385
2	185+385	185+435	CC	CC	0.05
3	185+435	243+470	BT	BT	58.035

Flexible Pavement

Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA 39.585 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 38.67 Km length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road 7m width has been proposed for the length of 1300 m.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in fair to poor condition.

56 nos. of authorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers and railing/safety barrier at narrow median near median opening throughout the project is not provided except at few locations.

Typical 1.5 m wide median	4.5m wide Median

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order, silt deposit need to be removed through routine maintenance. Total 5.415 Km of covered/open line side drain is found on site. The condition of the same is good to fair.

RCC Covered Drain at Project Road	Median Cut Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 5 Major and 15 minor junctions are present in project road. Minor junctions were generally present for access to nearby villages, towns, or agricultural areas.

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	23.842
Pedestrian Guard Rail	Carriageway Edge	4.509

PGR and W-Beampresent on the project road

6.2.8 Toll Plaza and Other Facilities

There is one existing Toll plaza at KM 185+370 at Nanguneri with the configuration 2 x (5+1). This has 11 single Toll booths, Canopy, user fee boards. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Sch-B states within 12 months these works to be completed. As per Sch-B toll plaza taper portion is to be constructed as rigid pavement as per IRC SP – 84: 2014.

The Details of Toll plaza are given below.

1. Centre of Toll Plaza : Km 185+370.
2. Start of Taper : Km 185+120
3. Start of Straight : Km 185+330
4. End of Straight : Km 185+410
5. End of Taper : Km 185+620
6. Taper in Length : 210.0m
7. Taper Out Length : 210.0m
8. Total Length of Toll Plaza : 500m (Including Rigid Pavement)
9. Lanes at Toll Plaza : 1+5+5+1 (12 Lanes, 6 lanes in each carriageway)

The Concessionaire has running the operation at the toll plaza with temporary iron cabins as there is no admin building in the project highway.

Toll Plaza Taper

Toll Plaza -Toll lane

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and urban section near Nanguneri city. Additionally, 12 High Mast has provided at Toll Plaza, major junction, and flyover. 41 Nos. Double Arm poles has been provided at site and as per 650nos. of lighting shall be provided.

Highway Lighting Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	181+575	Median	1	Double Arm	Working
2	197+925	Shoulder	1	Double Arm	Working
3	208+480	Median	1	Double Arm	Working
4	209+600	Median	1	Double Arm	Working
5	210+500	Median	1	Double Arm	Working
6	212+450	Shoulder	1	Double Arm	Working
7	213+130	Shoulder	1	Double Arm	Working
8	239+050	Median	1	Double Arm	Working
9	239+070	Median	1	Double Arm	Working
10	239+090	Median	1	Double Arm	Working
11	239+110	Median	1	Double Arm	Working
12	239+130	Median	1	Double Arm	Working
13	239+150	Median	1	Double Arm	Working
14	239+170	Median	1	Double Arm	Working
15	239+190	Median	1	Double Arm	Working
16	239+210	Shoulder	1	Double Arm	Working
17	239+230	Shoulder	1	Double Arm	Working
18	239+230	Shoulder	1	Double Arm	Working
19	239+250	Shoulder	1	Double Arm	Working
20	239+250	Shoulder	1	Double Arm	Working
21	239+270	Shoulder	1	Double Arm	Working
22	239+270	Shoulder	1	Double Arm	Working
23	239+290	Shoulder	1	Double Arm	Working
24	239+290	Shoulder	1	Double Arm	Working
25	239+310	Shoulder	1	Double Arm	Working
26	239+330	Median	1	Double Arm	Working
27	239+350	Median	1	Double Arm	Working
28	239+370	Median	1	Double Arm	Working
29	239+390	Median	1	Double Arm	Working
30	239+410	Median	1	Double Arm	Working

SN	Existing Chainage From	Side	Nos.	Type	Condition
31	239+430	Median	1	Double Arm	Working
32	239+450	Median	1	Double Arm	Working
33	239+470	Median	1	Double Arm	Working
34	239+490	Median	1	Double Arm	Working
35	239+510	Median	1	Double Arm	Working
36	239+530	Median	1	Double Arm	Working
37	239+550	Median	1	Double Arm	Working
38	239+570	Median	1	Double Arm	Working
39	239+590	Median	1	Double Arm	Working
40	239+610	Median	1	Double Arm	Working
41	239+870	Median	1	Double Arm	Working

High Mast Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	181+575	RHS	1	High mast	Working
2	189+400	LHS	1	High mast	Working
3	203+560	LHS	1	High mast	Working
4	204+850	RHS	1	High mast	Working
5	208+450	LHS	1	High mast	Working
6	217+840	LHS	1	High mast	Working
7	219+590	RHS	1	High mast	Working
8	222+410	LHS	1	High mast	Working

High Mast Light	Highway Lighting

6.2.10 Bus Bays and Bus Shelter

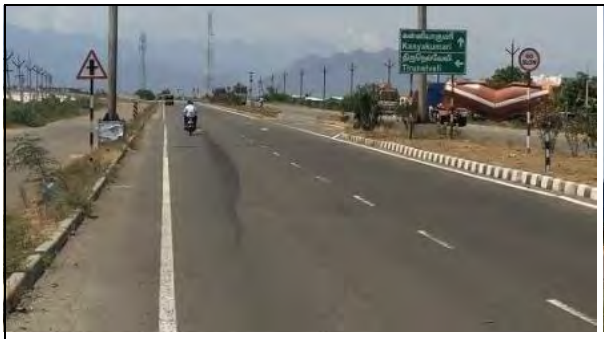
There are 12 Bus Bay & Shelter and 34 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter	Bus Bay with Bus Shelter

6.2.11 Signage and Marking

Road Signs

772 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.



Route Marker Board on the Project Road

Sign Board fixed at Project Road

Sl. No.	Sign Type	Approx. Nos.	Condition	Remarks
1	90 cm equilateral triangle	255	Fair	Approx. 15 to be replaced
2	60 cm equilateral triangle		-	
3	60 cm circular	4	Good	
4	75 cm circular		-	
5	Route Marker	7	Fair	Approx. to be replaced
6	60 cm x 45 cm rectangular	103	Fair	Approx. 2 to be replaced
7	Toll sign Single Post	16	Fair	Approx. 2 to be replaced
8	60 cm x 60 cm square		-	
9	Chevron sign	351	Fair	Approx. 14 to be replaced
10	Accident Zone sign	11	-	
11	90 cm high octagon (Stop)	1	Good	
12	60 cm high octagon (Go Slow)	14	-	
13	Overhead Gantry Sign	2	Fair	
14	Cantilever Gantry Sign	8	Fair	
	Total	**772**		

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road marking along the carriageway

6.2.12 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is Not good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road

Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc**.** and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 2 no of Major Bridge having total length varies from 64.2 m to 102 m are generally found in good condition.
- 31 nos. of Minor Bridges are generally found in good condition.
- 6 nos. of Underpass having minimum span arrangement of 1 x 10 are found in good condition.
- 2 nos. of Railway over Bridge total of total length vary from 25m to 103 are generally found in good condition.
- Not any Flyover is found within the chainage of KM 180+000 to KM 243+ 470
- 148 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.197+330

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 3x21.4m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. During inspection it was observed that expansion joints (Strip seal) filled with mud, all drainage spouts are clogged with mud, Crack has been observed at expansion joint, A2 median wall absent. Other conditions of the bridge are good**.** A few pictures to ascertain the conditions of Major Bridge are presented as follows:

Expansion joint in poor condition

Span Arrangement

Major Bridge at Ch. 197+330

b) Major Bridge – CH.239+800

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 6x17. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. During inspection it was observed that expansion joints (Strip seal) filled with mud, all drainage spouts are clogged with mud, Crack has been observed at expansion joint, A2 median wall absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Poor Maintenance of Ventway Minor Bridge at Ch. 239+800

Minor Bridge

Salient features along with condition of 31 Minor bridges are discussed here

a)Minor Bridge – CH.182+330

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x7.3m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that drainage spouts were blocked, Poor Floor Protection and Slope protection works. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 182+330

b) Minor Bridge – CH.184+697

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.3m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that poor pprotection works in LHS & RHS, Minor reinforcements exposed in slab and abutment, spalling of concrete found in slab and abutment. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 184+697

c) Minor Bridge – CH.189+490

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 2x6.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier. During the inspection it was observed that Major cracks and exposed reinforcements in RCC railing, Huge vegetation in waterway, Median protection walls absent, Drainage spouts blocked, Exposed reinforcements and efflorescence in slab and Cracks in substructure. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

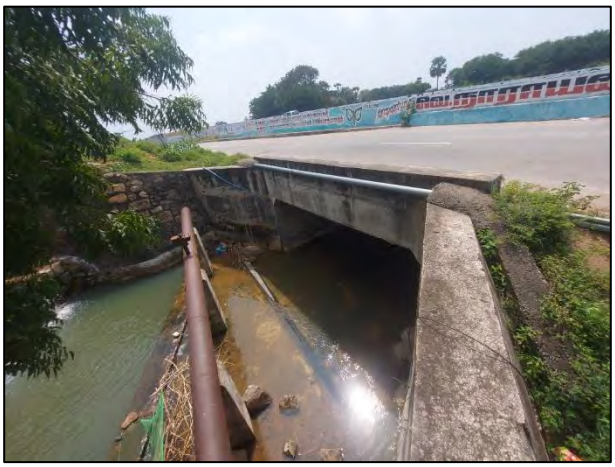
Span Arrangement

Minor Bridge at Ch. 189+490

d) Minor Bridge – CH.189+075

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.1m. The super structure comprises of RCC Box. During the inspection it was observed that, Minor honeycomb found in wing wall. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway



Span Arrangement

Minor Bridge at Ch. 189+075

e)Minor Bridge – CH.193+150

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Floor protection is missing, poor embankment slope protection, Honeycomb found in abutment, repairing of wearing coat is required. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span arrangement

View of carriageway

Minor Bridge at Ch. 193+150

f) Minor Bridge – CH.193+850

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 2x6.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier. During the inspection it was observed that Efflorescence found in slab concrete, Cracks and exposed reinforcements found in RCC railing, Vegetation in vents and RCC railing. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 193+850

g)Minor Bridge – CH.203+023

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Honeycomb in slab and abutments, no floor protection, Slope protection is absent, Drainage spouts blocked. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span Arrangement

View of carriageway

Minor Bridge at Ch. 203+023

h) Minor Bridge – CH.204+016

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 2x5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier.
During the inspection it was observed that RCC Railing as median protection wall is not recommended, Reinforcements exposed in RCC railing, Floor protection absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 204+016

i) Minor Bridge – CH.204+611

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 2x6m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier.
During the inspection it was observed that RCC Railing as median protection wall is not recommended, Reinforcements exposed in RCC railing, Floor protection absent, embankment slope protection absent, Drainage spouts blocked. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 204+611

j) Minor Bridge – CH.206+700

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Drainage spout blocked, minor repairing of wearing coat is required. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 206+700

k)Minor Bridge – CH.209+124

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that wearing coat and other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 209+124

l) Minor Bridge – CH.213+173

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 2x8.9m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment and pier. During the inspection it was observed that Floor protection is absent, Vegetation on embankment slope protection, Drainage spouts are buried. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriageway

Span Arrangement

Minor Bridge at Ch. 213+173

m) Minor Bridge – CH.216+087

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x8.5m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Drainage spouts are buried, Vegetation in embankment stone pitching, Bed protection failed, scouring observed at bridge, major cracks in slab and abutment, reinforcements exposed in slab & abutment, Spalling in slab and abutments. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriageway

Span Arrangement

Minor Bridge at Ch. 216+087

n) Minor Bridge – CH. 217+035

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation in waterway and over stone pitching, all drainage spouts are buried, Minor efflorescence in slab, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span arrangement

Minor Bridge at Ch. 217+035

o) Minor Bridge – CH. 226+335

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation and debris over stone pitching, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 226+335

p) Minor Bridge – CH. 226+500

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation grown over stone pitching, all drainage spouts are blocked, Minor efflorescence in abutment concrete, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 226+500

q) Minor Bridge – CH. 226+910

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10.2m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment.
During the inspection it was observed that Vegetation grown over slope pitching, drainage spouts are blocked, Minor efflorescence in abutment concrete, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 226+910

r) Minor Bridge – CH. 227+343

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation grown over slope pitching, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 227+343

s) Minor Bridge – CH. 229+962

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Median wall is to be provided, Vegetation grown over slope pitching, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 229+962

t) Minor Bridge – CH. 232+107

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.6m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Crash Barrier is to be provided at both edges, A2 median wall is recommended. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 232+107

u) Minor Bridge – CH. 232+620

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.6m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation grown over slope pitching, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 232+620

v)Minor Bridge – CH. 232+984

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation grown over stone pitching, all drainage spouts are blocked, Minor efflorescence in abutment concrete, floor protection absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 232+984

w) Minor Bridge – CH. 233+134

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation in over slope pitching, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 233+134

x) Minor Bridge – CH. 234+194

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.6m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation in over slope pitching & in waterways, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 234+194

y)Minor Bridge – CH. 235+236

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.6m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation in over slope pitching and in waterways, slope pitching is in poor condition, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Poor slope pitching

Span Arrangement

Minor Bridge at Ch. 235+236

z) Minor Bridge – CH. 237+412

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation grown over slope pitching, A2 median wall is recommended, drainage spouts are blocked. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 237+412

aa) Minor Bridge – CH. 237+945

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that minor efflorescence is seen in abutment concrete, Vegetation grown over slope pitching, drainage spouts are blocked, Floor protection is absent, minor repairing of wearing coat . Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 237+945

bb) Minor Bridge – CH. 238+309

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Vegetation in over slope pitching, drainage spouts are blocked, Median parapet wall is recommended. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 238+309

cc) Minor Bridge – CH. 238+981

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x6.8m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that Slope pitching is in poor condition, drainage spouts are blocked, Floor protection is absent. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 238+981

dd) Minor Bridge – CH. 239+695

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that drainage spouts are blocked, Expansion joint is filled with concrete. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 239+695

ee) Minor Bridge – CH. 239+952

It consists of bridge on both (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x10m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During the inspection it was observed that, drainage spouts are blocked, Expansion joint is filled with concrete. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 239+952

Under-Passes (UPs)

There is a total of 06 UPs has been provided. All UPs have minimum span of 1 x 10 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.

UPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

Superstructure is in fair condition

Span Arrangement

UP at Ch. 190+335

Super structure in fair condition

Span Arrangement

UP at Ch.192+352

Super structure in fair condition

Span Arrangement

UP at Ch. 200+980

Super structure in fair condition

Span Arrangement

UP at Ch. 202+710

Super structure in fair condition

Span Arrangement

UP at Ch. 206+880

Service road

Span Arrangement

UP at Ch. 218+361

Railway over Bridge (ROBs)

a. ROB at Ch. 219+170

It consists of bridge on LHS and RHS carriageway over railway tracks. Both ROB has a span arrangement of 1x25m. The super structure comprises of PSC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC wall type abutment. During the inspection it is observed that Drain spouts are blocked, Expansion joints are filled with sand, Minor repairing of slope protection is required. Other conditions of the bridge are good.
A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Expansion Joint in fair condition

ROB at Ch. 219+170

b. ROB at Ch. 242+750

It consists of bridge on LHS and RHS carriageway over railway tracks. Both ROB has a span arrangement of 2x20+23+2x20m. The super structure comprises of PSC Girder. Elastomeric bearings are adopted for resting of superstructure on RCC wall type abutment and pier. During the inspection it is observed that Drain spouts are clogged with soil and debris, Expansion joints are filled with soil, Other conditions of the bridge are good. A few pictures to ascertain the conditions of ROB are presented as follows: -

Culverts:

There are 148 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	**Good**	No immediate Repair / Maintenance Works Required
●	**Fair / Satisfactory**	Minor Repair Works Required
●	**Poor**	Major Repair Works or Replacement of components Required
N/A	**Not Applicable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	197+330	LHS	3x21.4	10.25	**MJB**	Y	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	3x21.4	10.25			●	●	●	●	●	●	●	●	●		●	**Stable**	
2	239+800	LHS	6x17	12.50	**MJB**	Y	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	6x17	12.50			●	●	●	●	●	●	●	●	●		●	**Stable**	
3	182+330	LHS	1x7.3	8.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		RHS	1x7.3	10.50			●	●	●			●	●	●	●			Stable	
4	184+697	LHS	1x6.3	12.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x6.3	12.00			●	●	●			●	●	●	●			Stable	
5	189+490	LHS	2x6.5	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x6.5	10.00			●	●	●			●	●	●	●			Stable	
6	189+075	SR+LHS	1x6.1	10+9.0	MNB	Y	●	●	●			●	●	●	●			Stable	
		SR+RHS	1x6.1	10+9.0			●	●	●			●	●	●	●			Stable	
7	193+150	LHS	1x6.8	12.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x6.8	12.00			●	●	●			●	●	●	●			Stable	
8	193+850	LHS	2x6.5	9.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x6.5	15.00			●	●	●			●	●	●	●			Stable	
9		LHS	1x8	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	203+023	RHS	1x8	10.00			●	●	●			●	●	●	●			Stable	
10	204+016	SR+LHS	2x5	8+9.75	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS+SR	2x5	9.75+8			●	●	●			●	●	●	●			Stable	
11	204+611	LHS	2x6	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x6	10.00			●	●	●			●	●	●	●			Stable	
12	206+700	SR+LHS	1x10	9+10	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS+SR	1x10	10+9			●	●	●			●	●	●	●			Stable	
13	209+124	SR(LHS)	1x6.5	9.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		Main+ SR	1x6.5	29.00			●	●	●			●	●	●	●			Stable	
14	213+173	LHS	2x8.9	10.50	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x8.9	10.50			●	●	●			●	●	●	●			Stable	
15		LHS	1x8.5	10.50	MNB	Y	●	●	●			●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	216+087	RHS	1x8.5	10.50			●	●	●			●	●	●	●			Stable	
16	217+035	LHS	1x8	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x8	10.00			●	●	●			●	●	●	●			Stable	
17	226+335	LHS	1x10	10.25	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.25			●	●	●			●	●	●	●			Stable	
18	226+500	LHS	1x10	10.25	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.25			●	●	●			●	●	●	●			Stable	
19	226+910	LHS	1x10.2	11.50	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10.2	11.50			●	●	●			●	●	●	●			Stable	
20	227+343	LHS	1x6.8	10.50	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x6.8	10.50			●	●	●			●	●	●	●			Stable	
21		LHS	1x10	10.25	MNB	Y	●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	229+962	RHS	1x10	10.25			●	●	●			●	●	●	●			**Stable**	
22	232+107	LHS	1x6.6	10.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.6	10.50			●	●	●			●	●	●	●			**Stable**	
23	232+620	LHS	1x6.6	10.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.6	10.50			●	●	●			●	●	●	●			**Stable**	
24	232+984	LHS	1x10	10.25	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x10	10.20			●	●	●			●	●	●	●			**Stable**	
25	233+134	LHS	1x10	10.00	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x10	10.00			●	●	●			●	●	●	●			**Stable**	
26	234+194	LHS	1x6.6	10.25	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.6	10.25			●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
27	235+236	LHS	1x6.6	11.75	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.6	11.75			●	●	●			●	●	●	●			**Stable**	
28	237+412	LHS	1x6.8	10.00	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.8	10.00			●	●	●			●	●	●	●			**Stable**	
29	237+945	LHS	1x6.6	12.00	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.6	12.00			●	●	●			●	●	●	●			**Stable**	
30	238+309	LHS	1x8	10.00	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x8	10.00			●	●	●			●	●	●	●			**Stable**	
31	238+981	LHS	1x6.8	12.00	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x6.8	12.00			●	●	●			●	●	●	●			**Stable**	
32	239+695	LHS	1x10	12.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x10	12.50			●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
33	239+952	LHS	1x10	12.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	1x10	12.50			●	●	●			●	●	●	●			**Stable**	
34	190+335	LHS	2x10	20.50	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	2x10	20.50			●	●	●			●	●	●	●			**Stable**	
35	192+352	LHS	1x10	23.0	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	1x10	23.0			●	●	●			●	●	●	●			**Stable**	
36	200+980	LHS	2x10	23.50	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	2x10	23.50			●	●	●			●	●	●	●			**Stable**	
37	202+710	LHS	1x11.5	23.50	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	1x11.5	23.50			●	●	●			●	●	●	●			**Stable**	
38	206+880	LHS	2x10	23.0	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	2x10	23.0			●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
39	218+361	LHS	2x10	21.6	**UP**	NA	●	●	●			●	●	●	●			**Stable**	
		RHS	2x10	21.6			●	●	●			●	●	●	●			**Stable**	
40	219+170	LHS	1x25	11	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1x25	11			●	●	●	●	●	●	●	●	●		●	**Stable**	
41	242+750	LHS	2x20+23+2x20	12.5	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	2x20+23+2x20	12.5			●	●	●	●	●	●	●	●	●		●	**Stable**	

TECHNICAL DUE DILIGENCE REPORT

Salaipudhur Madurai Tollway Limited (SMTL)

Report Number:

ACM-60657056-TDD-SMTL-001-R0

Date:

June 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Salaipudhur Madurai Tollway Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("Trust"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Salaipudhur Madurai Tollway Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Salaipudhur Madurai Tollway Limited

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset 5B,
Aerocity Hospitality District,IGI Airport
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

Project Background 3
Project Salient Features 3
Project Principle Participants 4
Project Operation and Maintenance Cost 4
Limitation of Scope 7

1. INTRODUCTION 8

1.1 Project Background 8
1.2 AECOM 10
1.3 Scope of Works 11
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS 14

2.1 General 14
2.2 Estimation of Design Traffic 15
2.3 Test Pit 16
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 19
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 20
2.6 Roughness Survey using Network Survey Vehicle (NSV) 21
2.7 Determination of Pavement Major Maintenance 22
2.8 Base Year Pavement Rehabilitation Requirement 22
2.9 Future Maintenance Requirements 23

3. CAPEX REQUIREMENT 25

3.1 CAPEX needs 25
3.3 Unit Rate Analysis 28
3.4 Cost Estimate 29

4. MAJOR MAINTENANCE COST 30

4.1 Major Maintenance Cycle 30
4.2 Major Maintenance Quantity 30
4.3 Unit Rate Analysis 30
4.4 Cost Estimate 33

5. OPEATION AND MAINTEANCE COST - OPEX 35

5.1 O & M Requirement as per CA 35
5.2 O & M Strategy 38
5.3 Routine and Preventive Maintenance 38
5.4 Highway Lighting 39
5.5 ATMS and TMS Cost 39
5.6 Incident Management 40
5.7 Manpower Cost 40
5.8 Office Expenses 40

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT 42

6.1 Reconnaissance Survey 42
6.2 Road Inventory and Condition Survey 42
6.3 Inventory and Condition Survey of Structures 55

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge
MNB	Minor Bridge

MoRTH	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SMTL	Salaipudhur Madurai Tollway Limited
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Salaipudhur Madurai Tollway Limited ("SMTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and SMTL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Madurai – Kanyakumari Section from Km 116+500 to Km 180+000 of NH 44 (Old NH-7) in the State of Tamilnadu (Package-3) is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by the Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Parameters	Details
Project Name	Tolling, Operation, Maintenance & Transfer of Madurai to Kanyakumari section from KM 116+500 to Km 180+000 Package-3 on NH-44 (Old NH-7) in the state of Tamilnadu.
Project Length	63.50 Km
Execution Type	Toll Operate and Transfer (TOT) Model
Name of SPV	Salaipudhur Madurai Tollway Limited (SMTL)
Signing of Agreement	27th December 2019
Appointed Date	20 Oct 2020
Concession Period	30 years
End of Concession Period	21 Oct 2050

Likely End of Concession Period	Oct 2050
Number of Toll Plaza	1 nos, Toll Plaza having 10 Hybrid lanes including Extra wide Lane

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Salaipudhur Madurai Tollway Limited (SMTL)
3	Independent Engineer	Bloom Companies LLC
4	Maintenance Contractor	1) Toll Operation (TBR Infra Pvt Ltd., Hyderabad), 2) Incident Management (Markolines Traffic Controls Private Limited) 3) G4S Security Solutions India Pvt Ltd., For Security 4) Routine Maintenance- M/s Racy Projects

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

Capex for Improvement and rehabilitation work as defined in Schedule B

Concessionaire is to undertake following major works from date of commencement and to be completed within 12 months.

- Maintenance and rehabilitation of Pavement
- Construction of New Service Road & Structures
- Repair and Rehabilitation of Structures and Cross Drainage Works
- Minor Junction Improvement
- Construction of Drain
- Road Furniture to enhance safety of asset
- Construction of New Toll Plaza including TMS system
- Landscaping and Tree Plantation
- Incident Management
- ATMS
- Rainwater Harvesting
- Slope Protection

The above work is to be completed within 18 months from appointed date and work in in progress. The estimated cost for balance work of above work as per information provided by Cube Highways is **Rs. 20,12** crore including GST as on FY 2022-23.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2028/29	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**66.66**
2.	2035/36	30 mm BC in Main Carriageway for 100% Length and 50mm DBM in 20% Length. 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**116.63**
3.	2042/43	30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	**102.83**
4.	**2049/50**	**30 mm BC in Main Carriageway for 100% Length 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road**	**172.62**

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Capacity Augmentation Cost

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contractor. The cost towards capacity augmentation is to be borne by the Authority as per Article 14 of Concession Agreement.

c) Operation and Maintenance (OpEX)

As per Schedule F, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule F elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	10,700,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	14,361,781
3	Security Services	Includes manpower associated with security services.	7,410,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	26,098,712
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	5,373,024
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	7,794,808
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	4,403,446
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	1,081,795
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	2,634,545
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	6,251,847
11	Community Development	Includes CSR related expenses.	219,545
12	Communication Expenses	Includes phone charges.	301,875
13	Conveyance Expenses	Includes boarding & lodging expense.	329,318
14	Project Insurance	Includes project insurance expenses.	

Sl. No.	Description	Remarks	Amount (in INR)
	Expenses		12,075,000
15	IE Fees	Includes IE fees.	3,842,045
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	11,600,121
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	4,147,474
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture, repair of kerb, kerb painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	1,444,442
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	410,357
		O & M Cost for Year 2022-23	**120,481,323**

A total of Rs. **12.05** crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

1.1 Project Background

Salaipudhur Madurai Tollway Limited (hereinafter referred to as SMTL or the Concessionaire), is a company to undertake Tolling, Operation, Maintenance & Transfer (**TOT Model**) of Madurai Kanyakumari Section of NH-44(Old NH-7) from Km 116+500 at Kayattur to Km 180+000 in the State of Tamilnadu is awarded under TOT mode for a Concession Period of 30 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI)

In this context, **M/s AECOM India Pvt. Ltd** is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on 20 Oct 2020 and concession period ends on 21 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Corridor

The project road is a section of National Highway 44 start from Km 116+500 at and ends at Km 180+000. NH 44, National Highway 44 (NH 44) is a major north–south National Highway in India, the longest in the country. It passes through the Union Territory of Jammu and Kashmir, in addition to the states of Punjab, Haryana, Delhi, Uttar Pradesh, Rajasthan, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.

It came into being by merging seven national highways, in full or part, starting with the Jammu-Srinagar National Highway (former NH 1A) from Srinagar in Jammu and Kashmir, former NH 1 in Punjab and Haryana ending at Delhi, part of former NH 2 starting from Delhi and ending at Agra, former NH 3 (popularly known as Agra-Bombay National Highway) from Agra to Gwalior, former NH 75 and former NH 26 to Jhansi, and former NH 7 via Lakhnadon, Seoni, Nagpur, Adilabad, Nirmal, Hyderabad, Kurnool, Anantapur,[2] Bangalore, Hosur, Krishnagiri, Dharmapuri, Salem, Namakkal, Karur, Dindigul, Madurai, Virudhunagar and Tirunelveli terminating at Kanyakumari. The project corridor is shown in map below.

Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	63.50 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1 m to 2 m earthen for MCW at Rural Area
Service Road / Slip Road	42.93 km one side length having width of varying from 4 to 5.5 to 7.0m
Major / Minor Junction	05 Major & 17 Minor
RCC Drain	Covered drain at Urban Section and between MCW and SR of length of 5.738 Km
Median Opening	24 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	2 Truck Lay byes
Bus Bays with shelter	17 Bus Bay and 17 Bus Shelter
Highway Lighting	47 Nos. Double Arm

Description	Project Features
High Mast	3 nos
Highway Patrol	1 nos
Ambulance	1 nos
Crane	1 nos

b) Structure

Description	Project Features
Major Bridge	5 No
Minor Bridge	17 Nos
ROB and RUB	3 No ROB
Flyover	1 Nos
VUP	16 VUP
Culverts	110 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With **approximately 1,00,000 employees** (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in **more than 150 countries** around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments**.**

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of **AECOM** based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management

- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) **Desk Study**: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) **Site Visit**: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) **CAPEX and OPEX:** calculation of immediate CAPEX requirement as per Schedule B, long term CAPEX (MM) based by analyzing FWD and NSV Survey report validated with site visit data. Determination of OPEX considering performance requirement as set in CA and industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures

  - bottlenecks in road alignment
  - operational Issue, if any

- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures, various facilities and engineering and safety improvements to be provided by the Concessionaire within 18 months from appointed date
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule F – Maintenance Requirement during Concession Period
- Inventory Report Highway and Structures prepared by Sai Consulting Engineers Pvt. Ltd.
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data
- MSA Calculation
- DPR Report prepared by Ceinsys Tech Ltd agency appointed by NHAI during bidding
- Bidding Documents prepared by NHAI
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2. CONDITION ASSESSMENT OF EXISTING PAVEMENT AND FUTURE MAINTENANCE REQUIREMENTS

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

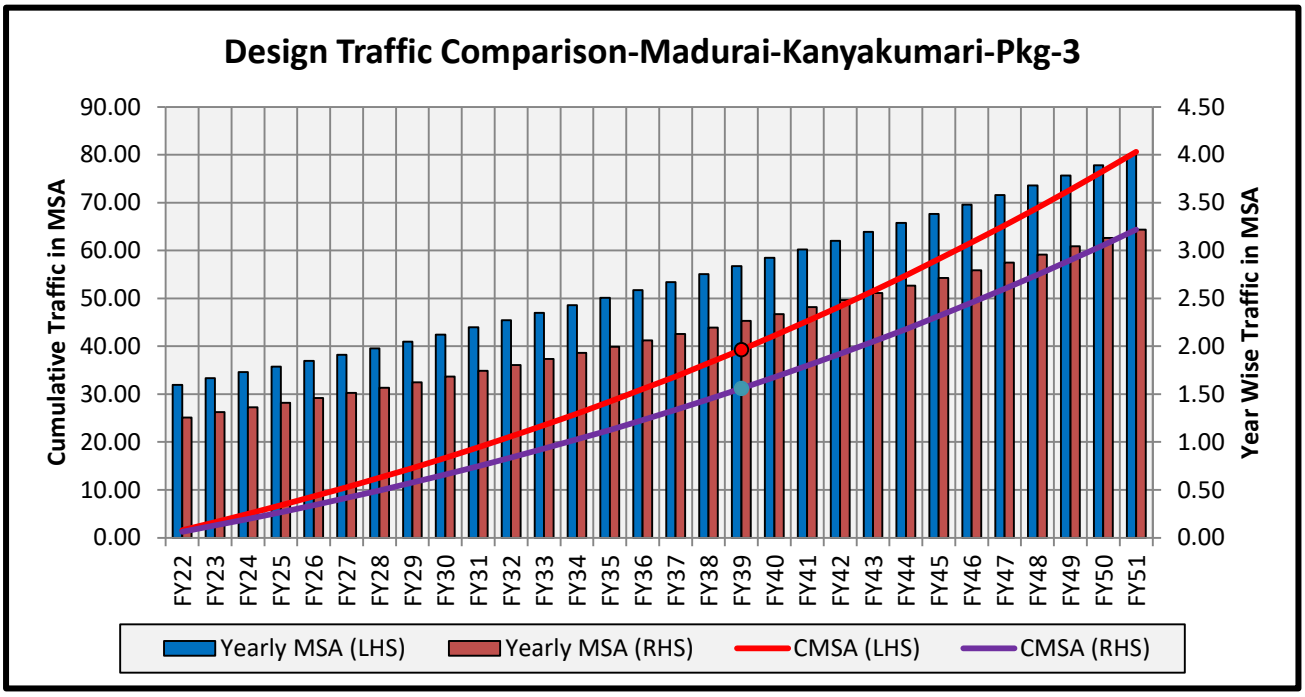
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till FY 31 for 1st Cycle of MM design period for LHS (MK) 18.89 MSA and RHS (KM) 14.94 MSA whereas cumulative MSA upto FY 51 is 80.62MSA for LHS (MK) and 64.35 MSA for RHS (KM). Year wise and cumulative MSA is presented in graph below:



MK – Madurai Kanyakumari (Kayattur to Munanthurai) direction

KM –Kanyakumari Madurai (Munanthurai to Kayattur) direction

2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S. No	Existing Chainage (km)	Side	DCP-CBR	4 Days Soaked CBR
1	117+500	RHS	13.1	11.3
2	120+000	LHS	24.3	13.0
3	122+600	RHS	15.2	11.4
4	125+000	LHS	13.9	10.5
5	128+000	RHS	15.3	16.8
6	130+700	LHS	19.9	12.6
7	131+600	RHS	16.2	14.1
8	132+500	RHS	14.4	14.0
9	135+000	LHS	17.2	14.3
10	137+400	RHS	16.3	13.1
11	137+550	RHS	13.9	15.2
12	139+800	LHS	16.1	10.1
13	142+700	RHS	15.6	13.9
14	145+000	LHS	20.0	16.2
15	147+550	RHS	12.4	9.2
16	150+800	LHS	14.1	10.2
17	152+450	RHS	13.9	11.7
18	154+650	LHS	17.0	12.1
19	155+000	LHS	12.2	9.7
20	157+000	LHS	21.6	13.6
21	157+100	RHS	13.5	18.7
22	160+020	LHS	17.2	15.2
23	162+700	RHS	15.3	15.7
24	164+950	LHS	11.2	10.4
25	166+800	RHS	13.4	16.7
26	170+150	LHS	12.6	11.5
27	172+400	RHS	16.8	15.1
28	175+000	RHS	19.7	16.7
29	177+200	RHS	16.4	14.1

S. No	Existing Chainage (km)	Side	DCP-CBR	4 Days Soaked CBR
30	177+300	LHS	13.7	9.7
31	180+000	LHS	16.9	14.6
Average DCP-Equivalent CBR			**15.8**	

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from **120 mm to 240 mm** and granular layer thickness varies from **360 mm to 600 mm**.

Samples were also collected on existing ground soil and the test results are tabulated below.

S:No	Location (Km.)	Side (LHS/RHS)	Soil Classification as per IS: 1498	Gradation: Percent by weight passing through the Sieve (IS:2720-IV)						Clay & silt content %	Atterberg Limits [IS :2720-Pt-V]			Modified Proctor Test (IS:2720-Pt-VIII)		4-Days Soaked CBR (%)	Free Swell Index (%)
				19.0 mm	10.0 mm	4.75 mm	2.0 mm	425 micron	75 micron		Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)	Max. dry density (gm/cc)	OMC (%)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	133+200	LHS	SM	95.5	88.5	65.3	6	21.5	15.8	15.8	18	NP	NP	2.11	8.3	18.7	0.0
2	141+800	LHS	ML-CL	100.0	100.0	88.5	5	65.2	55.4	55.4	28	21	7	1.97	9.6	8.6	15.0
3	145+000	RHS	MI	100.0	98.5	88.2	8	68.2	55.1	55.1	38	25	13	1.85	13.2	5.3	35.0
4	153+300	RHS	CL	100.0	100.0	88.5	6	55.0	52.1	52.1	30	22	8	1.96	10.4	8.9	20.0
5	163+100	LHS	ML-CL	100.0	100.0	88.5	6	65.2	51.2	51.2	28	21	7	1.91	10.0	8.3	15.0
6	166+500	LHS	SM-SC	100.0	100.0	78.5	55.2	45.2	38.8	38.8	21	17	4	2.03	9.0	13.7	10.0
7	166+600	RHS	ML-CL	100.0	100.0	88.5	65.2	55.5	50.2	50.2	28	22	6	1.95	9.2	9.2	10.0

Samples were also collected for granular layers and the test results are tabulated below.

S.No	Chainage (km)	Side (LHS/RHS)	Type of Sample	Cumulative Percetage of Passing through IS Sieve (mm)												MoRTH 5th Revision	MoRTH 4th Revision	Atterberg Limits			Specific Gravity	W.A (%)	AIV (%)
				75	53.0	45.0	26.5	22.4	11.2	9.5	4.75	2.36	0.600	0.425	0.075			Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)			
1	117+500	RHS	WMM	100.0	93.5	85.2	51.4	46.9	28.7	24.2	19.0	15.1	9.2	7.3	0.6	Not Conforming to any Gradation	Not Conforming to any Gradation	21	NP	NP	2.83	0.33	34.97
2	120+000	LHS	GSB	100.0	100.0	92.1	53.1	44.2	19.9	14.9	10.2	6.6	3.1	2.4	0.7	4.75mm IS Sieve Material is Slightly Coarser side in GSB-IV	4.75mm IS Sieve Material is Slightly Coarser side in GSB-V	23	18	5	2.82	0.39	35.47
3	122+600	RHS	GSB	100.0	100.0	100.0	68.0	59.8	34.2	28.0	21.5	16.3	10.5	8.7	1.1	Conforming to GSB-III & IV	Conforming to GSB-III & IV	21	NP	NP	2.76	0.23	32.71
4	125+000	LHS	WMM	100.0	100.0	100.0	91.9	78.6	41.0	32.7	24.6	20.7	11.8	9.4	1.0	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	22	NP	NP	2.77	0.21	30.15
5	128+000	RHS	WMM	100.0	100.0	100.0	76.3	48.9	36.2	30.5	26.9	19.5	11.9	8.6	1.2	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	23	NP	NP	2.80	0.25	27.57
6	130+700	LHS	GSB	100.0	98.3	82.6	6.5	0.8	0.5	0.4	0.3	0.3	0.3	0.2	0.2	Not Conforming to any Gradation	Not Conforming to any Gradation	24	NP	NP	2.83	0.30	30.18
7	131+600	RHS	WMM	100.0	100.0	98.6	58.5	46.7	38.1	31.0	26.5	20.3	16.8	10.2	1.0	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	20	NP	NP	2.74	0.28	31.63
8	132+500	RHS	GSB	100.0	100.0	98.2	58.2	44.1	18.2	13.6	9.7	7.1	4.7	4.5	0.5	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-III & IV	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-IV & V	21	NP	NP	2.81	0.25	32.6
9	135+000	LHS	WMM	100.0	100.0	100.0	95.6	83.6	37.9	31.1	26.8	20.7	14.3	12.4	0.8	22.4mm IS Sieve Material Slightly Finer & 11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22.4mm IS Sieve Material Slightly Finer & 11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	19	NP	NP	2.80	0.24	28.35
10	137+400	RHS	WMM	100.0	100.0	96.2	85.6	68.2	36.9	32.5	19.3	16.1	10.8	9.2	1.3	11.2mm,4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	11.2mm,4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	19	NP	NP	2.81	0.29	29.87
11	137+550	RHS	WMM	100.0	100.0	100.0	91.5	74.6	46.8	35.4	30.2	18.6	15.4	10.8	1.8	Confirming to WMM Gradation	Confirming to WMM Gradation	19	NP	NP	2.78	0.28	26.86
12	139+800	LHS	GSB	100.0	100.0	96.8	64.2	42.5	34.9	19.5	9.2	6.3	4.1	2.2	1.1	4.75mm IS Sieve Material is Slightly Coarser side in GSB-III&IV	4.75mm IS Sieve Material is Slightly Coarser side in GSB-IV&V	20	NP	NP	2.83	0.25	33.42
13	142+700	RHS	GSB	100.0	100.0	98.0	68.5	52.6	31.6	21.3	10.9	8.2	5.2	3.8	1.5	Confirming to GSB-III	Confirming to GSB-IV	23	NP	NP	2.82	0.24	35.14
14	145+000	LHS	WMM	100.0	100.0	100.0	75.5	55.9	35.3	30.3	30.0	20.2	8.9	6.4	0.9	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22.4mm,11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	22	NP	NP	2.79	0.31	30.15
15	147+550	RHS	WMM	100.0	100.0	100.0	72.7	60.7	36.9	31.9	26.9	23.0	11.7	9.2	1.0	11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	11.2mm IS Sieve Material Slightly Coarser side in WMM Gradation	20	NP	NP	2.82	0.32	33.24
16	150+800	LHS	GSB	100.0	100.0	100.0	43.7	35.2	15.0	13.1	11.4	9.7	7.3	6.1	1.0	26.5mm IS Sieve Material is Slightly Coarser Side in GSB-III	26.5mm IS Sieve Material is Slightly Coarser Side in GSB-IV	22	NP	NP	2.74	0.24	31.24
17	152+450	RHS	GSB	100.0	100.0	88.0	62.3	44.1	36.5	30.2	29.4	26.8	21.5	11.6	4.6	9.5mm IS Sieve Material Slightly Coarser side in GSB-I	9.5mm IS Sieve Material Slightly Coarser side in GSB-I	20	NP	NP	2.79	0.31	32.41
18	154+650	LHS	GSB	100.0	100.0	96.5	74.1	65.7	46.6	45.9	35.3	28.9	21.2	13.5	11.1	0.075 mm IS Sieve Material is Slightly Finer Side in GSB-I	0.075 mm IS Sieve Material is Slightly Finer Side in GSB-I	23	NP	NP	2.77	0.38	31.06
19	155+000	LHS	WMM	100.0	100.0	100.0	65.5	55.6	43.5	30.5	28.8	19.2	13.8	7.9	0.7	22.4mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	21	NP	NP	2.74	0.26	24.67
20	157+000	LHS	WMM	100.0	100.0	100.0	50.2	40.3	29.8	29.0	27.6	23.3	16.3	13.0	1.7	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	19	NP	NP	2.82	0.29	29.23
21	157+100	RHS	WMM	100.0	100.0	100.0	48.7	38.9	5.8	2.1	0.9	0.8	0.8	0.7	0.4	Not Conforming to Any Gradation	Not Conforming to Any Gradation	20	NP	NP	2.83	0.32	27.53
22	160+020	LHS	GSB	100.0	100.0	96.8	58.4	43.4	11.7	9.4	8.1	6.2	4.0	3.3	0.2	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-III & IV	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-IV& V	20	NP	NP	2.79	0.26	26.15
23	162+700	RHS	GSB	100.0	100.0	100.0	55.9	39.7	14.2	11.9	9.9	7.8	6.1	5.3	1.0	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-IV & V	4.75mm, IS Sieve Material is Slightly Coarser Side in GSB-III & V	23	NP	NP	2.82	0.37	31.55
24	164+950	LHS	WMM	100.0	100.0	100.0	82.0	67.1	45.3	35.9	21.6	16.8	12.1	9.8	0.6	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	4.75mm IS Sieve Material Slightly Coarser side in WMM Gradation	22	NP	NP	2.74	0.22	27.69
25	166+800	RHS	WMM	100.0	100.0	92.9	59.8	50.9	27.6	19.0	10.3	6.1	3.0	2.6	0.4	Not Conforming to any Gradation	Not Conforming to any Gradation	21	NP	NP	2.76	0.36	27.63
26	170+150	LHS	GSB	100.0	97.1	89.1	47.4	36.7	25.2	22.3	19.2	16.9	10.9	8.2	0.8	53mm,26.5 mm IS Sieve Material is Slightly Coarder Side in GSB-IV	26.5 mm IS Sieve Material is Slightly Coarder Side in GSB-IV	20	NP	NP	2.76	0.44	32.23
27	172+400	RHS	GSB	100.0	100.0	97.8	67.3	60.2	41.1	37.0	32.3	27.0	14.9	11.3	1.1	Conforming to GSB-I	Conforming to GSB-I	22	NP	NP	2.77	0.42	35.93
28	175+000	RHS	WMM	100.0	100.0	100.0	47.6	41.8	32.8	28.4	25.6	21.5	18.2	15.2	1.1	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	22.4mm,11.2mm IS Sieve Material is Slightly Coarser Side in WMM Gradation	20	NP	NP	2.83	0.41	36.45
29	177+200	RHS	WMM	100.0	100.0	95.2	65.3	62.3	48.2	34.3	30.2	23.6	16.8	16.2	1.1	Conforming to WMM Gradation	Conforming to WMM Gradation	22	NP	NP	2.81	0.38	34.26
30	177+300	LHS	WMM	100.0	100.0	100.0	73.2	62.7	40.1	34.3	28.7	23.5	14.4	10.6	0.5	Conforming to WMM Gradation	Conforming to WMM Gradation	21	NP	NP	2.75	0.34	33.45
31	180+000	LHS	GSB	100.0	97.8	82.2	47.6	43.9	34.8	31.9	27.8	23.8	13.9	10.4	0.2	53mm,26.5 mm IS Sieve Material is Slightly Coarder Side in GSB-III &IV	26.5 mm IS Sieve Material is Slightly Coarder Side in GSB-IV	23	NP	NP	2.78	0.38	36.52

Note: The Test results data are provided by client.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	Length in km	
	LHS	RHS
Length of Road where MSA is less than 10-year design MSA i.e. 18.89 MSA in LHS and 14.94 MSA in RHS. 30-year Design MSA is 80.62 for LHS and 64.35 for RHS.	-	-
Less than 100 MSA	5.0	6.0
From 100 MSA to 200 MSA	15.5	11.0
Greater than 200 MSA	43.0	46.5
Total Length	63.50	63.50

*Total Length 63.50 Km
Based on remaining life of pavement, structural overlay is not required till end of concession period.

2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	**Cracks**	- **Type:** Longitudinal, Transverse, Block, Alligator - **Extent: %** of Pavement Area Influenced by distress - **Severity:** High (> 3mm wide), Low (<3mm wide)
2	**Pothole**	- **Extent: %** of Pavement Area Influenced by distress - **No. of Potholes** - **Depth Severity:** Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	**Raveling**	- **Extent: %** of Pavement Area Influenced by distress - **Severity:** Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	**Patching**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	**Shoving**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<15mm), High (>15mm)
6	**Flushing/Bleeding**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	**Depression**	- **Extent: %** of Pavement Area Influence by distress - **Severity**
8	**Delamination**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (<1 sq.m area), High (>1 sq.m area)
9	**Edge Break**	- **Extent: %** of Pavement Area Influence by distress - **Severity:** Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	**Pavement Missing**	- **Extent: %** of Pavement Area Missing
11	**Rutting**	- **Rut Depth**

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

where, BI = Bump Integrator Roughness in mm/km

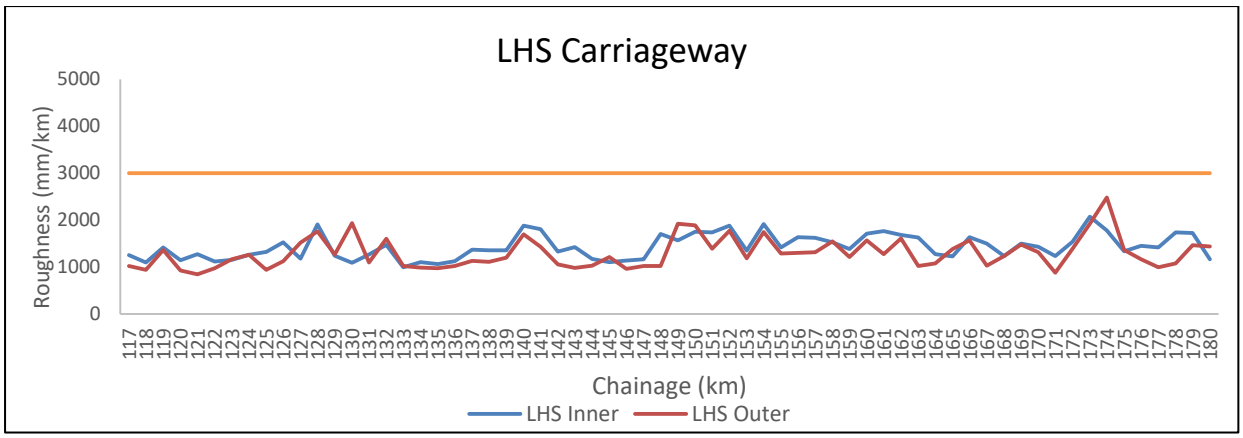
IRI = International Roughness Index

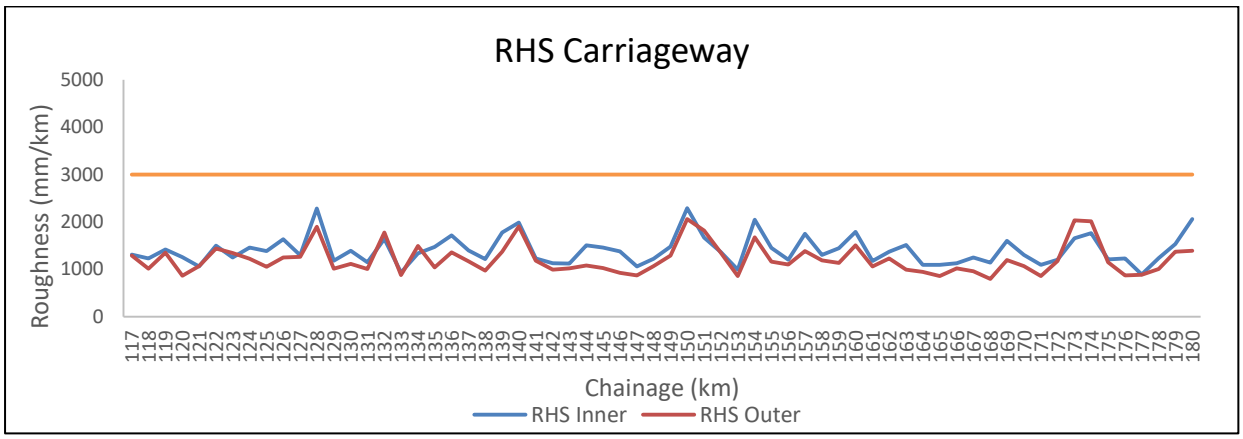
Roughness survey has been carried out after initial overlay (FY 21 /22) and result is summarized as below:

Ratings	Roughness Value (mm/km)	LHS in km*	RHS in km*
Good	<2000	62.5	61.5
Fair	2000 - 3000	1	2
Poor	>3000	0	0

***- Source of Information**: Based on NSV Survey Carried out by M/s V R Techniche Private Limited in the month of **April 2022**.

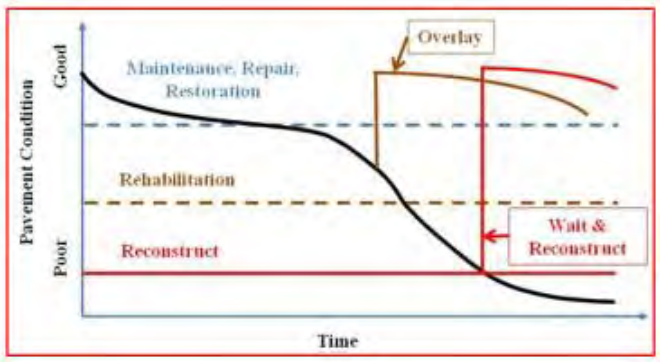
Minimum 30 mm BC overlay is proposed where roughness exceed more than 2000 mm / km.





2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule F. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is not required however functional overlay is required to bring down roughness value less than 2000 mm / km and to maintain performance requirement till next MM cycle. Also, as per Concession agreement, minimum overlay is to be provided at location as specified in Section 3.1 of Schedule B. The combined overlay location to be provide in FY 2021/22 based on pavement condition survey caried out and as specified in Schedule B is as below:

LHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	116+500	180+000	63.50	30	Full Width	BC Overlay

RHS

Sr. No.	Chainage		Length in km	Minimum Thickness in mm	Width	Remarks
	From	To				
1	116+500	180+000	63.50	30	Full Width	BC Overlay

In addition to above, additional area for milling and overlay by BC also considered. Pavement rectification has been completed in line with pavement design report and CA.

2.9 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule F requirement at all times.

As per Article 14, Authority shall do capacity augmentation under EPC contract once traffic exceeds 40,000 PCU for three consecutive accounting years. The Concession agreement do not clearly mention whether overlay on existing four lane shall be executed by the Authority during six laning under EPC or not. However, providing top layer in one go is required and providing one layer of overlay during six laning is considered to be executed by the Authority. In view of above major maintenance cycle is considered as follows:

Handback Requirement

There is no specific Handback requirement as per Concession Agreement. However, concessionaire is to maintain level of service as per Schedule F till end of concession period and at the time of divestment as per Article 31 of CA.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
2	2035/36	Functional Overlay	30 mm BC in entire length+ DBM 50 mm in 20 % Length	50% Micro-surfacing+ 50% 30mm BC
3	2042/43	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
4	2049/50	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3. CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

As per Concession Agreement, the project highway shall be retained with some additional features which shall enhance life of pavement, structure, improve safety of project road and new toll plaza with allied structures. The detail of work along with timeline has provided in Schedule B in accordance to Schedule C.

Scope of Work

The scope of work as per Schedule B is summarized as below:

1. Construction of New Slip / Service Road – 3020 m having width of 7.0 m to 7.5m including tapering location
2. Widening of Pipe Culvert– 6 Nos
3. Rehabilitation of Pavement – 40 mm BC in 3.7 km 2 Lane and 62.4+60.5 Km=122.9Km 30mm BC 2 Lane.
4. Minor Repair of Structures – Major Bridge 3nos, Minor Bridge 20 nos, Culverts – 89 nos, ROB – 2 nos, VUP – 10 nos.
5. Junction Improvement – 10 Minor Junctions
6. RCC Drain/Unlined drain –1000m along slip road/Service road
7. Road Furnitures – Solar Blinker 18 nos, Transverse Marking 63.5 km, W Beam 3015 m, Road Studs, Road Markings, Traffic Delineators, KM / Hecto / Boundary stones as per Manual
8. Toll Plaza Taper Portion as Rigid Pavement.
9. Landscaping and tree plantation
10. Way Side Amenities: to be constructed by NHAI
11. Incident Management – Highway Patrol, Ambulance, Crane
12. ATMS
13. Rainwater Harvesting
14. Slope Protection

Completion schedule for above work as mentioned in Schedule B is as follows:

Sn	Description of Work	Date of Completion
1	Service Roads / Slip Road	18 Months from Appointed Date
2	Construction of New Structures / Widening Reconstruction of Structures / Culverts	18 Months from Appointed Date
3	Strengthening / Overlay of Main Carriageway	12 months from Appointed Date
4	Repair and Rehabilitation of Structure	12 months from Appointed Date
5	Junction Improvement	12 Months from Appointed Date
6	Drain Construction	18 Months from Appointed Date
7	Road Furniture related Items	6 months from Appointed Date
8	Toll Plaza and allied Facilities	12 Months from Appointed Date
9	Incident Management – Highway Patrol, Ambulance, Cranes	1 Month from Appointed Date
9	ATMS	12 Months from Appointed Date
10	Landscaping and Tree Plantation	6 months from Appointed Date
11	Truck Lay byes and Bus Bays	18 Months from Appointed Date
12	Rainwater Harvesting	18 Months from Appointed Date
13	Slope Protection	18 Months from Appointed Date

Cost estimate for construction is to be invested at initial phase itself therefore consider as an important component of the present services as it provides vital input to financial evaluation. Hence proper care has been taken to arrive at realistic / actual cost.

As indicated in **Schedule C**, Engineering and Safety Improvements along the Project Highways shall confirm to **IRC: SP: 84 -2014**, Manual of Specifications & Standards for Four Laning of Highways through Public Private Partnership published by IRC. Therefore, while calculating cost estimate of project road, requirement of Schedule B, site requirement and requirement of manual has also taken into consideration.

3.2 Construction Quantities and Cost

Cost estimate of following major works / items as given in Schedule B are worked out:

1. **Construction of new / widening of Service road /Slip road**
   Length and width of new / widening of service / slip road quantity is taken from Schedule B. Pavement thickness has considered for 10 MSA traffic for 10 CBR as follows:
   BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm, Subgrade – 500mm.
2. **Reconstruction of existing Service road /Slip road**
   No existing service roads in this package.
3. **Construction of new / widening of culverts / bridges / Grade separated structures**
   As per the schedule B at new and widening of service road locations, widening of culverts are proposed. Detailed quantities of widening / reconstruction of culverts have been arrived based on schedule B provision.
4. **Repair / Rehabilitation of pavement (overlay)**
   Overlay and strengthening layer has calculated as per thickness and location provided in Schedule B and additional rehabilitation work as per Pavement Investigation survey carried out.
5. **Repair / Rehabilitation of structures**
   In schedule B, repair / rehabilitation works to be carried out for all existing bridges, underpasses and culverts is provided. During site investigation, Consultant has mapped required quantity for repair / rehabilitation.
6. **Junction improvement**
   A list of improvements to be carried out at Major / Minor junction has provided in Schedule B. Consultant has prepared Typical Layout Plan for junction development based on IRC SP 84-2014 and quantity calculation arrived accordingly. Pavement thickness for Junction is as follows:
   a) Junction having Flexible Pavement
      Area adjoining to MCW: BC – 40 mm, DBM -60 mm, WMM – 250 mm, GSB – 200 mm.
      Area adjoining to Cross Road - BC – 40 mm, DBM – 60 mm, WMM – 250 mm, GSB -200 mm.
   b) Junction having Rigid Pavement: PQC – Not appliable
7. **Construction of new drain**
   In schedule B list of locations where drain has to be provided is given. It is matching with new service road locations. The drain width of 1.5m having total depth of 1.50 m has considered in quantity calculation.
8. **Road furniture**
   a) Street Lighting – Not applicable
   b) High mast lighting – Not applicable
   c) Crash barriers (flexible / rigid) - quantity in terms of length is considered as per Schedule B.
   d) Guard posts/boundary stones - quantity in terms of nos. is considered as per Schedule B
   e) Pedestrian Guard Rail (PGR) - quantity in terms of length is considered as per Schedule B.
   f) Solar Blinkers - quantity in terms of nos. is considered as given in schedule B
   g) Sign Posts– Overhead gantry sign board has considered as given in schedule B. For shoulder and median mounted sign boards, total requirement for project has worked out and sign boards at site has deducted to arrive required numbers of new sign boards. Also, it is considered that life of retroreflective sheet has exhausted and all existing signs (kerb and shoulder mounted) shall be replaced with new sign board using existing supports.
   h) Hectometer / kilometer stones - quantity in terms of nos. is considered as per site requirement
   i) Road marking – quantity considered along entire length of project road

j) Delineators / road studs – quantity considered as per site requirement based on IRC SP 84-2014.

9. **Construction of Toll plaza Taper Portion as Rigid Pavement**

The existing toll plaza is having flexible pavement on tapper and rigid pavement in central portion therefore additional PQC has been considered. New TMS equipment confirming latest specification to comply Hybrid ETC requirement is considered in costing of TMS.

10. **Landscaping and tree plantation**

The project road is having median plantation and roadside (Avenue) plantation. Therefore, additional quantity is not considered in CAPEX. Maintenance cost for median plantation and avenue plantation has considered in OPEX.

11. **Highway Patrol vehicles, Ambulance, Cranes**

Two numbers at each toll location has been considered.

12. **ATMS / TMS**

Cost estimate for ATMS / TMS has calculated based on quantity required as per IRC SP: 84 – 2014, Schedule B and Circular multiply by rates provided by local vendor.

13. **Slope protection**

As per site investigation, no special slope protection is required other than regular maintenance which is covered under O and M. Therefore, separate cost for slope protection has not considered under this heading.

3.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates provide by the Company as follows:

Bitumen Price @ 16 March 2022	IOCL Chennai		
Bitumen	**Base Price**	**Discount**	**Ex MI price**
VG30	51752	5100	46652
VG40	55232	3800	51432

ii) Aggregates rates as per local market rates
iii) Equipment hire cost as per Standard Data Books published by MORTH
iv) Labour rates as per minimum wages applicable.
v) ATMS, TMS cost is based on offer from vendor.
vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.
vii) Items has breakdown in such a way that cost estimate can be easily established
viii) Computation of quantities for all items covering all the works to be carried out
ix) Calculation of repair and rehabilitation required for structure based on site condition.
x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.
xi) Unit Rate Analysis is based on Year 2022.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Sn	Items Description	Unit	Rates (Rs.)
1	Subgrade	Cum	441
2	Granular Subbase	Cum	1,303
3	Wet mix macadam	Cum	1,644
4	Dense Bituminous Macadam – CAPEX	Cum	10,122
5	Bituminous Concrete	Cum	11,918
6	Pavement Quality Concrete (PQC)	Cum	6,188
7	RCC M 20 for Drain	Cum	6,541
8	Reinforcement Steel	MT	1,12,935
9	Metal "W" Beam crash barrier	Rm	4,297

Note: above unit rates are excluding GST.

3.4 Cost Estimate

Summary of cost for engineering and safety improvements of Project as per requirement of Schedule B and as per survey investigation carried out is as below:

Cost as of 2022/23

S.no	Description	Cost in Rs	Remarks
1	Cost of Strengthening of existing carriageway	0	
2	Cost of Service/Slip road	83,974,269	As per WO PPO/2122/00080 & Invoice No. 4 Dated 18.03.2022
3	Cost of Road Furniture	0	
4	Cost of Drain	2,138,150	
5	Cost of Miscellaneous works	0	
6	Cost of Structure (BOX Culvert and Pipe culvert)	21,966,451	
7	Cost of repairs of existing structures	0	
8	Cost of Toll plaza Improvement	64,826,950	
9	Cost of ATMS	67,990,200	
10	Cost of Hybrid ETC	0	
11	Additional Requirement as per Site condition	0	
	Total	**179,704,839**	
	Add 12% for GST	**21,564,581**	
	Total including GST	**201,269,420**	

Total CAPEX – Rs. 20.12 crore

The detail calculation along with rate analysis and cost estimate is provide in Soft Copy along with this report.

4. MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2028/29	Overlay Thickness as per Pavement Survey and Schedule B	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
2	2035/36	Functional Overlay	30 mm BC in entire length+ DBM 50 mm in 20 % Length	50% Micro-surfacing+ 50% 30mm BC
3	2042/43	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC
4	2049/50	Functional Overlay	30 mm BC in entire length	50% Micro-surfacing+ 50% 30mm BC

4.2 Major Maintenance Quantity

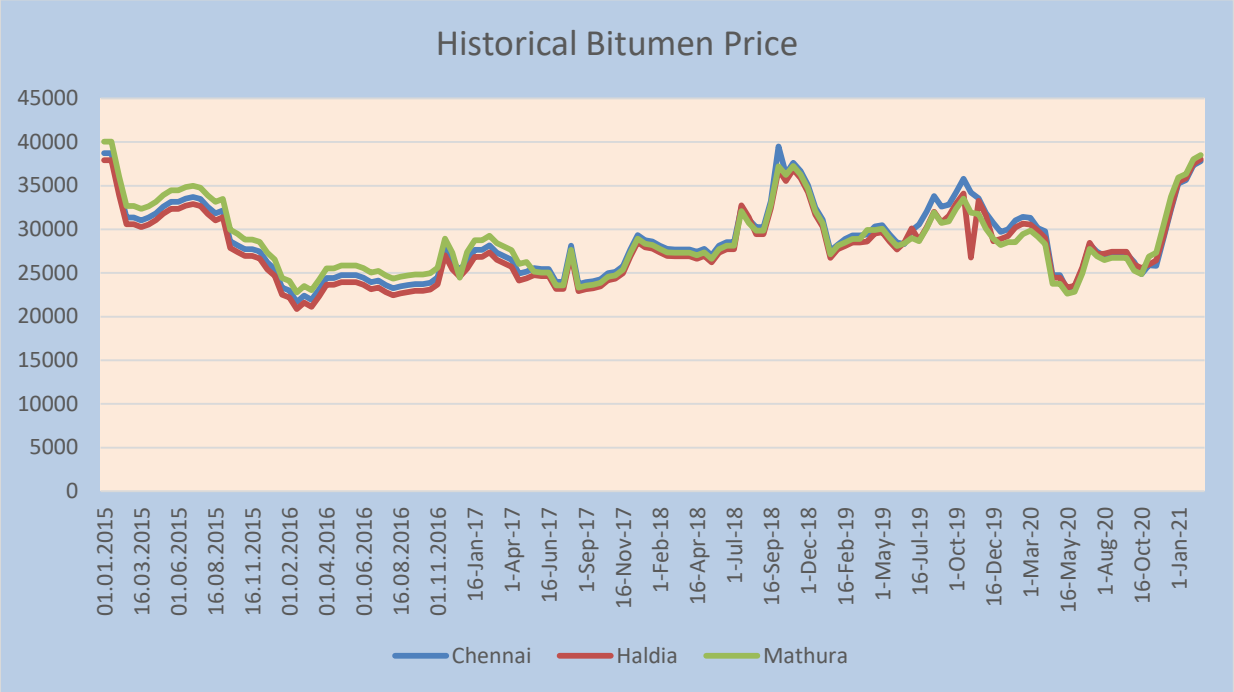
Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Methodology of calculation of unit rate is same as adopted during CAPEX Calculation.
ii) The historical bitumen price from year 2015 to till date is present in below graph.



iii) Based on Company Input, Price of Bitumen for year 2024 onwards is considered as below:

Bitumen	IOCL Chennai		
	Base Price	Discount	Ex MI price
VG30	31835	5100	26735
VG40	35315	3800	31515

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company (Escalation factor applied only on Major Maintenance Cost).

FY	Growth Rate	Cumulative Factor
FY 22	2.83%	1.000
FY 23	4.66%	1.047

FY	Growth Rate	Cumulative Factor
FY 24	5.65%	1.106
FY 25	5.37%	1.165
FY 26	5.52%	1.229
FY 27	5.25%	1.294
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948
FY 38	3.98%	2.026
FY 39	4.00%	2.107
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

v) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

vi) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate as of 2022/23 with bitumen price as stated above

Sn	Items Description	Unit	Rates (Rs.)
1	Dense Bituminous Macadam	Cum	7,572
2	Bituminous Concrete	Cum	8,790
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	22
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1,647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimates each cycle wise is presented below:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Sl. No.	Activity	Unit	Quantity				Unit Rate FY 2022#	Amount			
			2028/29	2035/36	2042/43	2049/50		2028/29	2035/36	2042/43	2049/50
	Main Carriageway - Flexible Pavement										
1	Tack Coat	Sqm	1,174,889	1,409,866	1,174,889	1,174,889	13	14,815,347	17,778,416	14,815,347	14,815,347
2	Bituminous Concrete - VG 40 / CRMB	Cum	35,247	35,247	35,247	35,247	8790	309,833,660	309,833,660	309,833,660	309,833,660
3	Dense Bituminous Macadam - VG 40	Cum		11,749			7572	-	88,959,048	-	-
								-	-	-	-
	Main Carriageway - Rigid										
1	Replacement of PQC Slab (1 %) in Every Fifth Year	Cum						-	-	-	-
2	Joint sealant replacement every 5th Year (5 %)	m	1,676	1,676	1,676	1,676	220	368,762	368,762	368,762	368,762
	Service Road										
1	Tack Coat	Sqm	150,883	150,883	150,883	150,883	13	1,902,635	1,902,635	1,902,635	1,902,635
2	DBM - VG 30	Cum						-	-	-	-
3	BC - VG 30	Cum	4,526	4,526	4,526	4,526	8040	36,392,811	36,392,811	36,392,811	36,392,811
4	Microsurfacing	Sqm	150,883	150,883	150,883	150,883	176	26,555,417	26,555,417	26,555,417	26,555,417
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)										
1	Tack Coat	Sqm	13585	13585	13585	13585	13	171,309	171,309	171,309	171,309
2	Bituminous Concrete - VG 40 / CRMB	Cum	408	408	408	408	8790	3,582,583	3,582,583	3,582,583	3,582,583
3	Dense Bituminous Macadam VG-40	Cum						-	-	-	-
4	Milling of existing Wearing Coat	Sqm	13585	13585	13585	13585	77	1,046,056	1,046,056	1,046,056	1,046,056
5	Painting of Crash Barrier	sqm					121	-	-	-	-
6	Microsurfacing	Sqm					176	-	-	-	-
	Other Works							-	-	-	-
1	Raising of Road Kerb	m		208,000		208,000	439.00	-	91,312,044	-	91,312,044
2	Replacement of Road Studs							-	-	-	-
	Road Studs	Nos	42,354	42,354	42,354	42,354	220	9,317,880	9,317,880	9,317,880	9,317,880
	Solar Studs	Nos	466	466	466	466	1647	767,502	767,502	767,502	767,502
3	Painting of Road Kerb	Sqm	78,000	78,000	78,000	78,000	121	9,438,005	9,438,005	9,438,005	9,438,005
4	Road Marking - MCW	Sqm	68658	68658	68658	68658	439	30,140,807	30,140,807	30,140,807	30,140,807
5	Shoulder Filling (40 to 50 mm)	Sqm	127000	127000	127000	127000	22	2,794,000	2,794,000	2,794,000	2,794,000
6	Median Filling	Cum	7620	7620	7620	7620	439	3,345,180	3,345,180	3,345,180	3,345,180
7	Cost for fixing Other CA Issue at Handback Time	LS									27,089,200
8	PMC Cost for Overlay @ 20 lakh per month	Month	8	8	8	8	2,000,000	16,000,000	16,000,000	16,000,000	16,000,000
	Major Maintenance Cost Per Year							466,471,953	649,706,114	466,471,953	584,873,196
	Major Maintenance Cost Per Year with GST							522,448,587	727,670,848	522,448,587	655,057,980
						Amount in Crore		52.24	72.77	52.24	65.51
	Escalation Factor							1.417	1.874	2.464	3.240
	Esclated Amount keping Bitumen Component w/o Escalation							66.66	116.63	102.83	172.62
						# - considering Bitumen Price of 2024					

5. OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 15 – Operation &Maintenance & Schedule – F Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 15 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule F. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule F of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-F (the “Maintenance Requirements”). The Maintenance requirement as per Schedule F is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAl and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-H' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-F.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule F. Optimized staff requirement at

Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 13,592/ km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 9,723 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 10.98 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	3.26	104,284	339,966
2	Highway Lighting Electricity Charge	Kwh	447,198	10.98	4,909,014
3	Operation and Maintenance of DG Set	Nos	1	112,188	112,188
4	Solar Blinker	Nos	4	3,293	11,855
	Total				**53,73,024**

5.5 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is **1.39 crore** per year and additional cost of **27.32 crore** for replacement of equipment at every 7 (seven) years.

5.6 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 15.5 of CA
b) Traffic Aid Post with 1 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 18.2 of CA

O & M Cost estimated towards incident management with operation manpower is **Rs. 1.95 crore** per year including GST.

5.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.

The cost of manpower is estimated as **Rs. 3.06 core (FY 23)** per year.

5.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is **Rs. 2.39 crore (FY 23)** per year.

Year wise O & M Cost (OPEX) is presented in next pages.

Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	6,002,274	11,600,121	5,373,024	12,198,255	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	120,481,323
3	2023-24	8,942,467	11,600,121	5,373,024	14,840,322	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	126,063,584
4	2024-25	10,555,412	11,600,121	5,373,024	16,601,701	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	129,437,907
5	2025-26	12,090,071	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	132,733,944
6	2026-27	12,694,574	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	133,338,448
7	2027-28	13,075,411	11,600,121	5,373,024	76,094,768	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	191,450,974
8	2028-29	3,901,047	11,600,121	5,373,024	10,436,876	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	116,618,718
9	2029-30	6,002,274	11,600,121	5,373,024	12,198,255	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	120,481,323
10	2030-31	8,942,467	11,600,121	5,373,024	14,840,322	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	126,063,584
11	2031-32	10,555,412	11,600,121	5,373,024	16,601,701	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	129,437,907
12	2032-33	12,090,071	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	132,733,944
13	2033-34	12,694,574	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	133,338,448
14	2034-35	13,075,411	11,600,121	5,373,024	76,094,768	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	191,450,974
15	2035-36	3,901,047	11,600,121	5,373,024	10,436,876	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	116,618,718
16	2036-37	6,002,274	11,600,121	5,373,024	12,198,255	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	120,481,323
17	2037-38	8,942,467	11,600,121	5,373,024	14,840,322	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	126,063,584
18	2038-39	10,555,412	11,600,121	5,373,024	16,601,701	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	129,437,907
19	2039-40	12,090,071	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	132,733,944
20	2040-41	12,694,574	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	133,338,448
21	2041-42	13,075,411	11,600,121	5,373,024	76,094,768	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	191,450,974
22	2042-43	3,901,047	11,600,121	5,373,024	10,436,876	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	116,618,718
23	2043-44	6,002,274	11,600,121	5,373,024	12,198,255	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	120,481,323
24	2044-45	8,942,467	11,600,121	5,373,024	14,840,322	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	126,063,584
25	2045-46	10,555,412	11,600,121	5,373,024	16,601,701	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	129,437,907
26	2047-48	12,090,071	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	132,733,944
27	2048-49	12,694,574	11,600,121	5,373,024	18,363,079	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	133,338,448
28	2049-50	3,901,047	11,600,121	5,373,024	76,094,768	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	182,276,609
29	2050-51	6,002,274	11,600,121	5,373,024	10,436,876	26,098,712	1,778,318	30,694,650	2,634,545	24,101,425	118,719,944
	Total	**261,971,885**	**324,803,381**	**150,444,664**	**667,592,317**	**730,763,928**	**49,792,904**	**859,450,188**	**73,767,273**	**674,839,907**	**3,793,426,448**
Total Cost in Crore		**26.20**	**32.48**	**15.04**	**66.76**	**73.08**	**4.98**	**85.95**	**7.38**	**67.48**	**379.34**

6. HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a **Salaipudhur Madurai** section of NH 44 from Madurai to Kanyakumari. Project road starts from Km 116+500 at Kayattur to Km 180+000 near Munanthurai in the state of Tamilnadu. The total length of the project road is 63.50 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Tolling, operation, maintenance & transfer of Madurai Kanyakumari Section of NH – 44 Package-3 on TOT Basis in the State of Tamilnadu	116+500	180+000	63.50	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.

Start Point of Project Road at Km 116+500

End Point of Project Road at Km 180+000

Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	**Project Road Start**	Km 116+500 at Kayattur of NH-44 (Old NH-7)	Km 116+500 at Kayattur of NH-44 (Old NH-7)
2	**Project Road End**	Km 180+000 at Munanthurai of NH-44 (Old NH-7)	Km 180+000 at Munanthurai of NH-44 (Old NH-7)
3	**Project Length**	63.50 Km	63.50 Km
6	**Carriageway**	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	**Shoulders**	1 m to 2 m earthen for MCW	1 m to 2 m earthen for MCW
8	**Median**	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	**Service Roads**	42.534 Km	LHS: 21.08 Km RHS: 21.85 Km
10	**Major Bridge**	5 No.	5 No.
11	**Minor Bridge**	17 Nos.	17 Nos.
12	**Pipe, Box & Slab Culverts**	110 Nos.	110 Nos.
13	**Major/Minor Junctions**	10 Minor	10 Minor
14	**Underpass**	16 VUP	16 VUP
15	**Grade Separator**	1 No	1 No
15	**ROB/RUB**	3 No	3 No
16	**Toll Plazas**	1 No	1 No
17	**Truck Lay-byes/Truck Parking**	2 No	2 No
18	**Bus Shelter**	17 Bus Bay and 17 Bus Shelter	17 Bus Bay and 17 Bus Shelter

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

Typical Cross Section having Service Road	Typical Section of Approach
Typical Rural Section	Toll Plaza

6.2.2 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length Km
	From	To	LHS	RHS	
1	116+500	125+595	BT	BT	9.095
2	125+595	125+645	CC	CC	0.05
3	125+645	180+000	BT	BT	54.355

Flexible Pavement

Rigid Pavement

6.2.3 Service Roads

As per Schedule A of CA 42.534 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 42.93 Km length of service road has been observed on site. Condition of service road is fair. As per Schedule B new service road vary from 7.0 m to 7.5 m width has been proposed for the length of 3020 m.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in fair to poor condition.

24 nos. of authorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers and railing/safety barrier at narrow median near median opening throughout the project is not provided except at few locations.

Typical 1.5 m wide median	4.5m wide Median

6.2.5 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order, silt deposit need to be cleared through routine maintenance. Total 5.738 Km of covered/open line side drain is found on site. Median drain has observed in 1.27 Km at site. The condition of the same is good to fair.

RCC Covered Drain at Project Road	Median Cut Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 10 minor junctions are present in project road. Minor junctions were generally present for access to nearby villages, towns, or agricultural areas.

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.

Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	14.204
	Median	1.572
Pedestrian Guard Rail	Carriageway Edge	1.708

PGR and W-Beampresent on the project road

6.2.8 Toll Plaza and Other Facilities

There is one existing toll plaza at KM 125+620 at Salaipudhur with the configuration 2 x (4+1). This has 9 single toll booths, canopy, 3 user fee boards only. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion. Sch-B states within 12 months these works to be completed. As per Sch-B toll plaza taper portion is to be constructed as rigid pavement as per IRC SP – 84: 2014.

The Details of Toll plaza are given below.

1. Centre of Toll Plaza : Km 125+620.
2. Start of Taper : Km 125+400
3. Start of Straight : Km 125+585
4. End of Straight : Km 125+665
5. End of Taper : Km 125+850
6. Taper in Length : 185.0m
7. Taper Out Length : 185.0m
8. Total Length of Toll Plaza : 50-60m (Including Rigid Pavement)
9. Lanes at Toll Plaza : 1+4+4+1 (10 Lanes, 5 lanes in each carriageway)

The Concessionaire has running the operation at the toll plaza with temporary iron cabins as there is no admin building in the project highway.

Toll Plaza Taper

Toll Plaza -Toll lane

6.2.9 Highway Lighting

Highway Lighting has been provided at approaches to toll plaza and urban section . Additionally, 3 High Mast has provided at Toll Plaza, major junction and flyover. 47 Nos. Double Arm poles has been provided at site.

Highway Lighting Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	117+286	Median	1	Double Arm	Working
2	117+286	Median	1	Double Arm	Working
3	120+800	Median	1	Double Arm	Working
4	122+700	Median	1	Double Arm	Working
5	124+200	Median	1	Double Arm	Working
6	124+800	Median	1	Double Arm	Working
7	126+800	Median	1	Double Arm	Working
8	134+770	Median	1	Double Arm	Working
9	139+560	Median	1	Double Arm	Working
10	139+580	Median	1	Double Arm	Working
11	142+000	Shoulder	1	Double Arm	Working
12	141+900	Shoulder	1	Double Arm	Working
13	142+030	Median	1	Double Arm	Working
14	146+900	Median	1	Double Arm	Working
15	154+280	Median	1	Double Arm	Working
16	164+800	Median	1	Double Arm	Working
17	117+135	Divider	1	Double Arm	Working
18	117+160	Divider	1	Double Arm	Working
19	117+185	Divider	1	Double Arm	Working
20	117+210	Divider	1	Double Arm	Working
21	117+235	Divider	1	Double Arm	Working
22	117+260	Divider	1	Double Arm	Working
23	117+285	Divider	1	Double Arm	Working
24	117+310	Divider	1	Double Arm	Working
25	117+335	Divider	1	Double Arm	Working
26	117+360	Divider	1	Double Arm	Working
27	117+385	Divider	1	Double Arm	Working
28	117+410	Divider	1	Double Arm	Working
29	117+435	Divider	1	Double Arm	Working
30	117+460	Divider	1	Double Arm	Working
31	117+485	Divider	1	Double Arm	Working
32	117+510	Divider	1	Double Arm	Working
33	117+535	Divider	1	Double Arm	Working

SN	Existing Chainage From	Side	Nos.	Type	Condition
34	117+560	Divider	1	Double Arm	Working
35	117+585	Divider	1	Double Arm	Working
36	117+610	Divider	1	Double Arm	Working
37	117+635	Divider	1	Double Arm	Working
38	117+660	Divider	1	Double Arm	Working
39	117+685	Divider	1	Double Arm	Working
40	117+710	Divider	1	Double Arm	Working
41	117+735	Divider	1	Double Arm	Working
42	117+760	Divider	1	Double Arm	Working
43	117+785	Divider	1	Double Arm	Working
44	117+810	Divider	1	Double Arm	Working
45	117+835	Divider	1	Double Arm	Working
46	117+860	Divider	1	Double Arm	Working
47	117+885	Divider	1	Double Arm	Working

High Mast Location

SN	Existing Chainage From	Side	Nos.	Type	Condition
1	139+570	LHS	1	High mast	Working
2	145+260	RHS	1	High mast	Working
3	159+070	RHS	1	High mast	Working

High Mast Light

Highway Lighting

6.2.10 Bus Bays and Bus Shelter

There are 17 Bus Bay and 17 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter	Bus Bay with Bus Shelter

6.2.11 Signage and Marking

Road Signs

681 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Route Marker Board on the Project Road	Sign Board fixed at Project Road

Sl. No.	Sign Type	Approx. Nos.	Condition	Remarks
1	90 cm equilateral triangle	171	Fair	Approx. 6 to be replaced
2	60 cm equilateral triangle			
3	60 cm circular	47	Fair	Approx. 2 to be replaced
4	75 cm circular			
5	Route Marker	5	Good	
6	60 cm x 45 cm rectangular	65	Fair	Approx. 15% to be Faded
7	60 cm x 60 cm square			
8	Chevron sign	351	Fair	Approx. 15 to be replaced
9	Accident Zone sign	19	Fair	Approx. 2 to be replaced
10	90 cm high octagon (Stop)	3	Good	All stop sign are on service road
11	60 cm high octagon (Go Slow)	9	Good	
12	Overhead Gantry Sign	4	Poor	Approx. 1 to be replaced
13	Cantilever Gantry Sign	9	Good	
Total		**681**		

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road marking along the carriageway

6.2.12 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is Not good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road	Plantation at 4.5 m Median

6.3 Inventory and Condition Survey of Structures

6.3.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc**.** and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 5 no of Major Bridge having total length varies from 72 m to 220 m are generally found in good condition.
- 17 nos. of Minor bridges having total length varies from 9.5 m to 22.5 m are generally found in good condition.
- 16 nos. of Underpass, mostly having span arrangement of 1 x 10, are found in good condition.
- 3 nos. of Railway over Bridge are in good condition
- 1 no of Flyover of total length of 200 m having span arrangement of 20+30+5x20+30+20m is found in good condition
- 110 (pipe/slab/box) nos. of culverts found at site

6.3.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.127+850

It consists of bridge on both side carriageways. Both the bridges have span arrangement of 6x17 m. The super structure comprises of RCC T- Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. **The existing bridge is using as underpass.**

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc.

A few pictures to ascertain the conditions of Major Bridge are presented as follows:

Super struvture in condition

Span Arrangement

Major Bridge at Ch. 127+850

b) Major Bridge – CH.130+100

It consists of bridge on both side carriageways. Both the bridges have span arrangement of 11x17.3 m. The super structure comprises of RCC T- Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. Repairing of wearing coat and joint is to be done with urgent basis. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Poor Expansion joint

Minor Bridge at Ch. 130+100

c) Major Bridge – CH.131+600

It consists of bridge on LHS and RHS carriage way. LHS bridge has Span arrangement of 9x8.0m. The super structure comprises of RCC Slab, and it is resting on RCC Wall type abutment & Pier.

RHS bridge has Span arrangement of 5x18.7m. The super structure comprises of RCC T-Girder. Elastomeric bearings are used for the resting of super structure on RCC Wall type abutment & Pier. Only RCC railings are provided without any crash barrier which is not acceptable. Wearing coat is in poor condition, it also requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. The other conditions of the bridge are good. A few pictures showing conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Major Bridge at Ch. 131+600

d) Major Bridge – CH.139+450

It consists of bridge on LHS and RHS carriage way. LHS bridge has Span arrangement of 15x12.0m. The super structure comprises of RCC T-Girder. Superstructure is resting on RCC Wall type abutment & Pier.
RHS bridge has Span arrangement of 7x24.0m. The super structure comprises of RCC T-Girder. Superstructure is resting on RCC Wall type abutment & Pier.
Wearing coat is in poor condition, It also requires regular repair works such painting and repairing of RCC railing, repairing of drainage spouts etc. The other conditions of the bridge are good. A few pictures showing conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Major Bridge at Ch. 139+450

e) Major Bridge – CH.153+800

It consists of bridge on both the Carriage way. Both the bridge has a span arrangement of 11x20.0m. The super structure comprises of RCC T-Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment & Pier. Parapet wall which had constructed between the median opening in the direction of the traffic, had broken and needs to be repaired immediately. It only requires minor repairing's like repair of crash barrier, cleaning of drainage spout etc. wearing coat and other conditions of the bridge are good. A few pictures showing conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 153+800

Minor Bridge

Salient features along with condition of 17 Minor bridges are discussed here ..

a) Minor Bridge – CH.118+440

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 4x5.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat and other general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 118+440

b) Minor Bridge – CH.118+640

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 3x4.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. The general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carraige Way

Span arrangement

Minor Bridge at Ch. 118+640

c) Minor Bridge – CH.122+110

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x6.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. W Beam crash barrier has to be repaired. The other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 122+110

d) Minor Bridge – CH.123+210

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x5.4m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat needs to be repaired. The general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of the Carriage Way

Span arrangement

Minor Bridge at Ch. 123+210

e) Minor Bridge – CH.125+510

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x6.8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Slope pitching is in poor condition. W beam crash barrier needs to be repaired. Wearing coat and other general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

Poor Slope Pitching

View of carriage way

Minor Bridge at Ch. 125+510

f) Minor Bridge – CH.129+100

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x9.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. RCC railing, slope pitching and wearing coat are in good condition. The other conditions of the bridge are also good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 129+100

g) Minor Bridge – CH.139+090

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x8m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Wearing coat needs to be repaired. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 139+090

h) Minor Bridge – CH.140+400

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x6.7m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat needs to be repaired. Cleaning of drainage spouts and repairing of RCC railing is required. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 140+400

i) Minor Bridge – CH.148+700

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 3x4.75m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat needs to be repaired. It requires painting and repairing of RCC railings. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 148+700

j) Minor Bridge – CH.151+700

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 2x410m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Parapet wall is not constructed between the median opening in the direction of the traffic. Wearing coat and slope pitching are in fair condition. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

Slab reinforcment exposed

Span Arrangement

Minor Bridge at Ch. 151+700

k) Minor Bridge – CH.152+000

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Wearing coat is in fair condition. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arangement

Minor Bridge at Ch. 152+000

l) Minor Bridge – CH.154+550

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Wearing coat is in fair condition. Other general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 154+550

m) Minor Bridge – CH.156+210

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Wearing coat needs to be repaired. Minor repairing and painting of RCC railing is required. The Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 156+210

n) Minor Bridge – CH.156+450

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 3x7.5m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment & Pier. Wearing coat and slope pitching are in fair condition. Other conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 156+450

o) Minor Bridge – CH.157+650

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. The general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 157+650

p) Minor Bridge – CH.166+012

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment. Wearing coat and slope pitching is in fair condition. It requires works like repairing of Parapet wall constructed between the median opening in the direction of the traffic, Cleaning of drainage spouts etc. The general conditions of the bridge are good. A few pictures showing the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 166+012

q) Minor Bridge – CH.166+350

It consists of bridge on both LHS and RHS carriage way. Both bridges have Span arrangement of 1x10m. The super structure comprises of RCC solid slab. Superstructure is resting on RCC Wall type abutment.

View of Carriageway

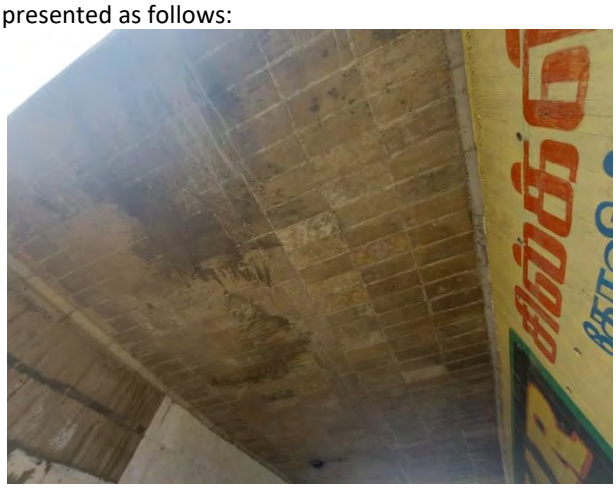
Minor Bridge at Ch. 166+350

Under-Passes (UPs)

There is a total of 16 UPs has been provided. Most of the UPs are single span of 1 x 10 m with RCC Box Type structure. Clear height of these underpass is 3.5 to 4 m as per Schedule B.
UPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

Span arrangement



Superstructure is in fair condition

UP at Ch. 127+600

Super structure in fair condition

Span Arrangement

UP at Ch. 130+730

Span Arrangement

Super structure is in fair condition

UP at Ch. 148+860

Super structure is in fair condition

Span Arrangement

UP at Ch. 149+130

Super structure in fair condition **Span Arrangement**

UP at Ch. 150+190

Super structure in fair condition **Span Arrangement**

UP at Ch. 153+630

Super structure in fair condition **Span Arrangement**

UP at Ch. 161+390

Railway over Bridge (ROBs)

a) ROB at Ch. 150+600

It consists of bridge on LHS and RHS carriage way over railway tracks. Both ROB has a span arrangement of 1x33.3m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash Barrier, repairing of drainage spouts, etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

ROB at Ch. 150+600

b) ROB at Ch. 161+520

It consists of bridge on LHS and RHS carriage way over railway tracks. Both ROB has a span arrangement of 1x27.3m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment.

The general condition of the bridge is good. Cleaning of the drainage spout is required. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Expansion joint in poor condition

Slope pitching is in good condition

ROB at Ch. 161+520

c) ROB at Ch. 150+600

It consists of bridge on LHS and RHS carriage way over railway tracks. The LHS ROB has a span arrangement of 3x22.10+26.70+22.10 m. The super structure comprises of PSC Girder. Elastomeric bearings are adopted for resting of superstructure on PCC wall type abutment and pier. The RHS ROB has a span arrangement of 1x12.14m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash barrier, repairing and cleaning of drainage spouts etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Expansion joint in fair condition

Slope pitching is in condition

ROB at Ch. 179+380

Grade Separators (Flyover)

Grade Separator at Ch. 159+400

It consists of flyover on both carriageways. It has a span arrangement of 20+30+5x20+30+20 m. The super structure comprises of RCC I-Girder. POT – PTFE bearings are adopted for resting of superstructure on RCC Wall type abutment.

The general condition of the bridge is good. It requires regular repair works such painting and repairing of RCC Crash Barrier, repairing of drainage spouts etc. As periodic maintenance, replacement of elastomeric strip seal and wearing coat is required after certain time.

A few pictures showing conditions of Grade Separator are presented as follows: -

Super structure is in fair condition

Span Arrangement

Flyover at Ch. 159+400

Culverts:

There are 110 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

A few pictures to ascertain the conditions of Slab/Box Culverts are presented as follows:

6.3.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	**Good**	No immediate Repair / Maintenance Works Required
●	**Fair / Satisfactory**	Minor Repair Works Required
●	**Poor**	Major Repair Works or Replacement of components Required
N/A	**Not Applicable**	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
1	127+850	LHS	6x17	10.50	**MJB**	Y	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	6x17	10.50			●	●	●	●	●	●	●	●	●		●	**Stable**	
2	130+100	LHS	11x17.3	10.50	**MJB**	Y	●	●	●	●	●	●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches	Drainage Spouts		
		RHS	11x17.3	10.50			●	●	●	●	●	●	●	●	●		Stable	
3	131+600	LHS	9x8	11.00	**MJB**	Y	●	●	●	●	●	●	●	●	●		Stable	
		RHS	5x18.7	10.50			●	●	●	●	●	●	●	●	●		Stable	
4	139+450	LHS	15x12	11.00	**MJB**	Y	●	●	●	●	●	●	●	●	●	●	Stable	
		RHS	7x24	10.50			●	●	●	●	●	●	●	●	●	●	Stable	
5	153+800	LHS	11x20	10.50	**MJB**	Y	●	●	●	●	●	●	●	●	●	●	Stable	
		RHS	11x20	10.50			●	●	●	●	●	●	●	●	●	●	Stable	
6	118+440	LHS	4x5.8	8.50	**MNB**	Y	●	●	●			●	●	●	●	●	Stable	
		RHS	4x5.8	13.50			●	●	●			●	●	●	●	●	Stable	
7	118+640	LHS	3x4.8	8.50	**MNB**	Y	●	●	●			●	●	●	●	●	Stable	
		RHS	3x4.8	13.50			●	●	●			●	●	●	●	●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
8	122+110	LHS	2x6.5	8.50	**MNB**	Y	●	●	●			●	●	●	●		●	**Stable**	
		RHS	2x6.5	13.50			●	●	●			●	●	●	●		●	**Stable**	
9	123+210	LHS	2x5.4	8.50	**MNB**	Y	●	●	●			●	●	●	●		●	**Stable**	
		RHS	2x5.4	10.00			●	●	●			●	●	●	●		●	**Stable**	
10	125+510	LHS	2x6.8	8.50	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	
		RHS	2x6.8	12.00			●	●	●			●	●	●	●			**Stable**	
11	129+100	LHS	1x9.5	10.00	**MNB**	Y	●	●	●			●	●	●	●		●	**Stable**	
		RHS	1x9.5	10.00			●	●	●			●	●	●	●		●	**Stable**	
12	139+090	SR+LHS	2x8	8+12.9	**MNB**	Y	●	●	●			●	●	●	●		●	**Stable**	
		RHS+SR	2x8	10+8			●	●	●			●	●	●	●		●	**Stable**	
	140+400	SR+LHS	2x6.7	8+11.1	**MNB**	Y	●	●	●			●	●	●	●			**Stable**	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
13		RHS+SR	2x6.7	10+8			●	●	●			●	●	●	●			Stable	
14	148+700	SR+LHS	3x4.75	8+9.75	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS+SR	3x4.75	11+8			●	●	●			●	●	●	●			Stable	
15	151+700	LHS	2x10	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	2x10	10.00			●	●	●			●	●	●	●			Stable	
16	152+000	LHS	1x10	10.50	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.50			●	●	●			●	●	●	●			Stable	
17	154+550	LHS	1x10	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.00			●	●	●			●	●	●	●			Stable	
18	156+210	LHS	1x10	10.50	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.50			●	●	●			●	●	●	●			Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
19	156+450	LHS	3x7.5	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	3x7.5	10.00			●	●	●			●	●	●	●			Stable	
20	157+650	LHS	1x10	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
		RHS	1x10	10.00			●	●	●			●	●	●	●			Stable	
21	166+012	LHS	1x10	10.00	MNB	Y	●	●	●			●	●	●	●			Stable	
22		RHS	1x10	10.00			●	●	●			●	●	●	●			Stable	
23	166+350	LHS	1x10	10.00	MNB	Y													
		RHS	1x10	10.00															

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
24	127+600	LHS	2x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	2x10	25.0			●	●	●			●	●	●	●		●	Stable	
25	128+210	LHS	1x10	10	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	10			●	●	●			●	●	●	●		●	Stable	
26	130+730	LHS	2x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	2x10	25.0			●	●	●			●	●	●	●		●	Stable	
27	140+700	LHS	1x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	25.0			●	●	●			●	●	●	●		●	Stable	
28	148+860	LHS	2x10	20.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	2x10	20.0			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
29	149+130	LHS	1x10	20.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	20.0			●	●	●			●	●	●	●		●	Stable	
30	150+190	LHS	2x10	20.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	2x10	20.0			●	●	●			●	●	●	●		●	Stable	
31	151+125	LHS	1x5.5	32.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x5.5	32.0			●	●	●			●	●	●	●		●	Stable	
32	153+630	LHS	1x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	25.0			●	●	●			●	●	●	●		●	Stable	
33	157+050	LHS	1x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	25.0			●	●	●			●	●	●	●		●	Stable	
34	158+260	LHS	1x10	24.0	UP	NA	●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
		RHS	1x10	24.0			●	●	●			●	●	●	●		●	Stable	
35	161+390	LHS	1x12.7	27.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x12.7	27.0			●	●	●			●	●	●	●		●	Stable	
36	162+710	LHS	1x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	25.0			●	●	●			●	●	●	●		●	Stable	
37	166+650	LHS	1x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	25.0			●	●	●			●	●	●	●		●	Stable	
38	169+475	LHS	2x10	25.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	2x10	25.0			●	●	●			●	●	●	●		●	Stable	
39	171+780	LHS	1x10	20.0	UP	NA	●	●	●			●	●	●	●		●	Stable	
		RHS	1x10	20.0			●	●	●			●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)	Structure	Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
40	182+050	LHS	1X36.0	12.5	**FO**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1X36.0	12.5			●	●	●	●	●	●	●	●	●		●	**Stable**	
41	150+600	LHS	1x33.3	10	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1x33.3	10			●	●	●	●	●	●	●	●	●		●	**Stable**	
42	161+520	LHS	1x27.3	12.5	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1x27.3	12.5			●	●	●	●	●	●	●	●	●		●	**Stable**	
43	179+380	LHS	3x22.10+26.70 +22.10	12.5	**ROB**	NA	●	●	●	●	●	●	●	●	●		●	**Stable**	
		RHS	1x12.14	10.5			●	●	●	●	●	●	●	●	●		●	**Stable**	

AECOM Imagine it. Delivered.

TECHNICAL DUE DILIGENCE REPORT

Western UP Tollways Limited

Report Number:

ACM-60655667-TDD-WUPTL-001-R0

Date:

June, 2022

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Western UP Tollways Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Western UP Tollways Limited**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Western UP Tollways Ltd

5th Floor, OSE Commercial Block,
Hotel Aloft, Asset 5B,
Aerocity Hospitality District,IGI Airport
New Delhi – 110037

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

LIST OF ABBREVIATION II

1. EXECUTIVE SUMMARY 3

1.1 Basis of Preparation 3
1.2 Overview of the Project 4
1.3 Key Findings 5
1.4 Asset Condition 9
1.5 Toll Plaza and TMS 11
1.6 Change of Scope (COS) 12
1.7 Balance Work 12
1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement 12
1.9 Insurance 13
1.10 Introduction of Asset 15
1.11 Review of Pavement 17
1.12 Major Maintenance 20
1.13 Operation & Maintenance Works 21
1.14 Major Maintenance Cost 23
1.15 List of Document Reviewed 23

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS 25

2.1 Background 25
2.2 Pavement Design 25
2.3 Survey and Investigations 26
2.4 Determination of Pavement Major Maintenance 34

3 CAPEX REQUIREMENT 36

4 MAJOR MAINTENANCE COST 37

4.1 Major Maintenance Cycle 37
4.2 Major Maintenance Quantity 37
4.3 Unit Rate Analysis 37
4.4 Cost Estimate 40

5 OPERATION AND MAINTENANCE COST 42

5.1 Introduction 42
5.2 Forecast Methodology 42
5.3 Requirement of CA (Schedule L and Concession Agreement) 43
5.4 Routine and Preventive Maintenance 43
5.5 Highway Lighting 44
5.6 TMS Cost and ATMS 44
5.7 Corridor Management 44
5.8 Manpower Cost 45
5.9 Office Expenses 45

6 PROJECT ROAD ANALYSIS 47

6.1 Reconnaissance Survey 47
6.2 Road Inventory and Condition Survey 47
6.3 Toll Plaza and Associated Facilities 62
6.4 Inventory and Condition Survey of Structures 66

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract	FWD	Falling Weight Deflectometer
ATMS	Advanced Traffic Management System	GAD	General Arrangement Drawing
BC	Bituminous Concrete	GSB	Granular Sub-base
BHS	Both Hand Side	GST	Goods and Services Tax
BI	Bump Integrator	HSYD	High Yielding Strength Deformed
BOQ	Bill of Quantity	INR	Indian Rupees
BT	Bituminous Top	IRC	Indian Road Congress
CA	Concession Agreement	ITM	Integrated Traffic Management
CAPEX	Capital Expenditures	KVA	Kilo-Volt-Ampere
CC	Control Centre	LCV	Light Commercial Vehicle
CCTV	Closed Circuit Television Systems	LED	Light Emitting Diode
CMSA	Cumulative Million Standard Axles	LHS	Left Hand Side
COS	Change of Scope	LIU	Light Interface Units
COD	Commercial Operation Date	LVUP	Light Vehicular Underpass
CUP	Cattle Underpass	MAV	Multi Axle Vehicle
DBM	Dense Bituminous Macadam	MCA	Model Concession Agreement
DG	Diesel Generator	MCW	Main Carriageway
DLC	Dry Lean Concrete	MDS	Metrological Data System
ECB	Emergency Call Box	MET	Meteorological
EPC	Engineering, Procurement, and Construction	MIS	Management Information System
ESAL	Equivalent Standard Axle Load	MJB	Major Bridge
ETC	Electronic Toll Collection	MNB	Minor Bridge
EW	East West	MoRTH	Ministry of Road Transport and Highways
FO	Flyover	MSA	Million Standard Axles
FOB	Foot Over Bridge	MT	Metric Ton

NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam
WUPTL	Western UP Tollway Limited

DUE DILIGENCE REPORT

1. EXECUTIVE SUMMARY

1.1 Basis of Preparation

1.1.1 General

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Western UP Tollways Limited ("WUPTL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

M/s Cube Highways and WUPTL (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Meerut – Muzaffarnagar of NH – 58 on BOT Basis in the State of Uttar Pradesh (herein after refer as "the Project") which is being operated by "M/s Western UP Tollway Limited" (hereinafter refer as "the Concessionaire or Company or WUPTL").

1.1.2 Scope of Works

This report is prepared as per scope of work defined in Work Order and directed in various meeting to include in report by the Client and test report provided to us. Our work, which is summarized in this Due Diligence Report, has been limited to matters which we have identified that would appear to us to be of significance within the context of our scope. This report is prepared based on visual condition survey of highway and structures and test report provided by the Client.

In this report, AECOM provides an overview of the asset based on site survey on Year 2020 from technical perspective, comparison between scope of works as per contract and executed at site, review of operation and maintenance approach adopted by the Client, review of Major Maintenance (MM) approach and methodology and balance work if any.

Further documents / test report received from Cube highways and accordingly report is updated as Mar 2022.

1.1.3 Sources of Information

AECOM has reviewed the information uploaded by the Client in the electronic data room. Primarily the following documents have been studied:

a) Project Document

- Documents from Concessionaire
- Concession Agreement
- Schedule A, B, C and D
- Pavement Design Report
- Plan and Profile
- PCOD Letter / COD Letter
- Change of Scope Document
- O and M Cost
- Major Maintenance Cost
- Monthly Progress Report prepared by IE
- Test Report
- Traffic Data

b) Test Report
- Axle Load Survey Data with VDF
- NSV Survey Data
- FWD Test Report with analysis
- Test Pit and Core Test Report

Apart from data room, information / data provided thorough email has also reviewed and included in this report.

1.1.4 Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1.2 Overview of the Project

Agreement was signed between National Highways Authority of India (NHAI) and M/s Western UP Tollway Limited (WUTL, a Company promoted and incorporated by M/s Nagarjuna Construction Company Limited and M/s Maytas Infra Private Limited on 9 Sep 2005 for Improvement, Operation and Maintenance, Rehabilitation and Strengthening of the existing 2-lane and widening it to 4-lane divided highway of KM 52.250 to KM 131.560 of NH-58 Meerut – Muzaffarnagar Section in the state of Uttar Pradesh on BOT Basis (hereinafter called "the Project"). We understand that Cube Highways Group acquired the SPV WUTL in the year 2016 and has been operating the project road since year 2016.

Project Corridor	Four Laning of Meerut - Muzaffarnagar Section of NH – 58) on BOT Basis in the State of Uttar Pradesh
Employer	National Highways Authority of India, Ministry of Road, Transport and Highways

Concessionaire	Western UP Tollway Limited (WUTL)
Independent Engineer (During O & M)	M/s Lea Associate South Asia Pvt. Ltd.
EPC Contractor	M/s Nagarjuna Construction Company Limited M/s Gayatri Project Limited
Project Road Length	78 km
Project Cost	551 Crore (as per IE MPR Sep 2019)
Grant	127.80 crores
Date of Concession Agreement	9 Sep 2005
Appointed Date	07 Mar 2006
Concession Period	20 years including Construction Period
Construction Period	36 months (Extended to 64 months 19 days)
Schedule Date of COD	06 Mar 2009 / Extended Completion date 31 Jul 2011
PCOD (Chainage as per IE Letter)	MS-1 (57.3 km from 73+260 to 130+560) – 18 April 2011
	MS-2 (21.01 km from 52+250 to 73+260) – 21 Oct 2011
Date of Final Completion Certificate	02 June 2016
O & M Contractor	1) Toll Operation Services (Markolines Traffic Controls Pvt Ltd.) 2) Ganpati Constructions Route Patrolling and Incident Management 5) Hajaria Security Services for Security
Number of Toll Plaza and Lanes	1 plaza having 12 lanes including extra width
End of Concession Period as per CA	06 Mar 2026

Source: IE MPR Sep 2019, O & M Contracts, Concession Agreement

1.3 Key Findings

We have rated key findings with Red/Amber/Green for high risk, medium risk and low risk respectively.

🔴	High Risk: Critical risks that will have material impact on cost of project during balance concession period
🟡	Medium Risk: Moderate likelihood of impact on cost of project during balance concession period
🟢	Low Risk: Low level of impact on cost of project during balance concession period

Diligence Area	Findings	Risk
Completion Certificate (COD)	PCOD 1 was issued on 18 April 2011 from Km 73+260 to Km 130+560 for a length of 57.30 km and PCOD 2 was issued for 21.01 km from 52+250 to 73+260 on 21 Oct 2011 whereas extended Completion date was 31 Jul 2011. It is noticed Km 73+260 to Km 130+560 was completed before extended period and Km 52+250 to 73+260 was completed with 82 days delay i.e. within grace period of 90 days. Per Clause 16.5, Completion Certificate is to be issued after completion of Punchlist issued with PCOD. Punchlist items are to be completed within 120 days from PCOD and further 180 days will be made available with penalty of 200,000/- per week. However, Final Completion Certificate was issued on 2 June 2016 which is well beyond time specified in CA to issue Completion Certificate. It is learned that penalty / settlement was made by the former Concessionaire and as such there is no risk due to delay in Completion Certificate.	🟢

Diligence Area	Findings	Risk
Operation and Maintenance	As per Section XVIII of Concession Agreement, Concessionaire shall maintain project highway in conformity with Maintenance Requirements, the Maintenance Manual or Maintenance Program as the case may be. Concessionaire is fulfilling O & M obligations and there is no adverse comment from IE. As per O & M Inspection Report pursuant to Sub Clause 19.2 of Concession Agreement prepared by IE, Concessionaire is advised to carryout day to day routine maintenance activity no major defects has identified. As per AECOM assessment average O & M cost per year 13.89 crore.	
Major Maintenance (MM)	As per Schedule L (Page No L-13), BC of 25 mm thickness as renewal coat, is required when surface roughness is exceeding 3000 mm / km to bring it to less than 2000 mm and structural overlay is required when characteristic deflection exceeds 0.80 mm. As per Sub Clause 4.3.2.3 of Schedule L, renewal / strengthening course to be provided on as required basis (once 5 years). Last MMR was completed on 5 Jan 2017 whereas it has to be completed by 7 Jul 2016 (Ref: PD letter Ref: NHAI / PIU-MRT/11022/2016/D-13359 dated 3 Aug 2017). MM cycle along with escalation cost for balance concession period shall be: 1st cycle of MM was completed on 5 Jan 2017 whereas it has to be completed by 7 Jul 2016 (Ref: PD letter Ref: NHAI / PIU-MRT/11022/2016/D-13359 dated 3 Aug 2017). 2nd cycle of MM was completed cycle on 25th July 2021 (Ref: LASA/Highway/O&M/73588/Meerut-Mzn/WUPTL/2021/830. Next MM cycles along with escalation cost for balance concession period shall be: (1) Year 2026/27 - MM Cost 66.29 Crs	
Maintenance Manual and Yearly Program	As per Article 18.3 of Concession Agreement, Concessionaire required to submit proposed Program not later than 45 days before beginning of each accounting year. It is understood, Concessionaire is submitting yearly program as per requirement of CA.	
Pavement Design	Pavement design was done and approved by IE for 15 year of design traffic as per IRC 37 – 2001 considering 7 % CBR. Key fact of pavement design is as follows: - Pavement design for 15 years - Design Traffic 85 MSA till year 2023 Adopted Pavement thickness: BC – 50 mm, DBM -75 mm, BM-75, WMM + GSB-450 mm. Adopted pavement design for MCW is in line with the Sub Clause 5.0 Pavement Design of Schedule D. Pavement design for Service Road is to be designed for 25 MSA as per Schedule D and accordingly following pavement thickness was proposed for Service Road. PC – 40 mm, DBM – 85 mm, WMM – 250 mm, GSB – 200 mm.	
Pavement Condition	As per Roughness Survey carried out by M/s V R Techniche Consultants Private Limited in the month of Feb 2022, the project road is in Good to Fair condition. The summary of test is presented below: | | | Length (in km) |	

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td></td><td><table>
<tr><th>Riding Condition</th><th>Roughness Index (mm/KM)</th><th>LHS</th><th>RHS</th></tr>
<tr><td>Good</td><td>< 2000</td><td>67</td><td>64</td></tr>
<tr><td>Fair</td><td>2000 - 3000</td><td>11</td><td>14</td></tr>
<tr><td>Poor</td><td>> 3000</td><td>0</td><td>0</td></tr>
</table></td><td></td></tr>
<tr><td>Pavement Condition Survey Test</td><td>As per Sub Clause 3.4.2.2 of Schedule L, roughness value to be measured at least twice in a year (before monsoon in the month of April and after monsoon in the month of Oct) and BBD survey is to be carried out every year as per IRC 81. Concessionaire has conducted FWD Survey in Oct 2019 and Roughness Survey in Feb 2022.</td><td>●</td></tr>
<tr><td>Penalty</td><td>Penalty for delay in completion of MMR (delay period 7 Jun 2016 to 5 Jan 2017) was imposed by NHAI for the sum of 2.00 crore and same amount also paid by the former Concessionaire. There is no other penalty imposed / recommended by NHAI / IE.</td><td>●</td></tr>
<tr><td>Change of Scope</td><td>NHAI issued COS notices to the Company Pursuant to Article 17 of the CA for following Items:
1) COS of Rs. 67.4 lakh towards installation of Hybrid ETC lane of all lanes of Toll Plaza work completed due payment
2) COS of Rs. 1.15 crore towards installation of SSWIM & SWB payment due
3) COS of Rs. 1.38 crore towards installation of MSWIM work completed unpaid
4) Construction of Toilet Blocks of Rs. 6.16 lakh (Only GST) work completed unpaid
It is observed, COS work though completed two years before also unpaid. There is no other COS notice from NHAI for submission of proposal.</td><td>●</td></tr>
<tr><td>Balance Work</td><td>Final Completion Certificate was granted on 2 June 2016 stating project road has been completed successfully and tested as per Schedule J of Concession Agreement. All works as per Concession Agreement There is no balance work.</td><td>●</td></tr>
<tr><td>Toll Plaza and TMS</td><td>There is one toll plazas along project corridor at Km 75+990 (TP) having 6 + 6 lanes. Flexible pavement has provided at tapper portion and center portion of toll lanes has provided with rigid pavement.
TMS at both toll plaza installed in year 2017 by M/s Tollman International Pvt Ltd (TECHSTURE in 2017) and tolling is continuing with current equipment. The existing system is in order and do not envisaged any issue till end of Concession Period.</td><td>●</td></tr>
<tr><td>Major Issue Identified by IE</td><td>As per IE OM Inspection Report for Sep 2019 there is no major issues in the project. Current issue as per IE MPR is as follows:
1. Unauthorized Median – 5 locations
2. Median Kerb Damaged
3. Damaged KM / HM/ Sign Board / Delineator
4. ROW Cleaning
5. Cleaning of Bridge -Expansion Joint
6. Median Plantation trimming and cleaning
7. Routine Maintenance of Road Furnitures (MBCB, Road Signs etc.)</td><td>●</td></tr>
</table>

<table>
<tr><th>Diligence Area</th><th>Findings</th><th>Risk</th></tr>
<tr><td>Road Safety</td><td>Road safety appurtenances in the form of sign board, blinker, road marking, lighting of highway, metal beam crash barrier etc. has provided as per Concession Agreement.

As per AECOM site visit, following additional measures are recommended to enhance safety for road users:

• Vertical drop between MCW and Bus bays to be removed
• Provide blinkers at all median opening (14 nos out of 34 nos do not have blinkers)
• Provide missing median plant to reduce glare affect during night
• Missing Sign Boards
• Provide PGR between MCW and SR at all locations
• Antiglare arrangement at narrow median (width less than 2 m)
• Unauthorized Median opening found in many locations.
Safety Audit through independent agency (M/s VR Tech) has conducted in the month of Feb 2019. It is recommended to implement suggestion made by the Safety Consultant.
To enhance road safety, NHAI has executing following additional work through separate EPC Contractor M/s Krishna Construction:

<table><tr><th>Sn</th><th>Location</th><th>Proposal</th></tr><tr><td>1</td><td>Km 57.550 to Km 57.920</td><td>Service Road on RHS</td></tr><tr><td>2</td><td>Km 67.340 to Km 67.500</td><td>Service Road on LHS</td></tr><tr><td>3</td><td>Km 71.780 to Km 72.820</td><td>GSS with Slip Road on BS</td></tr><tr><td>4</td><td>Km 79.160 to Km 79.680</td><td>Service Road on LHS</td></tr><tr><td>5</td><td>Km 88.380 to Km 89.800</td><td>GSS with Slip Road on BS</td></tr><tr><td>6</td><td>Km 92.140 to Km 93.300</td><td>GSS with Slip Road on BS</td></tr><tr><td>7</td><td>Km 98.150 to Km 98.660</td><td>Service Road on LHS</td></tr><tr><td>8</td><td>Km 101.280 to Km 102.000</td><td>GSS with Slip Road on BS</td></tr><tr><td>9</td><td>Km 103.740 to Km 103.930</td><td>Service Road on RHS</td></tr><tr><td>10</td><td>Km 114.300 to 114.850</td><td>ROB with Approach on RHS</td></tr></table></td><td>●</td></tr>
<tr><td>Geometric Design</td><td>The project road is to be designed as per Specifications and Standards provided in Schedule D. Key parameters of design is as follows:
Design Speed – 100 kmph, Minimum Radius 360 m as ruling and 230 m as absolute minimum, Min length of vertical Curves 60.
Project road confirms requirement of Schedule D.</td><td>●</td></tr>
<tr><td>As-Built Drawing</td><td>As per provision of Contract Sub Clause 33.2 (iv), the Concessionaire is to deliver relevant records and reports pertaining to the Project Highway and its design, engineering, construction, operation and maintenance including all and all operation and maintenance records and programmes and manuals pertaining thereto and complete As-Built Drawing on the Date of Divestment. Soft copy has provided and found to be in order and site team confirms having of Signed As-Built Drawing at project office at TP 1.</td><td>●</td></tr>
<tr><td>Handback requirement</td><td>As specified in Schedule L, all defects and deficiencies specified in this Schedule –L shall be repaired and rectified by the Concessionaire so that the Project Highway conforms to the Maintenance Requirements on the Transfer Date. Also following specific requirement has stated in Schedule L
• Overlay to be carried out in the last year of Concession Period (Ref. Schedule L Sub Clause 3.3.7, Carriageway)</td><td>●</td></tr>
</table>

Diligence Area	Findings	Risk
	• Characteristic deflection shall not be less than 0.50 mm (Ref: Schedule L Sub Clause 3.4.2.5, Structural Condition Survey) • Roughness value shall be less than 2500 mm / km (Ref: Sub Clause 33.2 of CA) As stated in Article 34.11, from the date which is 2 years prior to the expiry of the Concession Period a sum equal to the fess realizable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or a higher a sum estimated by the IE for renewal works, shall be retained in Escrow Account or a Bank Guarantee of equal amount to be furnished to NHAI.	

1.4 Asset Condition

In general, the condition of asset is in Good to Fair condition at the time of survey as of Oct 2019. As per AECOM study, with existing arrangement for Operation and Maintenance and with every 5 years cycle of Major Maintenance (Overlay) cycle, project road will continue to fulfill Level of Service as set forth in Schedule L and requirement of Article 18 of Concession Agreement except following improvements are required:

- Safety enhancement
- Roughness Survey and BBD Survey to be conducted as per frequency stated in Schedule L

The summary of asset condition (as of Oct 2019) is tabled as follow:

Sn	Asset	Condition
1	Main Carriageway	Project road is four lane having paved width of 2 x 9 m along at grade section and 2 x 11 m at approach of grade separated structures. The pavement condition of existing pavement is in Good condition in terms of roughness however cracks has observed from Km 52.500 to Km 76.000. NHAI has appointed EPC Contractor for construction of 4 nos of GSS including approach in 4.34 km length including structure length and ROB and its approach on RHS 550 m I approach length including structure length.
2	Service Road	5.50 m width of service road has provided at approach of Grade Separated Structures and at built up area. Total one side length of 18 km has provided as service road. The pavement condition of service road is in good condition. Service. Also, routine maintenance of service road was found in poor condition. 1.78 km additional length of Service Road under construction by NHAI through EPC Contractor.
3	Median	4.5 m raised median along rural sections and 1.5 m raised median along Built Up area and approach of grade separated structures has provided. Plantation has provided in rural areas having width of 4.5 m width and wide median having width of 11.3 (wide median at 15.2 km length). Trimming, cleaning of weeds /vegetation is required from median.
4	Median Opening	34 nos of Median openings have provided out of which 20 median openings are with shelter lanes and remaining 14 nos of median opening are without shelter lanes. Solar blinkers have been

Sn	Asset	Condition
		provided on 20 nos of median opening and 14 nos of median openings are without blinkers. It is suggested to provide blinkers are all median opening as all median openings are safety hazard.
5	Drainage arrangement	Lined drain has provided between Main Carriageway and Service road at built up area and at outer edge of slip road at approach of grade separated structures (FO, PUP / CUP). Existing drainage system along rural area is in order. Poor Drainage at Km 74 to 75 LHS.
6	Major and Minor Junctions	12 nos of major junctions and 57 nos of minor Junctions are found along project road.
7	Safety Barrier	17.464 km of Metal Beam Crash barrier has provided along outer edge and median side and RCC Crash barrier has provided over approach of GS Structure on top of RE Wall at approximately in 10 km length. Existing metal beam crash barriers are found in fair condition, except at 60 m length found to be damaged.
8	Pedestrian Guard Rail	Pedestrian Guard Rail has provided in between MCW and SR at some built up area to guide pedestrian safely to cross road at designated location. However, PGR has not provided at complete required length i.e. between MCW and SR. As per Inventory condition survey report only 90 m is found on site.
9	Toll Plaza	Km 75+990 at Siwaya (TP 1): - (5+1) lanes in each direction Existing toll plaza including administrative building, TMS are in order and complying project requirement. Existing rigid pavement approximately 10 panels are having cracks which required repair and rehabilitation.
10	Highway Lighting	Highway lighting has provided at approach of Toll Plaza, approach of major Junction at median. Existing condition of highway lighting is in order.
11	Bus Bays and Bus Shelters	13 nos of bus bays with shelter has observed at site and conditions of bus bays and shelters are found to be in good condition.
12	Truck Laybys	4 nos of truck laybys has been provided with facility of toilets and drinking water facilities. The facilities as provided confirm requirement of Schedule C of CA.
13	Traffic Sign and Marking	708 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good except 28 nos of sign boards are required to be replaced with new. Road Marking is in poor condition.
14	Major Bridge	2 no of Major Bridge having span arrangement of 1x20 + 3x30 + 1x20 (total length of 130 m) and 1x20 + 2x30 (total length of 80 m) has provided and structural condition of bridge is “Good to Fair”. Drainage Spout cover and elastomeric strip seal are found to be defective which are required to be provided.
15	Minor Bridge	6 numbers of Minor Bridge are in fair to good condition. Maintenance / cleaning of Expansion Joint, drainage spouts and protection work are required.

Sn	Asset	Condition
16	Flyover	1 No of FO having span arrangement of 3 x 35 (total length 105 m) in RHS is found structurally sound condition. Cleaning of expansion joint / replacement elastomeric strip seal, replacement of drainage spout.
17	UP	8 Nos of UPs are structurally in good condition.
18	ROB	3 No of ROB having span arrangement of 1x40.6, 1X12+2X30+1X12 and 1X48.6 is found in good condition. Cleaning of expansion joint and replacement of elastomeric strip seal, replacement of drainage spout is required.
19	Cross Drainage	Total 256 nos of cross drainage structures has found and condition of structure are found to be in order. It is noticed some of culverts are blocked and vent cleaning is required.

The project road has been visited by Consultant's team of Engineers in the month of Oct 2019.

Note: The project road has a long operational history and we had forecasted the operations & maintenance costs/ strategies for the entire balance concession period primarily based on i) the original pavement design during construction phase, ii) the various investigations and surveys carried out to assess the technical performance and quality of the project road and iii) other information provided to us by the Client and we don't expect any material change in operations & maintenance costs/ strategies year on year.

1.5 Toll Plaza and TMS

Toll Plaza including collection and TMS is operated / maintained as per requirement of concession agreement. Existing TMS is installed by M/s Tollman International Pvt Ltd. 2017. Existing system is as per requirement of applicable Manual all equipment are found to be working condition.

NHAI issued circular on 30 Nov 2017 for installation of Hybrid ETC lane at all toll lane and NHAI shall borne all cost of equipment and O & M cost under COS. Concessionaire has installed Hybrid ETC system at all toll lanes and MSWIM under COS. Existing toll lane configuration with type of equipment is summarized as follows:

Item	TP
Total Number of Lane	12
Total number of Regular Lane	10
Total Number of Extra Width Lane	2
Tolling Equipment	
Number of Dedicated ETC Lane	-
Number of Hybrid ETC Lane	12
Number of Reversible Lane	-

As per AECOM assessment total cost of TMS System is approximately 2.58 crore. The life TMS equipment is considered 7 years therefore it is expected to replace 50 % equipment 2 years before end of Concession Period i.e. in Year 2024.

1.6 Change of Scope (COS)

As per Article XVII, Sub Clause 17.1 to 17.4, NHAI may, notwithstanding anything to the contrary contained in the Agreement, require provision of such addition / deletion to the works and services on or about the Project Highway which are beyond the scope of Project as contemplated by the Agreement. All such changes shall be made by NHAI by an order ("the Change of Scope Order"). The list of COS along with status of COS order is tabled below:

Sn	Description of Work	Status of COS Order	Amount	Work Status	Remarks
1	GST of Toilet Block	Work Completed GST reimbursement not made	6.16 lakh	Completed	
2	Implementation of Hybrid ETC Lane of all lanes of Toll Plaza	Work completed payment due since last 2 years	67.4 lakh	Completed	
3	Installation of MSWIM	Work completed payment due	1.38 Crore	Completed	
4	Installation of SSWIM & SWB	Work completed payment due	1.15 crore	Completed	
	Total Amount		3.27 crore		

*- Source: WUPTL letter Ref: 107 dated 6 Sep 2019

There is no other COS in pipeline.

1.7 Balance Work

All work has completed as per Scope of Works under this Contract and there is NO balance work.

1.8 Requirement of O & M and Periodic Maintenance as per Concession Agreement

As per Schedule L, the Concessionaire shall take all such actions and do all such things (including without limitation, organizing itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols and engaging contractors, if any, agents and employees) in such manner, as well:

i) Ensure the safety of personnel deployed on and users of the project facilities or part thereof
ii) Keep the Project Facilities from undue deterioration and wear
iii) Permit unimpaired performance of statutory duties and functions of any party in relation to

During concession period, the Concessionaire is fully responsible for Operation & Maintenance of Project Highway. Schedule L elaborates requirement various service factor desirable level and acceptable level during O & M period along with time period if any parameter level of service beyond acceptable limit.

Periodic Maintenance (overlay) is required to be provided at least once in every 5th year (from COD) and in the last year of concession period. Also, overlay is required if Characteristic Deflection is more than 0.80 mm and roughness value exceeded more than 3000 mm / km.

Structural overlay is required if design MSA is less than anticipated MSA till end of Concession Period. As per Pavement design report, pavement was design for 85 MSA i.e. till Year 2023 whereas Concession Period ends in year 2026. Two cycles of Overlay has completed in Year 2017 and in FY 2020/21 therefore structural overlay is not required other than as proposed overlay.

1.8.1 Staff Requirement

Concession agreement does not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule L. Staff requirement at Toll plaza ground staff, office staff, ambulance, highway patrol and monitoring staff at site level has been considered based on requirement estimated by AECOM and as discussed with client.

1.8.2 O and M Strategy

The overall responsibility of O and M works is Concessionaire's responsibility. To meet requirement of contract, Concessionaire has set up administrative office headed by Project Manager / Project Director has set up at toll plaza. Current strategy adopted by the Concessionaire as follows:

S. No	Activity	Recommendation
1	Routine Maintenance	In house
2	Preventive Maintenance	Out source
3	Operation cost of Toll Plaza and Administration Building	In house
4	Security of Toll Plaza and Cleaning	Out Source
5	Highway Lighting	In house
6	Maintenance of ATMS / TMS	Out Source - AMC
7	Corridor Management	Out Source
8	Major Maintenance	Out Source

1.8.3 Handback Requirement

As per Clause 33.2 of Concession Agreement, all project assets including the road, pavement, structure and equipment shall have been renewed and cured of all defects and deficiencies as necessary so that project highway is compliant with the Specification and standards set forth in this Agreement. All sections of traffic lane shall have a roughness value not more than 2500 mm and characteristic deflection shall not be more than 0.50 mm. To satisfy above requirement, 30 mm BC overlay is required at end of Concession Period.

Also, NHAI shall hold a sum equal to the Fees realizable during last two years of the Concession Period for a traffic volume calculated at the rate of 10,000 PCUs per day per year or higher sum estimated by the IE for renewal works shall be retained in Escrow Account provided that if Concessionaire submit a Bank Guarantee of equal amount acceptable to NHAI, no such retention shall be made.

1.9 Insurance

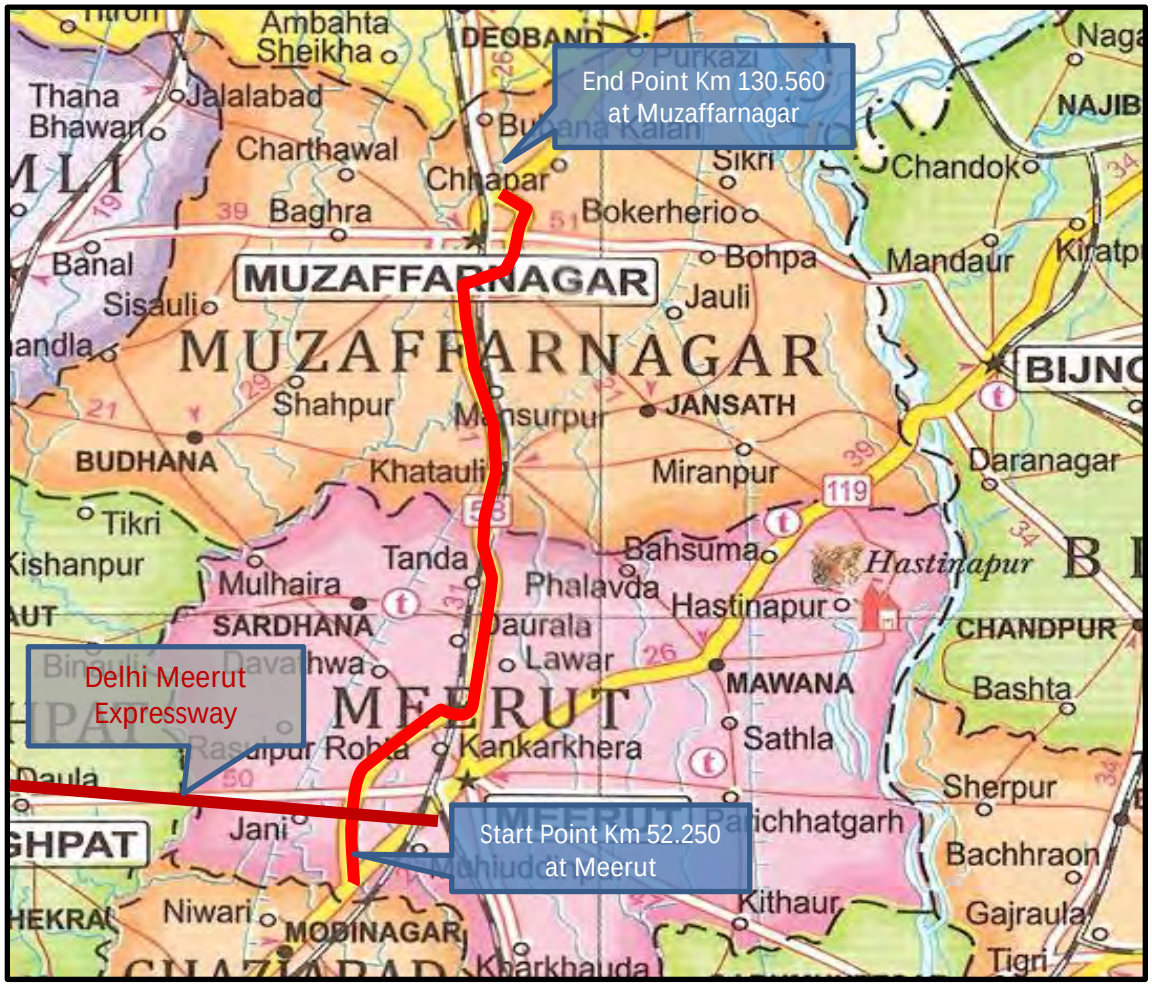
As per Sub Clause 27.2 of Concession Agreement, Concessionaire shall obtain and maintain at no cost to NHAI during Operation Period in respect of the Project Highway and its operations such insurance as may be required under any of the Financing Documents, Applicable Laws and such insurance as the Concessionaire may reasonably consider necessary or desirable in accordance with Good Industry Practice. The following insurance are maintained:

Sn	Description
1	Industrial All Risk Insurance Policy Schedule
2	Burglary – Standard Policy Schedule
3	Electronic Equipment Insurance
4	Standard Fire & Special Perils Policy
5	Money Insurance Policy
6	Business Interruption (FIRE) Policy
7	Policy Schedule For Fidelity Guarantee
8	Policy Schedule for Public Liability
9	Policy Schedule for Package Insurance Policy

1.10 Introduction of Asset

1.10.1 Project Corridor

The project road is a section of National Highway No. 58 start from KM 52.250 at Meerut and ends at KM 130.560, Muzaffarnagar. NH 58, one of the major arterial roads of the country originates from Ghaziabad in Uttar Pradesh near New Delhi with Badrinath and Mana Pass in Uttarakhand near Indo-Tibet border. The total length of highway is 538 km. Major cities along NH 58 are Meerut, Muzaffarnagar and Kahului. The project road starts Km 52.250 at Meerut and ends at Km 130.560 at Muzaffarnagar. It is noticed Delhi Meerut Expressway cross Project Road at Km 53.000 and construction of interchange is in progress at the time of site visit during year 2019. The total length of the project road is 78.31 km. The project corridor is shown in map below.



Location Map

Project Start KM 52.250	Project End KM 130.560

1.10.2 Salient Features of the Project:

Salient Features of Project in comparison with Schedule B is table below:

a) Highway

Description	As per Schedule B and C	Existing Features
Length of Project Highway	78.31 Km	78.31 km
Carriageway	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of underpasses and FO Approach	Four Lane (2 x 9 Paved Width), Six lane (2 x 11 Paved Width) at Approach of underpasses and FO Approach
Shoulder	2.0 m earthen for MCW at Rural Area	2.0 m earthen for MCW at Rural Area
Service Road / Slip Road	17.68 km one side length having width of 5.50 m	17.44 km one side length having width of 5.50 m and 0.56 km one side length having width in 5.50 m.
ROW	45 to 60 m	45 to 60 m
Major / Minor Junction	12 Nos Major and 57 Nos Minor	12 Nos Major and 57 Nos Minor
RCC Drain	Covered drain at Urban Section and open pucca drain between MCW and SR	RCC Covered Drain 5.010 km as per Site Inventory
Median Opening		34 Nos

Description	As per Schedule B and C	Existing Features
Toll Plaza	1Nos	1 Nos
Truck Lay-bys	2 Nos at each side (4 Nos Total)	4 Nos total on both sides
Bus Bays with shelter	18 Nos Total	13 Nos Total
Highway Lighting	Rest Area, Toll Plaza and Interchanges	Provided as per Schedule C (Total 215 nos of Double Arm and 155 nos of Single arm lighting provided)
High Mast	At Major Junctions, ROB / Flyover	Provided as per Schedule C (6 nos of high mast provided)
Highway Patrol	2 nos	2 nos
Ambulance	2 nos	2 nos
Crane	2 nos	2 nos
Traffic Aid Post	At Toll Plaza	At Toll Plaza
Medical Aid Post	At Toll Plaza	At Toll Plaza

b) Structure

Description	As per Schedule B	Existing Features
Major Bridge	2 No	2 No
Minor Bridge	3 Nos	6 Nos
Flyovers	1 No	1 No
ROB and RUB	3 No	3 No
VUP	7 Nos	8 Nos
Culverts	256 Nos	256 Nos

1.11 Review of Pavement

1.11.1 Pavement Design

During construction of road, pavement design was carried out for 85 MSA till year 2023 i.e. 15 years design traffic. Summary of Report is presented as below:

Section	Chainage		Design traffic in MSA for 15 years of Concession period	Design MSA	Pavement Thickness (mm)				
	From	To			CBR %	BC	DBM	BM	WMM + GSB
HS-1	52.250	70.000	64	85	10%	50	75	75	450
HS-2	70.000	95.000	83	85	10%	50	75	75	450
HS-3	95.000	113.000	66	85	10%	50	75	75	450
HS-4	113.000	130.000	36	85	10%	50	75	75	450

Section	Chainage		Design traffic in MSA for 15 years of Concession period	Design MSA	Pavement Thickness (mm)				
	From	To			CBR %	BC	DBM	BM	WMM + GSB
HS-5	130.000	131.000	43	85	10%	50	75	75	450

1.11.2 Analysis of Existing Pavement Condition

To understand existing pavement condition of project road NSV survey, FWD Survey, Test Pit and Core Test have been conducted by the Client.

a) Roughness Survey:

Pavement condition is categorized based in following criterion:

Good - less than 2000 mm / km
Fair -2001 to 3000 mm / km
Poor – above 3000 mm / km

As per Roughness Survey carried out by M/s V R Techniche Consultants Private Limited in the month of Feb 2022, the project road is in Good to Fair condition. The summary of test is presented below:

Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		LHS	RHS
Good	< 2000	67	64
Fair	2000 - 3000	11	14
Poor	> 3000	0	0

b) Analysis of Existing Pavement – FWD Test

Evaluation of existing pavement using Falling Weight Deflectometer (FWD) survey was carried out in year Oct 2019 for Km 52 to 130. Summary of FWD Survey report is presented as below:

Description	Length in km	
	LHS	RHS
less than 17.22 MSA	25	14
Greater than 17.22 MSA	54	65
Total Tested Length	79	79

Note: Required remaining life of pavement till end of Concession Period is 17.22 MSA.

c) Test Pit
As per test conducted by the Concessionaire, CBR result is found from 5.7 % to 14.1 % and average CBR is found as 10.4%. Design CBR is 10% thus confirm requirement of pavement design.

From observation of test pits, it was found that the pavement crust along the project road composed of following two layers: i) Bituminous Top (BT) ii) Granular Layer Graphical illustration of pavement thickness and crust summary for the project road is given below:

Twenty (20) numbers of test pit results were provided to assess the existing pavement crust

composition. Abstract of existing subgrade test result is as follows:

- Degree of compaction 89.3 % to 98.5 %
- Free Swell Index 0 to 28.6
- CBR result is found from 5.7 % to 14.1 % and average CBR is found as 10.4%.

Design CBR is 10% and average existing subgrade CBR is more than 10% thus confirms requirement.

Layer	Thickness (mm)		
	Minimum	Maximum	Average
Bituminous Layer	180	340	260
Granular Layer	290	470	380

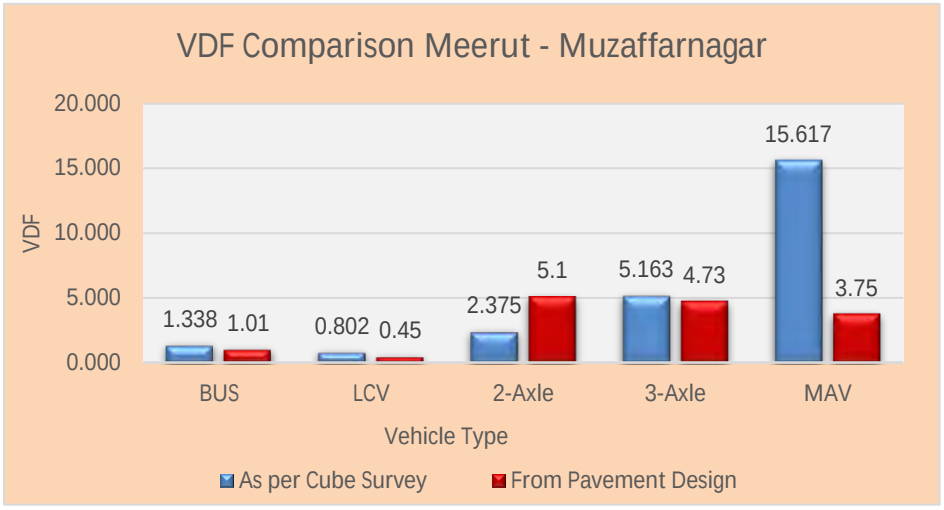
d) Core Test

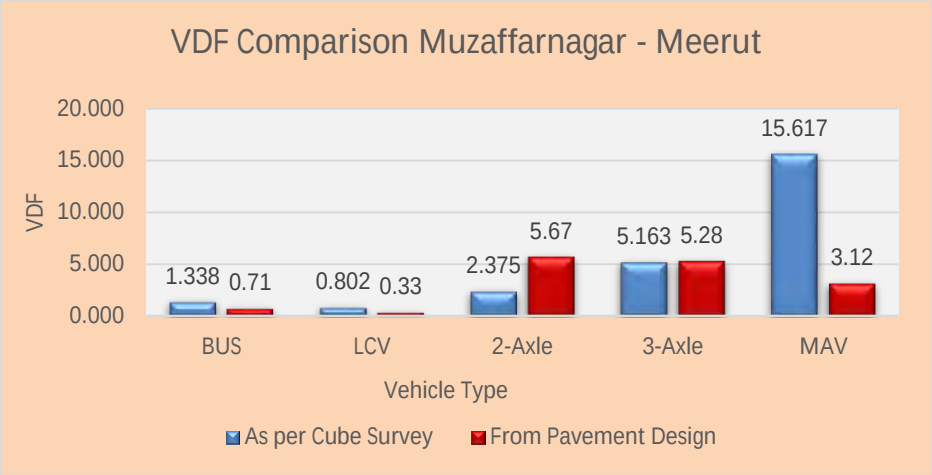
Thickness of existing pavement layers has provided based by conducting Core Test and test pit. Furthermore, the core samples and granular material (base and subbase layers) were also taken for laboratory test in order to determine various material properties such as bitumen content, aggregate properties of bituminous layers etc. The test result is summarized as below:
Pavement Thickness –

- based on Core Cutting bituminous layer thickness 180 mm to 340 mm. An average of bituminous layer in 240mm.
- Thickness of Granular Layer (GSB + WMM) – 290 mm to 470 with an average of 410 mm.
- % of bitumen – 3.86 % to 4.61 % in DBM and 4.48 % to 5.21 % in BC

e) Axle Load Survey

VDF as adopted during pavement design and VDF as per current Axle Load Survey data conducted in Year Oct 2019 at Toll Plaza are presented as below:





f) Design Traffic for Balance Concession Period

Design traffic for balance concession period has calculated based on traffic data, growth rate and VDF provided and compare with as assumed during pavement design is summarized as below:

Design Traffic from FY 2022 to FY 2026

Homogenous Section	Location		As per Pavement Design	As per Current Survey
	From	To		
MS 1	52+250	131+560	20 to 53 MSA	17.22 MSA

From the above test report and analysis and requirement of Schedule L, AECOM is in the opinion overlay is required in Year 2025/26 (end of concession period).

1.12 Major Maintenance

Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. It is noted that Concessionaire has carried out MM in Year 2016 & 2021.

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. MM Cycles for balance concession period is to be planned as follows:

Proposed MM Cycle for balance Concession Period

i) Main Carriageway

Sn	Year	Description	Length (2 lane km)
1	2025 /26	30 mm BC Overlay	157.50 km

i) Service Road: 30 mm BC in 50 % length and 50 % with Microsurfacing

ii) Structure Major Maintenance
a) Replacement of Wearing Coat every fifth year at same time as above

1.13 Operation & Maintenance Works

The Concessionaire shall Operate and Maintain the Project Highway till balance end of concession period. O & M cost has worked out under following heads:

1. Annual Road Maintenance (Preventive & Routine Maintenance)
2. Highway Lighting running expenses
3. TMS Cost
4. Corridor Management
5. Manpower Cost
6. Toll Plaza Operation Cost
7. Administration Cost including remuneration cost of IE

As per current NHAI Policy, all toll lanes shall have compulsory Fast Tags at all lanes and payment to be collected through ETC system only. Due to which it is expected to reduce operation cost mainly for manpower cost and will have slight increase in TMS O & M cost. Implementation of Hybrid ETC is considered from Year 2022/23 considering overloading shall not be collected.

As per AECOM calculation average yearly O & M Cost non-escalated is Rs. 14.49 crore per year. Year wise cost summary is appended in next page.

O and M Cost including GST - Toll Collection											
Abstract of Cost for Operation & Maintenance Cost - Western UP Tollway Limited (WUPTL)											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	11,203,424	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	144,894,103
3	2023-24	12,847,652	17,786,663	9,897,261	28,221,019	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	166,411,244
4	2024-25	14,179,560	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	147,870,239
5	2025-26	5,683,222	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	139,373,901
	Total	43,913,857	71,146,654	39,589,042	53,265,338	106,555,427	7,113,272	122,778,598	17,388,000	136,799,299	598,549,488
Total Cost in Crore		4.39	7.12	3.96	5.33	10.66	0.71	12.28	1.74	13.68	59.86

1.14 Major Maintenance Cost

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Major Maintenance cost for balance Concession Period is summarized as below:

Sn	Year	Cost with Escalation and GST
1	2021 / 2022	Overlay completed
2	2026 / 2027	66.29 crore

1.15 List of Document Reviewed

Documents uploaded till 28 Nov 2019 has reviewed during preparation of this DD report. The followings documents were reviewed during study:

Sn	List of Document	Status	Remarks
1	Concession Agreement – all Vols.	Available	
2	Supplementary Agreement to Concession Agreement or Any MOU at the time of Appointed Date if any	Available	State support agreement available
3	Detail Highway Inventory and Condition Survey Report	Available	Condition Survey report not available
4	Detail Structure Inventory and Condition Survey Report	Available	Condition Survey report not available
5	Strip Chart of Highway and Structures and Highway / Structure Inventory	Available	
6	Balance Work List with BOQ if any	Not Available	
7	Past Technical DD Report	Not Available	
8	Change of Scope Documents	Available	
9	Provisional COD Letter along with Punch List	Available	
10	Final COD Letter with Exclusion List if any	Available	
11	Important Correspondences with IE/NHAI (Major Maintenance, O & M related, Damages due to breach of Maintenance Obligations, extension of concession period if any)	Available	Penalties Correspondence Letters
12	NCR Status	Not Available	
13	Operation and Maintenance Manual, Yearly Maintenance Program	Available	
14	Current Operation and Maintenance Arrangement / Strategy	Available	Maintenance manual
15	Detail of TMS and ATMS / HTMS installed at site	Available	

Sn	List of Document	Status	Remarks
16	Pavement Design Report	Available	
17	Historical Major Maintenance and Strategy	Available	Periodic maintenance report
18	Test Report (FWD / BBD, Roughness Survey Data / NSV Survey if any, Test Pit / Core if any)	Available	Axle Load, Core Cutting, Roughness, FWD, Pavement condition and investigation reports
19	As Built Drawing	Available	Structure Drawing
20	MPR during Construction Stage (only last three months)	Not Available	
21	MPR of Independent Engineer during Maintenance stage	Available	
22	MPR Lender Report	Not Available	
23	Monthly Inspection Report during O and M	Available	
24	Historical O&M and MM Cot Cost	Available	O & M Contract with vendor
25	Major Maintenance Forecast	Available	
26	Traffic Data (Actual till now and projection till end of Concession Period)	Available	AADT, Traffic Growth Rate
27	Safety Consultant Report - Pre COD, Final Safety Report during End of Construction Period, During O & M	Available	Draft Road Safety Audit Report Dated Feb 2019
28	Other Documents		

2 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS

2.1 Background

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

2.2 Pavement Design

As per the Concession Agreement pavement is required to be designed for the 15 Years for minimum 85 MSA.

a) Review of Pavement Design

During construction of road, pavement design was carried out for 85 MSA till year 2023 i.e. 15 years design traffic. Summary of Report is presented as below:

Section	Chainage		Design traffic in MSA for 15 years of Concession period	Design MSA	Pavement Thickness (mm)				
	From	To			CBR %	BC	DBM	BM	WMM + GSB
HS-1	52.250	70.000	64	85	10%	50	75	75	450
HS-2	70.000	95.000	83	85	10%	50	75	75	450
HS-3	95.000	113.000	66	85	10%	50	75	75	450
HS-4	113.000	130.000	36	85	10%	50	75	75	450
HS-5	130.000	131.000	43	85	10%	50	75	75	450

The proposed design has approved by IE / NHAI during construction therefore consider as compliance of Concession Agreement. It is to be noted that based on survey data provided by the Client design traffic for HS 2 is higher than other 4 sections while comparing. VDF adopted for calculation of design traffic by concessionaire is given below:

Vehicle Type	VDF Adopted	
	Meerut - Muzaffarnagar	Muzaffarnagar - Meerut
LCV	0.45	0.33
2 – Axle	5.1	5.67
Std. Bus	1.01	0.71
3-T	4.73	5.28
MAV	3.75	3.12

2.3 Survey and Investigations

Following site investigations and surveys were carried out to determine the present condition of pavement as well as to find out the future maintenance requirements.

i) Roughness Survey
ii) Test Pits
iii) Core Cutting of Bituminous Layers
iv) Falling Weight Deflectometer (FWD) Test
v) Axle Load Survey

2.3.1 Roughness Survey using Network Survey Vehicle (NSV)

NSV survey was conducted by M/s VR TECHNICHE Consultants Private Limited in the month of Feb 2022 to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer.

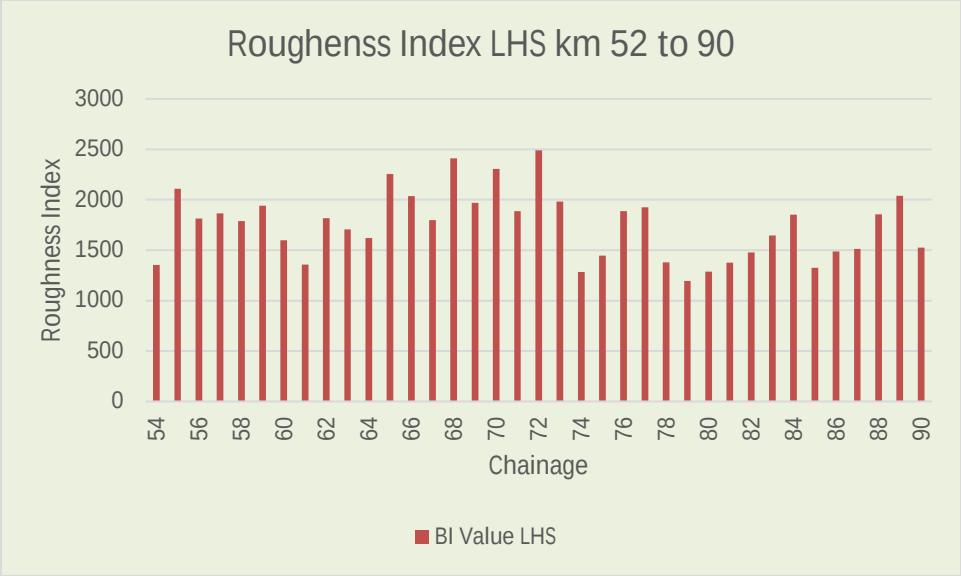
Based on the Roughness value, project road was classified into following three categories:

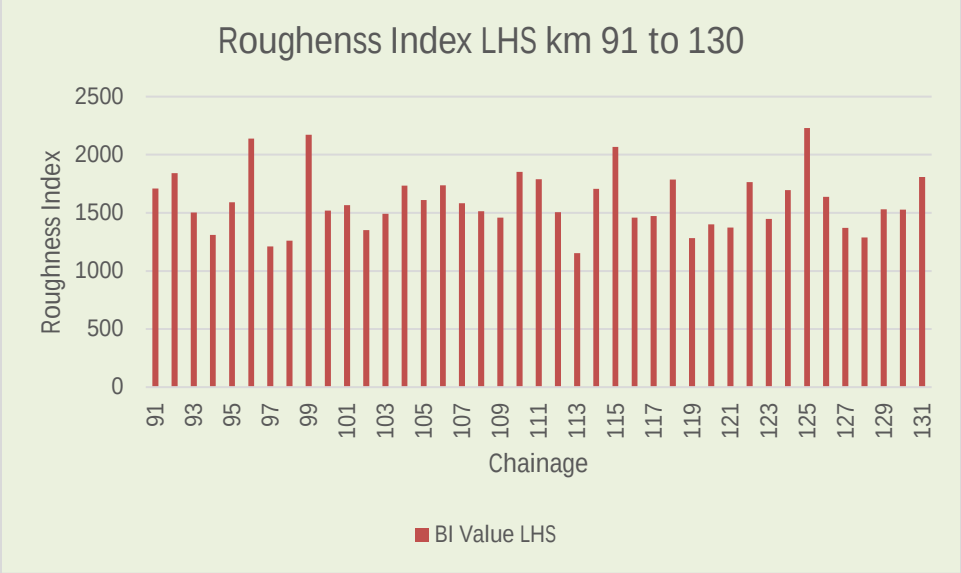
Ratings	Roughness Value (mm/km)
Good	<2000
Fair	2000 - 3000
Poor	>3000

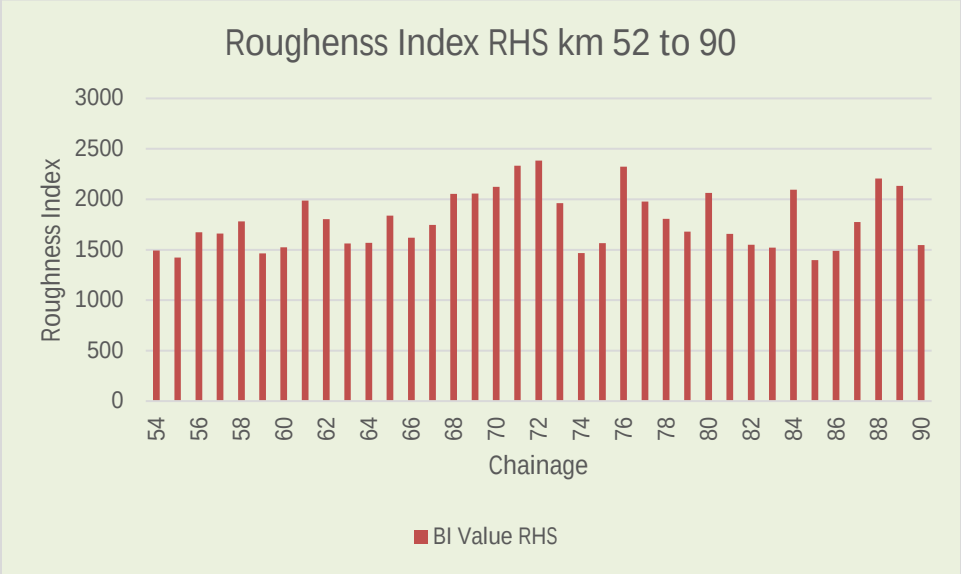
The riding quality of project road based on the Roughness Index is summarized in the table below and Roughness along the project road is illustrated in the figure below:

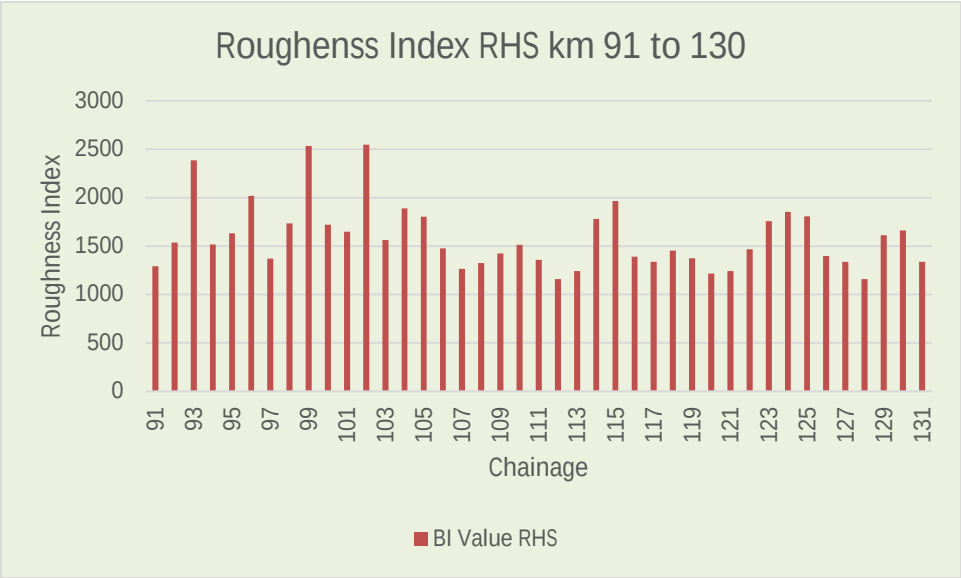
Summary of Roughness Index

Riding Condition	Roughness Index (mm/KM)	Length (in km)	
		Length - km	
		LHS	RHS
Good	< 2000	67	64
Fair	2000 - 3000	11	14
Poor	>3000	0	0


Roughenss Index LHS km 52 to 90
Roughness Index
3000
2500
2000
1500
1000
500
0
54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90
Chainage
BI Value LHS


Roughenss Index LHS km 91 to 130
Roughness Index
2500
2000
1500
1000
500
0
91 93 95 97 99 101 103 105 107 109 111 113 115 117 119 121 123 125 127 129 131
Chainage
BI Value LHS


Roughenss Index RHS km 52 to 90
Roughness Index
3000
2500
2000
1500
1000
500
0
54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90
Chainage
BI Value RHS



2.3.2 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade and embankment materials used in project road, test pits of size (approx.) 1m x 1m x 1m have been excavated alternatively on LHS and RHS carriageway at 20 locations and data provided by the Concessionaire.

Field Dry Density (FDD) and Field Moisture Content (FMC) tests were also conducted for subgrade soil at pit. The subgrade soil sample from each test pit was also collected and taken for laboratory examination.

Following tests were conducted on the samples: - Gradation / Sieve Analysis - Soil Classification - Clay and Silt Content - Atterberg's Limit (Liquid Limit, Plastic Limit) - Compaction Test (Modified Proctor Test) - 4-day soaked CBR

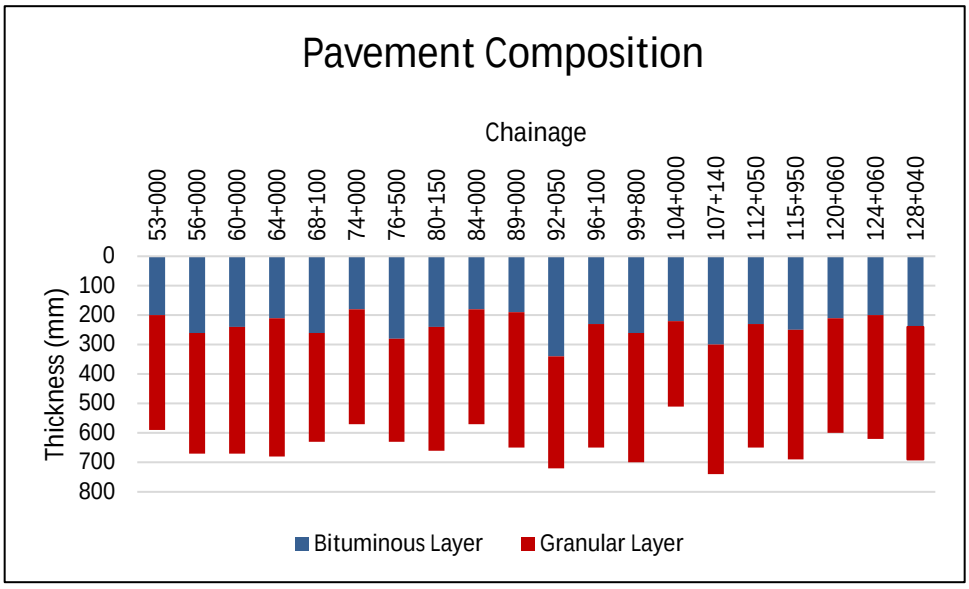
Similarly, from some of the test pits, samples of Granular Material were also collected and taken for laboratory testing. Following tests were performed for laboratory material. - Gradation / Sieve Analysis - Specific Gravity - Water Absorption

As per test conducted by the Concessionaire, CBR result is found from 5.7 % to 14.1 % and average CBR is found as 10.4%. Design CBR is 10% % thus confirm requirement of pavement design.

Crust Composition and Thickness:

From observation of test pits, it was found that the pavement crust along the project road composed of following two layers: i) Bituminous Top (BT) ii) Granular Layer Graphical illustration of pavement thickness and crust summary for the project road is given below:

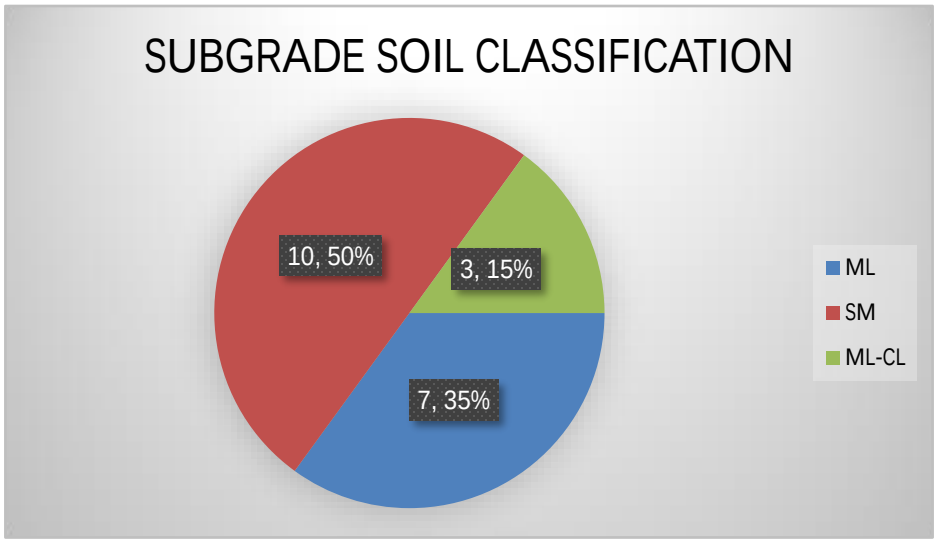
Layer	Thickness (mm)		
	Minimum	Maximum	Average
Bituminous Layer	180	340	260
Granular Layer	290	470	380



Existing average bituminous pavement thickness is more than pavement design thickness thus confirms requirement.

Subgrade Test:
As mentioned earlier, subgrade soil samples were collected from each test pit and taken for laboratory testing. Summary of laboratory test results for subgrade soil sample is given below:

Properties	Minimum	Maximum	Average
Liquid Limit (LL) %	18.00	26.00	22.00
Plastic Limit (PL) %	17.00	NP	18.50
Plasticity Index (PI	6.00	NP	6.50
Max. Dry density (gm/cc.)	1.87	2.06	1.97
OMC (%)	8.10	12.30	9.30
4-Days Soaked CBR (%)	5.70	14.10	10.40
Free Swell Index (%)	0.00	28.60	8.3



Granular Material Test:
Test report of 20 samples of Granular materials (10 nos. each of WMM and GSB) were provided and Summary of laboratory test results for Granular sample is given below:

Properties	Minimum	Maximum	Average
Liquid Limit (LL) %	17	25	19.9
Plastic Limit (PL) %	NP	NP	NP
Plasticity Index (PI	NP	NP	NP
Specific Gravity	2.59	2.68	2.64
Water Absorption	0.54	0.96	0.66
Aggregate Impact Value	21.41	29.84	25.049

2.3.3 Core Test

Core test result were provided along with test report of bitumen, aggregates used in pavement. Summary of core cutting report is summarized hereunder.

S. No	Chainage (Km)	Side (LHS/RHS)	Height of the Core (mm)	Remarks
1	52+730	LHS	202	
2	55+000	RHS	180	
3	56+000	LHS	200	De-bonding of Layers
4	58+000	RHS	290	De-bonding of Layers
5	60+000	LHS	230	
6	61+900	RHS	115	Top down crack, De-bonding of Layers
7	64+000	LHS	200	Full depth crack
8	66+040	RHS	210	
9	67+900	LHS	160	
10	70+000	RHS	120	Full depth crack
11	71+620	LHS	130	Top down crack, De-bonding of Layers
12	74+160	RHS	260	
13	76+340	LHS	214	
14	78+000	RHS	230	De-bonding of Layers
15	80+000	LHS	140	De-bonding of Layers
16	82+000	RHS	195	
17	84+000	LHS	190	
18	86+280	RHS	95	Top down crack
19	88+000	LHS	110	Top down crack, De-bonding of Layers
20	89+740	RHS	180	
21	91+750	RHS	235	De-bonding of Layers
22	92+000	LHS	220	De-bonding of Layers
23	95+900	RHS	200	
24	96+000	LHS	210	Top down crack, De-bonding of Layers
25	100+000	LHS	110	
26	101+400	RHS	200	Top down crack, De-bonding of Layers
27	105+900	RHS	270	
28	106+250	LHS	220	
29	108+480	LHS	150	De-bonding of Layers
30	109+360	RHS	140	Full depth crack, Fully Pulverized
31	112+000	LHS	150	De-bonding of Layers
32	112+700	RHS	240	
33	116+280	LHS	240	
34	117+920	RHS	240	

S. No	Chainage (Km)	Side (LHS/RHS)	Height of the Core (mm)	Remarks
35	120+000	LHS	257	
36	121+700	RHS	275	
37	124+000	LHS	235	
38	126+000	RHS	278	De-bonding of Layers
39	128+000	LHS	187	De-bonding of Layers
40	130+000	RHS	200	De-bonding of Layers

2.3.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

Concessionaire has conducted FWD survey in the month of Oct 2019 for entire Project road. Summary of Remaining life of existing pavement as per the FWD Test results provided by the client is presented below:

S.no	Chainage		Remaining Life	
	From	To	LHS	RHS
1	52.000	53.000	8.89	30.71
2	53.000	54.000	5.51	41.90
3	54.000	55.000	27.20	35.57
4	55.000	56.000	13.83	37.61
5	56.000	57.000	70.42	49.28
6	57.000	58.000	30.95	15.01
7	58.000	59.000	32.27	34.90
8	59.000	60.000	45.44	21.44
9	60.000	61.000	46.98	4.69
10	61.000	62.000	36.26	12.77
11	62.000	63.000	8.16	15.00
12	63.000	64.000	19.98	135.62
13	64.000	65.000	20.16	82.45
14	65.000	66.000	15.53	35.75
15	66.000	67.000	15.29	159.66
16	67.000	68.000	26.25	81.64
17	68.000	69.000	6.05	47.01
18	69.000	70.000	9.98	25.90
19	70.000	71.000	27.16	31.93
20	71.000	72.000	40.93	16.75
21	72.000	73.000	138.41	42.60
22	73.000	74.000	70.55	8.09
23	74.000	75.000	59.72	22.50
24	75.000	76.000	32.14	50.21
25	76.000	77.000	319.82	50.05
26	77.000	78.000	319.75	38.11

S.no	Chainage		Remaining Life	
	From	To	LHS	RHS
27	78.000	79.000	74.13	23.17
28	79.000	80.000	162.26	18.55
29	80.000	81.000	15.25	16.56
30	81.000	82.000	177.40	21.65
31	82.000	83.000	178.14	74.22
32	83.000	84.000	34.31	60.34
33	84.000	85.000	30.46	40.78
34	85.000	86.000	14.84	9.45
35	86.000	87.000	98.57	12.07
36	87.000	88.000	3.39	4.50
37	88.000	89.000	27.58	3628.54
38	89.000	90.000	21.40	1825.15
39	90.000	91.000	14.54	220.60
40	91.000	92.000	154.15	121.16
41	92.000	93.000	15.12	231.41
42	93.000	94.000	18.88	149.58
43	94.000	95.000	13.14	49.47
44	95.000	96.000	15.51	23.94
45	96.000	97.000	8.32	23.02
46	97.000	98.000	6.61	22.15
47	98.000	99.000	8.46	23.01
48	99.000	100.000	9.97	20.75
49	100.000	101.000	10.97	20.69
50	101.000	102.000	8.32	28.26
51	102.000	103.000	113.05	123.16
52	103.000	104.000	104.80	39.33

S.no	Chainage		Remaining Life	
	From	To	LHS	RHS
53	104.000	105.000	249.97	40.43
54	105.000	106.000	81.90	46.37
55	106.000	107.000	157.24	91.16
56	107.000	108.000	126.17	71.42
57	108.000	109.000	66.87	65.99
58	109.000	110.000	42.21	108.66
59	110.000	111.000	37.64	87.64
60	111.000	112.000	28.00	34.89
61	112.000	113.000	35.24	19.89
62	113.000	114.000	14.84	25.45
63	114.000	115.000	33.22	29.61
64	115.000	116.000	13.61	66.86
65	116.000	117.000	58.60	22.50
66	117.000	118.000	63.03	25.03

S.no	Chainage		Remaining Life	
	From	To	LHS	RHS
67	118.000	119.000	36.00	54.71
68	119.000	120.000	75.52	169.11
69	120.000	121.000	19.00	15.11
70	121.000	122.000	11.91	8.57
71	122.000	123.000	28.90	41.03
72	123.000	124.000	29.78	13.42
73	124.000	125.000	23.65	13.77
74	125.000	126.000	34.89	311.70
75	126.000	127.000	835.85	292.72
76	127.000	128.000	801.40	36.92
77	128.000	129.000	290.50	225.42
78	129.000	130.000	36.18	123.15
79	130.000	131.000	11.85	0.00

2.3.5 Axle Load Survey

Due to the mixed traffic condition of the project highway, the traffic load is heterogeneous in nature. In order to know the actual impact of heterogeneous traffic load on highway pavement it is essential to convert the heterogeneous traffic to equivalent homogenous traffic. Equivalent Standard Axle Load (ESAL) is a parameter used to express the heterogeneous traffic load in terms of a standard axle load of 80KN and VDF is the multiplying factor use to convert the traffic loads of different type of vehicle into the equivalent number of standard axle loads.

Axle Load Survey was conducted in the Month Oct. 2019 and analysis has been provided. Comparison between VDF based on traffic survey conducted in July 2018 and VDF adopted during Pavement Design is given below:

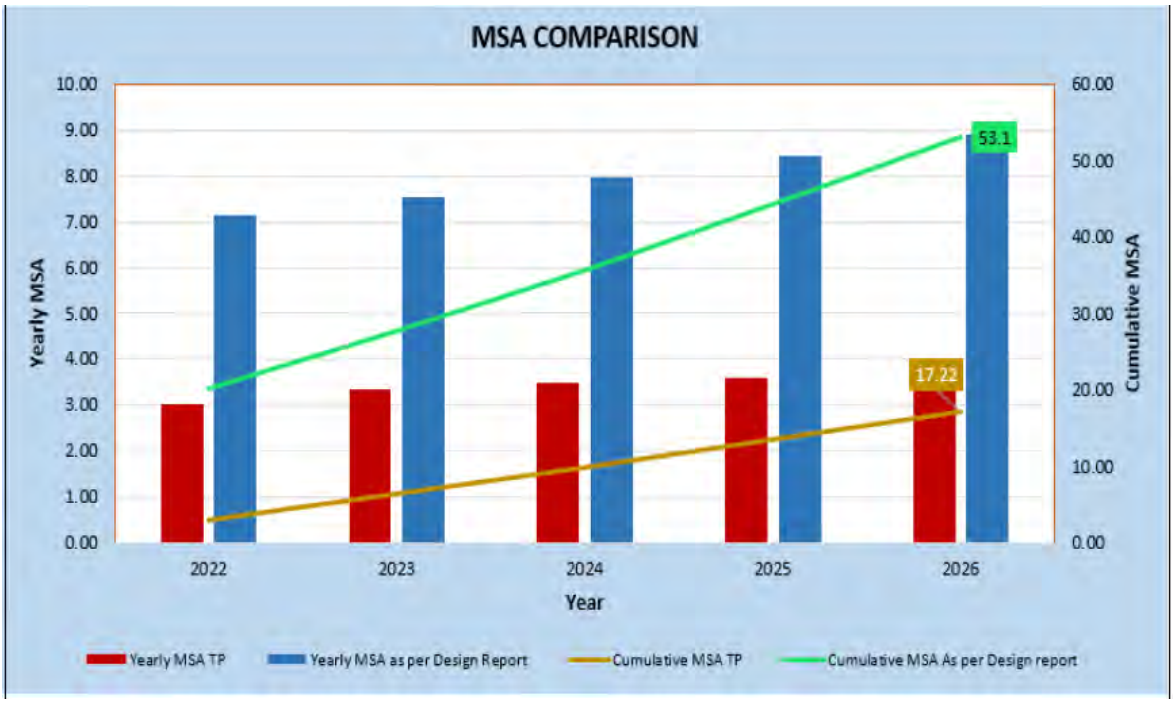
VDF Comparison

S. No	Vehicle Type	As per Pavement Design Report		As per Cube Survey		
		From Meerut - Muzaffarnagar	From Muzaffarnagar-Meerut	From Meerut - Muzaffarnagar	From Muzaffarnagar-Meerut	Adopted Value
1	BUS	1.01	0.71	1.338	0.863	1.338
2	LCV	0.45	0.33	0.625	0.802	0.802
3	2-Axle	5.1	5.67	2.375	1.764	2.375
4	3-Axle	4.73	5.28	4.342	5.163	5.163
5	MAV	3.75	3.12	15.617	11.335	15.617

2.3.6 Homogeneous Section and Design MSA

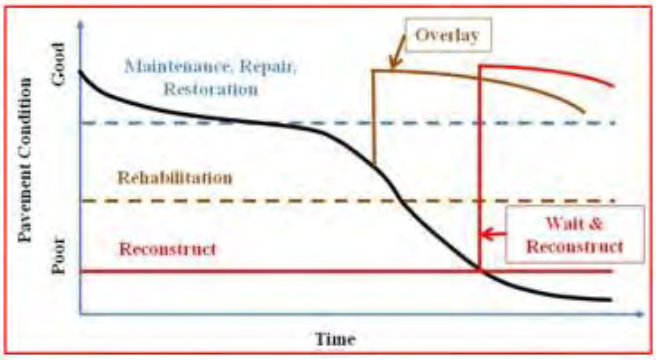
As per current traffic pattern, two homogeneous sections considered for calculation Design MSA. However, during pavement design four homogeneous section was considered. MSA has calculated based on traffic data provided for balance Concession period and VDF as calculated above for balance Concession period. The comparison of balance MSA upto end of Concession period as per pavement design and as per data provided is tabled below.

Homogenous Section	Location		As per Pavement Design	As per Current Survey
	From	To		
MS 1	52+250	131+560	20 to 53 MSA	17.22 MSA



2.4 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule L. Concessionaire has conducted detail pavement investigation in Oct 2019 and Major Maintenance was carried out accordingly.

Proposed MM Cycle for balance Concession Period

As per Concession Agreement, Overlay is to be carried out in every five years and end of Concession Period. Proposed MM cycles for balance concession period based on survey data is summarized as follows:

i) Main Carriageway

Main Carriageway

Sn	Year	Description	Length (2 lane km)
1	2025 /26	30 mm BC Overlay	157.50 km

The detail calculation of overlay requirement considering FWD Analysis and other parameters is provided in soft copy along with this report.

Service Road:

a) Year 2026 / 27 – 30 mm BC on 50 % and Microsurfacing on 50 % length

Structure Major Maintenance
Replacement of Wearing Coat every fifth year at same time as above

3 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, construction of highway on the site set forth in Schedule A and as specified in Schedule B, together with provision of Project Facilities as specified in Schedule C, and in conformity with the Specifications and Standards set forth in Schedule-D. Project road has completed in compliance to Concession Agreement and there is no balance work to be considered in CAPEX. In general CAPEX is considered for following works:

1. Balance work as per Original scope of work – Not applicable
2. Replacement of defective Equipment at Toll Plaza, software and ECB – Not Applicable
3. Penalty for due to Failure of rectification of defects and deficiency during O & M Period

The summary of all work and cost considered under Initial CAPEX is tabled as below:

Sn	Description of Work	Quantity	Amount
A	Balance Work		
B	Immediate rehabilitation of existing pavement		
C	Replacement of defective Equipment at Toll Plaza and software		
D	Penalty for due to Failure of rectification of defects and deficiency during O & M Period		

There is no CAPEX requirement for this project.

4 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Section 2.4 of this report is calculated for the project:

Sn	Year	Description	Length (2 lane km)
1	2025 /26	30 mm BC Overlay	157.50 km

iii) Service Road: 30 mm BC in 50 % length and 50 % with Microsurfacing

iv) Structure Major Maintenance

MM Cycle of FY 2020/21 has completed in FY 2022.

4.2 Major Maintenance Quantity

Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Microsurfacing
- Milling
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) Bitumen rates as of 16 Mar 2022 is as follows:

Bitumen Price @ 16th March 2022	IOC Mathura		
Bitumen	Base Price	Discount	Ex MI price
VG30	37960	2650	35310
VG40	39350	2650	36700

ii) Aggregates rates as per local market rates

iii) Equipment hire cost as per Standard Data Books published by MORTH

iv) Labour rates as per minimum wages applicable.

v) ATMS, TMS cost is based on offer from vendor.

vi) The element of labour, material and machinery has been adopted from the Standard Data Book of the Ministry of Road Transport and Highways published in Year 2019.

vii) Items has breakdown in such a way that cost estimate can be easily established

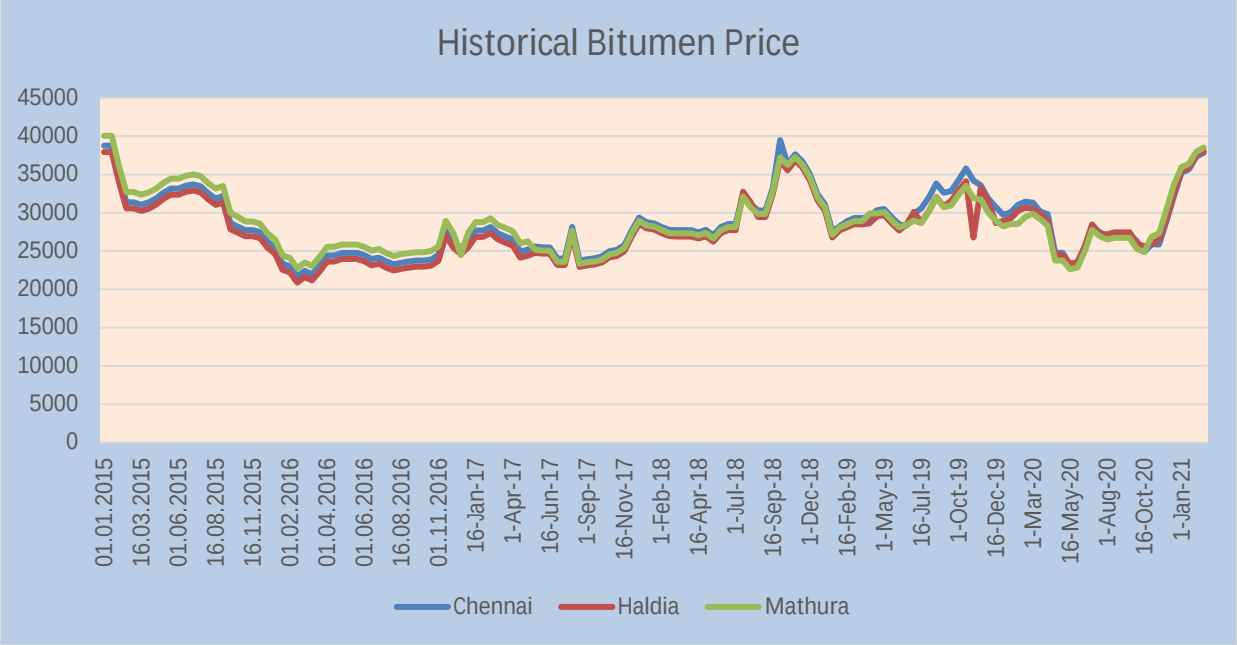
viii) Computation of quantities for all items covering all the works to be carried out

ix) Calculation of repair and rehabilitation required for structure based on site condition.

x) Unit rate of each item includes of 10 % overhead for road works, 15 % overhead for structure works and 10 % contractor's profit.

xi) Unit Rate Analysis is based on FY 2022.

xii) The historical bitumen price from year 2015 to till date is present in below graph.



xiii) Cube Highway forecast Bitumen for upcoming year as follows:

a) FY 2024 onwards till end of Concession Period, Bitumen Price is considered same rate as below:

VG 40 – 32,403 Rs / MT, VG 30 – 28,923 Rs / MT

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

xiv) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company.

Year	Growth Rate	Escalation Factor
FY 22	2.83%	1.000
FY 23	4.66%	1.047
FY 24	5.65%	1.106

Year	Growth Rate	Escalation Factor
FY 25	5.37%	1.165
FY 26	5.52%	1.229
FY 27	5.25%	1.294

Year	Growth Rate	Escalation Factor
FY 28	4.86%	1.357
FY 29	4.44%	1.417
FY 30	4.24%	1.477
FY 31	4.13%	1.538
FY 32	4.08%	1.601
FY 33	4.01%	1.665
FY 34	4.00%	1.732
FY 35	4.03%	1.801
FY 36	4.01%	1.874
FY 37	3.98%	1.948
FY 38	3.98%	2.026
FY 39	4.00%	2.107

Year	Growth Rate	Escalation Factor
FY 40	3.99%	2.191
FY 41	3.99%	2.278
FY 42	3.99%	2.369
FY 43	3.99%	2.464
FY 44	3.99%	2.562
FY 45	3.99%	2.664
FY 46	3.99%	2.771
FY 47	3.99%	2.881
FY 48	3.99%	2.996
FY 49	3.99%	3.116
FY 50	3.99%	3.240

xv) While calculating escalation, cost of bitumen is considered fixed throughout balance Concession Period. Equipment hire cost as per Standard Data Books published by MORTH

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below:

Unit Rate of Major Items

Sn	Items Description	Unit	Rate (Rs) applicable for FY 24 onwards
1	Bituminous Concrete (VG 40)	Cum	9,552
2	Microsurfacing	Sqm	176
3	Replacement of Joint Sealant in PQC	m	132
4	Raising of Road Kerb	m	439
5	Road Marking	sqm	439
6	Kerb and Crash Barrier Painting	sqm	121
7	Shoulder Filling	cum	307
8	Road Studs - Normal	nos	220
9	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented in next page.

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

Bill of Quantities for Major Maintenance (Overlay and Strengthening)

Sl. No.	Activity	Unit	Unit Rate	Quantity MMR (2026/27)	Amount MMR (2026/27)
A	**Main Carriageway - Flexible Pavement**				
1	Tack Coat	Sqm	13	1,469,138	18,599,289
2	Bituminous Concrete	Cum	9,552	44,074	387,537,791
3	Milling of existing BC	Sqm	77		-
4	Raising of Road Kerb	m	439	90,053	39,533,407
5	Painting of Road Kerb	sqm	121	38,594	4,669,908
6	Microsurfacing	sqm	176	-	-
B	**Service Road**				
1	Tack Coat	Sqm	13	52,377	663,097
2	BC - VG 30	Cum	9,005	1,571	14,150,482
3	Microsurfacing	sqm	176	52,377	9,218,405
4	Road Marking - SR	Sqm	439	6,600	2,897,400
C	**Other Works**				
1	Replacement of Road Studs				-
	Road Studs	Nos	220	8432	1,855,040
	Solar Studs	Nos	1,647		-
2	Road Marking - MCW	Sqm	439	55,356	24,301,398
3	Maintenance of Earthen Shoulder	cum	307	9,190	2,821,222
D	**Contingency - 2 % above amount**				**10,124,949**
	70 % Work Completed as of 31 Mar 2021				
	Major Maintenance Cost Per				**516,372,388**
	GST				**61,964,687**
	Major Maintenance Cost				**578,337,075**
	Amount in Crores				**57.83**
	Escalation Factor				1.23
	Escalated Amount keeping Bitumen Component w/o Escalation				66.29

5 OPERATION AND MAINTENANCE COST

5.1 Introduction

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 18 – Operation &Maintenance & Schedule – L Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 18 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee;
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State;
- carrying out periodic preventive maintenance of the Project Highway;
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices;
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment;
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway;
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway;
- protection of the environment and provision of equipment and materials therefore;
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway;
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- complying with Safety Requirements in accordance with Article 18.

Operation and Maintenance requirements of concessionaire have elaborated in Schedule K of Concession agreement. To satisfy operation and maintenance requirement, the following type of maintenance is required to be carried out:

1. Routine Maintenance of Highway and Structure
2. Highway Lighting
3. ATMS and TMS Cost
4. Corridor Management
5. Operation and Maintenance Cost (Toll Plaza, Administrative Building)

5.2 Forecast Methodology

In order to determine the Asset Performance Parameters for the Base Year 2018, the following method has adopted:

Sn	Description of Data	Methodology adopted
1	Asset Inventory (Highway, Structures, Road Furniture, Facilities)	Visual Survey and Validation of Concessionaire data
2	Pavement Distress – (Cracking and other distress)	NSV Survey
3	Roughness Value (IRI), Rutting	NSV Survey
4	Deflection Value/Remaining Life	Falling Weight Deflectometer
5	Condition Survey of Structures	Visual Inspection

Sn	Description of Data	Methodology adopted
6	Condition Survey of Road Furniture, Facilities	Visual Inspection and NSV Survey
7	Traffic Data	As per Survey data provided by Client
8	Axle Load Data	As per Survey data provided by Client
9	ATMS (ECB)	As per manufacturer's / supplier's recommendation
10	TMS	As per manufacturer's / supplier's recommendation

Based on above methodology, detailed quantity for all types of maintenance has calculated for existing Four Lane and costing has done using unit Rates for each item.

5.3 Requirement of CA (Schedule L and Concession Agreement)

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-L (the "Maintenance Requirements").

5.4 Routine and Preventive Maintenance

Routine and Preventive maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine and Preventive Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 16,900 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 7,134 / km / month excluding GST.

5.5 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-Watt LED light will be operated for 12 hours a day round the year
b) Lighting post at median / separator are having with two halogen lamp and service road shall be with single lamp only.
c) Electricity cost is considered 11 Rs / Kwh.

The calculated electricity cost (Yearly) for existing lighting system is tabled as below:

Sn	Description of items	Unit	Quantity	Unit Rate	Amount
1	Spare Parts for highway lighting (AMC)	km	14.61	164,659	2,405,669
2	Highway Lighting Electricity Charge	Kwh	488,808	12.08	5,902,357
3	Operation and Maintenance of DG Set	Nos	1	140,235	140,235
4	Solar Blinker	Nos	40	3,293	131,727
5	Office Building Electricity Charge	LS	1	1,317,273	1,317,273
	Total for FY 22				9,897,261

5.6 TMS Cost and ATMS

Following consideration has made during calculation of O & M cost for TMS and ATMS:

a) AMC cost towards TMS is considered 1.5 lakh per lane per year
b) 70 % of equipment shall be replaced in every 7year interval.
c) However, NHAI has decided to implement 100 % HYBRID ETC lane at all toll lanes, it is expected increase in AMC (considered 12 % of Total Equipment Cost) and replacement of equipment in every five year as per NHAI Policy and accordingly same has considered.

Average O & M Cost as per AECOM calculation is 0.83 crore per year and additional cost of 1.99 crore for replacement of equipment at every 5 (five) years.

5.7 Corridor Management

The following equipments along with operation manpower is required to provide as per CA:

a) 2 nos of Crane of 30 MT
b) Traffic Aid Post with 2 nos of route patrol vehicle
c) 2 nos of Ambulance

O & M Cost estimated towards incident management with operation manpower is Rs. 2.6 crore per year including GST.

5.8 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1. Management, Administration / HR and Supervision Staff: in-house manpower
2. Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of toll. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower from 2022/23 onwards.

The cost of manpower is estimated as Rs. 3.86 core for year 2021/22 and Rs. 3.07 crore per FY 2022/23 onwards.

5.9 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 3.4 crore per year. Year wise O & M Cost (OPEX) non-escalated is presented in next page.

O and M Cost including GST - Toll Collection											
Abstract of Cost for Operation & Maintenance Cost - Western UP Tollway Limited (WUPTL)											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	11,203,424	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	144,894,103
3	2023-24	12,847,652	17,786,663	9,897,261	28,221,019	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	166,411,244
4	2024-25	14,179,560	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	147,870,239
5	2025-26	5,683,222	17,786,663	9,897,261	8,348,106	26,638,857	1,778,318	30,694,650	4,347,000	34,199,825	139,373,901
	Total	43,913,857	71,146,654	39,589,042	53,265,338	106,555,427	7,113,272	122,778,598	17,388,000	136,799,299	598,549,488
Total Cost in Crore		4.39	7.12	3.96	5.33	10.66	0.71	12.28	1.74	13.68	59.86

6 PROJECT ROAD ANALYSIS

6.1 Reconnaissance Survey

This project road is a section of NH 58 which starts Delhi and extends upto Mana in the state of Uttarakhand. Project road starts from Km 52+250 at Meerut bypass and ends at Km 130+560 at Muzaffarnagar in the state of Uttar Pradesh. The total length of the project road is 78.31 km located in plain terrain. The project road has been visited by Consultant's team of Engineers in the month of October 2019 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures and other facilities.

The project stretches and length is given as below:

Detail of Project Stretch

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Improvement,Operation and Maintenance of Rehablitation and Strengthening of Existing 2-Lane Road and Widening to 4-lane Divided Highway	52+250	130+560	78.31	Four lane divided Carriageway

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements
- Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and cross road details
- Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, water bodies, sensitive locations etc.

Start Point of Project Road at Km 52+250	End Point of Project Road at Km 130+560

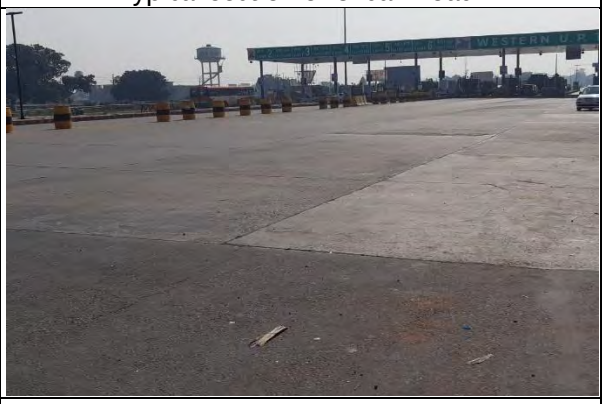
Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

Comparison of Project Highway Components

Sn	Particulars	As per Schedule-B	As per Site Condition	Remarks
1	Project Road Start	Km 52+250 at Meerut Bypass of NH-52	Km 52+250 at Meerut Bypass of NH-52	
2	Project Road End	Km 130+560 of NH-52	Km 130+560 of NH-52	
3	Project Length	78.31 km	78.31 km	
6	Carriageway	4 lane highway with paved width 8.5 m on either side and 10.5 m paved at approach of underpass, Flyover and ROB	4 lane highway with paved width 9.0 m on either side and 11.0 m at approach of underpass, Flyover and ROB	
7	Shoulders	2.0 m earthen shoulder for main carriageway and 2.5 m paved Footpath for Service road	2.0 m earthen shoulder for main carriageway	
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	
9	Service Roads	LHS: 8.840 km RHS: 8.840 km	LHS: 8.71 km RHS: 9.290 km	
10	Major Bridge	2 Nos.	2 Nos.	
11	Minor Bridge	3 Nos.	6 Nos.	
12	Pipe, Box & Slab Culverts	256 Nos	256 Nos	
13	Major/Minor Junctions	12 Major Junction	12 Major Junction + 57 Minor Junction	
14	Underpass	7 Nos	11 Nos	
15	Grade Separator	1 No.	1 No.	
15	ROB/RUB	3 No.	3 No.	
16	Toll Plazas	1 Nos.	1 Nos.	
17	Truck Lay-byes/Truck Parking	4 Nos.	4 Nos	
18	Bus bays/Bus Stops	18 Nos	13 Nos	

6.2.1 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Cross Section</td><td>Typical Section of Urban Road</td></tr>
<tr><td> </td><td>  </td></tr>
<tr><td>Typical Section of Approch</td><td>Toll Plaza</td></tr>
</table>

Seven type of TCS has been proposed in Schedule-B of CA and same has adhered along project road. It is observed NHAI has appointed Agency M/s Krishna Construction for construction of 4 nos of Grade Separated Structure (VUP, FO), construction of service road and construction of ROB and approach at following locations:

Construction of Approach and GSS

FROM	TO	LENGTH	Side	Structure
71780	72820	1040	BS	GS
88380	89800	1420	BS	GS
92140	93300	1160	BS	GS
101280	102000	720	BS	GS
114300	114850	550	RHS	ROB
Total one side Length		9230		

Construction of Service Road

FROM	TO	LENGTH	SIDE
52250	53280	30	RHS
57550	57920	370	LHS
67340	67500	160	LHS
79160	79680	520	RHS
98150	98660	510	LHS
103740	103930	190	RHS
TOTAL (m)		1780	

6.2.2 Pavement Type

Flexible pavement has provided along the entire length of project road except at Toll Plaza where Rigid Pavement has been provided. Pavement condition is generally Fair to Poor throughout the project corridor.

6.2.3 Service Roads

Schedule B has proposed service roads at Urban stretches to segregate the local and diverging traffic from main carriageway. Comparison of service Road as per Schedule B and as per Site is as follows:

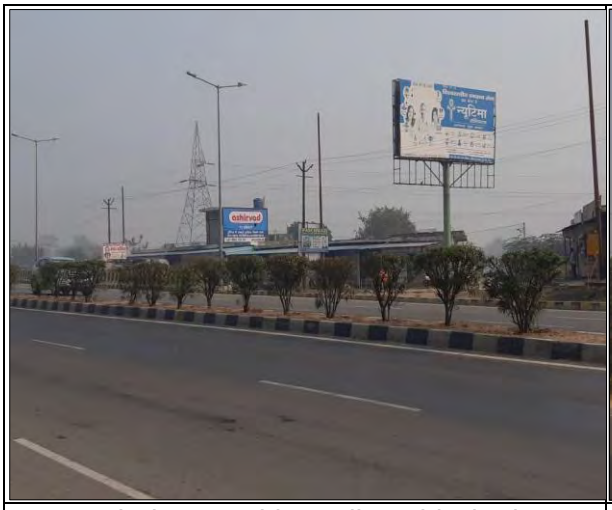
Comparison of Service Road Location between Schedule B and as per Site

	As per Schedule B					As Per Site				
Sn	Location		Side	Length (km)	Width (m)	Location		Side	Length (km)	Width (m)
	From	To				From	To			
1	58.450	59.050	Both	0.600	5.5	58.400	59.170	Both	0.770	5.5
2	61.450	62.075	Both	0.625	5.5	61.320	62.180	Both	0.860	5.5
3	66.575	67.150	Both	0.575	5.5	66.500	67.000	Both	0.500	5.5
4	70.750	72.825	Both	2.075	5.5	70.780	72.850	Both	2.070	5.5
5	78.350	79.400	Both	1.050	5.5	78.360	79.420	Both	1.060	5.5
6	80.400	80.750	Both	0.350	5.5	80.340	80.760	Both	0.420	5.5
7	105.275	106.015	Both	0.740	5.5	105.320	106.060	Both	0.740	5.5
8	107.350	109.050	Both	1.700	5.5	107.360	107.860	LHS	0.500	5.5
9						107.860	108.420	LHS	0.560	3.5
10						107.360	109.000	RHS	1.640	5.5
11	118.200	118.825	Both	0.625	5.5	118.200	118.900	Both	0.700	5.5
12	121.900	122.400	Both	0.500	5.5	121.920	122.450	Both	0.530	5.5
			Total	17.680				Total	18.00	

The above table do not include service road under construction.

6.2.4 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in good condition.

	
Typical 1.5 m wide median with Shrubs	4.5m wide Median with Shrubs

34 nos. of authorized and @ nos of unauthorized median openings are found along project road. Most of median openings are having storage lane and blinkers. List of authorized median openings is tabled below:

Sn	Location		Blinker	Length (m)	Storage Lanes
	From	To			
1	54.360	54.390	NO	30	B/S
2	55.830	55.860	NO	30	B/S
3	57.245	57.255	NO	10	NO
4	57.700	57.720	NO	20	B/S
5	64.220	64.230	NO	10	NO
6	68.680	68.700	YES	20	NO
7	71.390	71.400	NO	10	NO
8	72.940	72.970	NO	30	B/S
9	73.250	73.260	YES	10	NO
10	74.030	74.060	NO	30	B/S
11	77.850	77.870	YES	20	B/S
12	80.200	80.220	YES	20	B/S
13	81.910	81.930	YES	20	B/S
14	81.910	81.930	YES	20	B/S
15	85.880	85.910	YES	30	B/S
16	86.850	86.880	YES	30	B/S
17	91.530	91.560	NO	30	B/S
18	103.050	103.070	YES	20	NO
19	104.540	104.560	NO	20	B/S
20	105.720	105.740	YES	20	NO
21	106.060	106.080	YES	20	NO

Sn	Location		Blinker	Length (m)	Storage Lanes
	From	To			
22	107.210	107.220	YES	10	NO
23	107.690	107.710	NO	20	NO
24	110.250	110.260	YES	10	NO
25	110.680	110.720	YES	40	NO
26	112.200	112.210	NO	10	NO
27	113.760	113.780	NO	20	NO
28	114.920	114.940	YES	20	B/S
29	119.900	119.930	YES	30	B/S
30	123.440	123.460	YES	20	B/S
31	123.930	123.960	YES	30	B/S
32	126.220	126.240	NO	20	B/S
33	128.140	128.160	YES	20	B/S
34	129.200	129.240	YES	40	RHS

Median Opening without Solar Blinker

Medain Opening with Solar Blinker

6.2.5 Road Side Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order. Location and type of drain as provided is presented below:

Location of RCC Drain

S N	CHAINAGE		LENGTH	SIDE
	FROM	TO		
1	57+550	57+840	290	LHS
2	57+920	58+280	360	LHS
3	67+340	67+500	160	LHS
4	80+340	80+760	420	LHS
5	88+150	88+790	640	LHS

S N	CHAINAGE		LENGTH	SIDE
	FROM	TO		
6	107+360	107+860	500	LHS
7	118+190	118+835	645	LHS
8	108+620	109+000	380	RHS
9	107+360	107+980	620	RHS
10	80+350	80+760	410	RHS
11	74+690	75+090	400	RHS
12	70+080	70+265	185	RHS

Location of Median Drain

S N	CHAINAGE		LENGTH	TYPE
	FROM	TO		
1	62+160	62+620	460	Median Cut Drain
2	74+960	75+180	220	Median Cut Drain
3	78+360	79+390	1030	Median Cut Drain
4	86+500	86+620	120	Median Cut Drain
5	86+860	86+950	90	Median Cut Drain
6	89+000	89+300	300	Median Cut Drain
7	108+880	109+020	140	Median Cut Drain
8	113+510	113+600	90	Median Cut Drain
9	113+785	114+240	455	Median Cut Drain
10	119+180	119+800	620	Median Cut Drain
11	120+720	120+980	260	Median Cut Drain
12	122+800	122+860	60	Median Cut Drain
13	124+280	124+840	560	Median Cut Drain
14	125+170	125+440	270	Median Cut Drain
15	121+720	122+260	540	Median Cut Drain
16	125+170	125+440	270	Median Cut Drain
17	125+800	125+860	60	Median Cut Drain
18	126+000	126+180	180	Median Cut Drain
19	126+300	126+380	80	Median Cut Drain
20	127+040	127+140	100	Median Cut Drain
21	128+800	129+185	385	Median Cut Drain
22	52+250	52+850	600	Median Drain
23	115+840	116+640	800	Median Drain
24	117+230	117+700	470	Median Drain
25	117+750	117+860	110	Median Drain

RCC Covered Drain at Project Road	Median Drain at Project Road

6.2.6 Major and Minor Junctions

As per the site inventory, 12 major and 57 minor junctions are present in project road. Major junctions were found mainly at start and end of bypasses and crossings with NH/SH. Minor junctions were generally present for access to nearby villages, towns or agricultural areas.

Remarks	Nos.	
	As per CA	As per Site
Major Junctions	12	12
Minor Junctions	57	57

Major Junction at 113+450	Minor junction at 107+750

Details of Major Junctions along the project are presented in the table below:

Details of Major Junctions

Sn	Existing Chainage	Type of Junction	Side	Cross Road Leading to	Width of Cross Road (m)	Surface Type
1	52.500	Y	RHS	Meerut	7.0	BT
2	58.800	X	LHS	Bagpat	7.0	BT
			RHS	Meerut	4 Lane	BT
3	61.750	X	LHS	Baraut	7.0	BT
			RHS	meerut	7.0	BT
4	66.875	X	LHS	Karnal	4 Lane	BT
			RHS	Meerut	4 Lane	BT
5	70.750	Y	RHS	Meerut	7.0	BT
6	78.815	X	LHS	Sardhana	4 Lane	BT
			RHS	Mawana	7.0	BT
7	92.500	Y	RHS	Khatauli	7.0	BT
8	101.700	Y	RHS	Khatauli	7.0	BT
9	113.700	T	LHS	Muzaffarnagar	7.0	BT
10	118.550	X	LHS	Muzaffarnagar	7.0	BT
			RHS	Jansat	7.0	BT
11	122.175	X	LHS	Muzaffarnagar	4 Lane	BT
			RHS	Bhopari	7.0	BT
12	129.125	Y	LHS	Muzaffarnagar	7.0	BT

6.2.7 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road. Detail of crash barriers present in the project road is given below:

Type of Crash Barrier	Side	Length (km)
Metal Beam	Carriageway Edge	10.096
	Median	0.960
Pedestrian Guard Rail	Carriageway Edge	0.09
RCC Crash Barrier	Carriageway	10.400

Metal beam and RCC crash Barrier present on the project road

6.2.8 Toll Plaza and Other Facilities

As per Schedule-C; maximum number of two toll plazas are proposed at suitable locations in consultation with Independent Engineer/NHAI such that there is no possibility of traffic bypassing but at site there is only one toll plaza. The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement. The location Toll Plaza is at Siwaya Chainage 75+990

Siwaya Toll Plaza at Km 75+900

6.2.9 Highway Lighting

Highway Lighting has been provided at urban and semi-urban areas, approach to toll plaza, Rest areas, and at intersections as per Schedule C. Additionally, High Mast has provided at major junction, ROBs and flyover confirming Schedule C.

Lighting location along the project road is presented in the table below:

Highway Lighting Location

S N	CHAINAGE		LENGTH	SIDE	Nos	TYPE
	FROM	TO				
1	58+400	59+170	770	LHS	6	SINGLE ARM
2	61+300	62+220	920	LHS	16	DOUBLE ARM
3	66+260	66+400	140	LHS	5	SINGLE ARM
4	66+500	67+240	740	LHS	26	DOUBLE ARM
5	70+780	71+820	1040	LHS	11	SINGLE ARM
6	73+050	73+170	120	LHS	5	SINGLE ARM
7	75+830	75+905	75	MEDIAN	3	DOUBLE ARM
8	76+085	76+170	85	MEDIAN	3	DOUBLE ARM
9	75+995			LHS	2	SINGLE ARM
10	78+360	79+420	1060	MEDIAN	18	DOUBLE ARM
11	80+340	80+730	390	MEDIAN	16	DOUBLE ARM
12	81+090	81+380	290	LHS	11	SINGLE ARM
13	87+000	88+120	1120	LHS	26	SINGLE ARM
14	87+000	88+120	1120	RHS	26	SINGLE ARM
15	92+180	92+450	270	LHS	9	SINGLE ARM
16	104+830	105+050	220	LHS	5	SINGLE ARM
17	105+320	106+060	740	LHS	26	SINGLE ARM
18	107+360	107+860	500	LHS	12	SINGLE ARM
19	113+500	113+620	120	LHS	4	SINGLE ARM
20	113+880	114+265	385	LHS	13	DOUBLE ARM
21	114+265	114+520	255	LHS	11	SINGLE ARM
22	122+260	122+455	195	LHS	7	DOUBLE ARM
23	122+760	122+910	150	LHS	8	SINGLE ARM
24	129+085	129+150	65	MEDIAN	2	DOUBLE ARM
25	129+290	129+340	50	MEDIAN	2	DOUBLE ARM
26	118+180	118+920	740	RHS	21	DOUBLE ARM
27	107+390	108+900	1510	RHS	20	SINGLE ARM
28	105+320	106+060	740	RHS	28	SINGLE ARM
29	70+400	71+200	800	RHS	28	DOUBLE ARM

High Mast Location

SN	CHAINAGE	SIDE	NOS	LOCATION
1	75+995	LHS	2	TOLL PLAZA
2	75+995	RHS	2	TOLL PLAZA
3	52+250	RHS	1	JUNCTION
4	70+650	RHS	1	JUNCTION

High Lighting at Project Road

Highway Mast light at Toll Plaza

6.2.10 Bus Bays and Bus Shelter

There are 13 Bus bays along the project road. All bus shelters present in the project road are in Fair to Poor condition

Bus Shelter at Km 66+300

Bus Shelter at Km 113+500

The details of Bus Bays and bus shelters are provided in the table below:

Locations of Bus Bay with shelter

S. N	CHAINAGE	SIDE	TYPE	Detail		
				PAVEMENT	PASSENGER SHELTER	LIGHTING
1	66.300	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
2	73.100	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
3	78.040	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
4	92.280	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
5	104.920	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE

S. N	CHAINAGE	SIDE	TYPE	Detail		
				PAVEMENT	PASSENGER SHELTER	LIGHTING
6	107.940	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
7	113.500	LHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
8	67.625	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
9	79.705	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
10	88.250	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
11	106.225	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
12	108.030	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE
13	113.630	RHS	STEEL SHELTER RCC SEATS	BT	AVAILABLE	AVAILABLE

6.2.11 Truck Lay Byes

Four numbers of Truck Laybys / parking found at site is presented in table below:

Details of Truck Lay bye

S. N	Chainage	Side	Facilities		
			Rest Area	Toilet/Drinking Water Facilities	Lighting
1	81.280	LHS	NA	AVAILABLE	AVAILABLE
2	81.400	RHS	NA	AVAILABLE	AVAILABLE
3	122.750	LHS	NA	AVAILABLE	AVAILABLE
4	122.750	RHS	NA	AVAILABLE	AVAILABLE

As per Schedule C, total four numbers are to be provided and same numbers are provided at site.

Toilet Block and Truck Laybye

6.2.12 Signage and Marking

Road Signs

723 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Good condition.

Cantilever Gantry at Project Road

Direction Board at Project Road

Summary of different sign board found along the project road is presented below:

SIGNAGE	Nos
Accident Zone	9
Bus Stop	5
Cantilever Gantry	14
Chevron	248
Cross Junction	8
Cross Road	2
Destination Board	9
Direction Board	44
Double hazard Marker	6
Emergency Nos	21
Go slow	1
Hazard Marker	54
Hospital	3
Informatory Board	5
Median Opening	56
No overtaking Zone	4
No Stop	9
Object Marker	31

SIGNAGE	Nos
Overhead Gantry	10
Pedestrian Crossing	48
Petrol Pump	5
Place Identification	21
Police	8
Restaurant	2
Road Diverging ahead	1
Road Left	11
Road Merging Ahead	1
Road Right	5
Route Marker	7
School Ahead	16
Service Road Ends	3
Service Road Starts	3
Speed limit	8
Toll Boards	12
Turn Left	11
Turn Right	7

Road Marking

Road Marking along the project corridor was found to be in Fair to Poor condition.

Road marking along the carriageway

6.2.13 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is good in 4.5 m median and 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road | Plantation at 4.5 m Median

6.3 Toll Plaza and Associated Facilities

Toll Plaza and Associated Facilities

Concession Agreement Provision: As per Schedule-C; maximum number of two toll plazas are proposed at suitable locations in consultation with Independent Engineer/NHAI such that there is no possibility of traffic bypassing.

The design of Toll Plaza shall confirm to the standards set out in Schedule D of Concessionaire Agreement.

Siwaya Toll Plaza at km.75+990

"Open System" of toll collection shall be provided on the Project highway with collection of user fee from vehicles only at the Toll Plaza. There shall be total of minimum 8 lanes having a semi-automatic system of toll collection comprising equipment's for registering of vehicle classification, ticket issuing,

data processing and power supply. One toll lane in each direction shall be provided for traffic not required to pay fees. Appropriate technology shall be used in this regard so that not more than 6 vehicles/lane queue up during the peak hours.

The design for Toll Plaza shall confirm to the standards set out in Schedule-D of the Concessionaire Agreement.

Site Observations:

1. During the site visit, it was observed that there is one Toll Plaza located at Km 75+99 having 6 LHS+6 RHS lanes.
2. All the lanes are under Hybrid mode.
3. The Toll Plaza is equipped with the Administrative Building having all the provisions mentioned in Concessionaire Agreement.
4. There are 12 WIMs (6 LHS+6 RHS) and 2 SWB (1 LHS+1 RHS). All of these are approved under COS.
5. There is an underground tunnel for the movement of toll collectors between the toll office and toll lanes and its dimensions are sufficient to accommodate the required wiring/cabling system.
6. All the prefabricated toll booths have an adequate space for toll collector; computer, printer, cash box etc. are as per the provisions of Concessionaire Agreement.

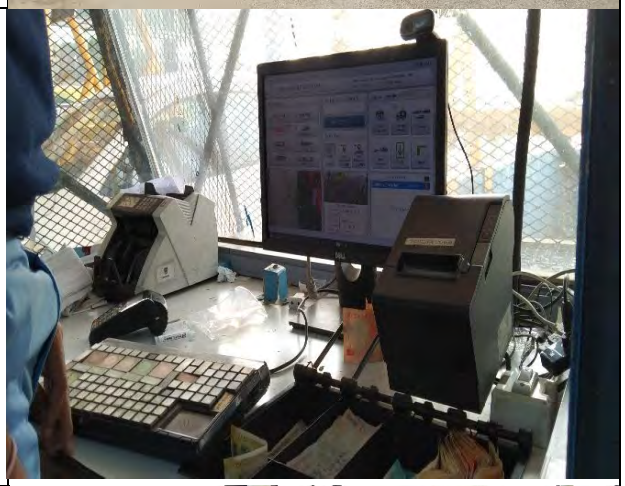
Facilities available at Toll Plaza at Km 75+990

The available facilities at existing Toll Plaza along with condition are presented in Table below:

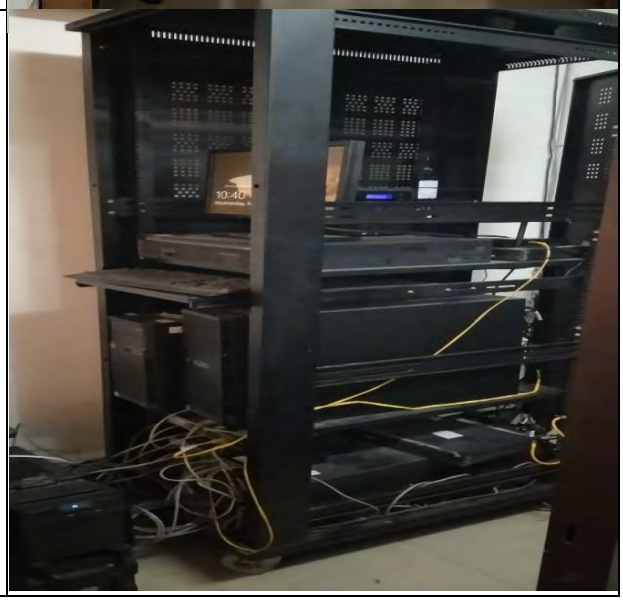
Table: Facilities available at Toll Plaza

Parameter	Concessionaire Agreement Provision	Current Status
AVC (Automatic Vehicle Classifier) System	Should be installed in each and every lane.	Installed and working in all the lanes.
Basic Equipment outside and inside the Toll Booth such as Boom Barrier, Traffic Light, User Fare Display, OHLS, Collector Monitor, Keyboard, Printer, Violation Alarm, booth camera etc.	All such basic equipments are required to be installed and functional in all the lanes.	Installed and working in all the lanes.
Availability of Tunnel	For movement between Toll office and toll booth of each toll lane.	Available.
Administrative Building	Administrative Building should have all basic requirements such as Control Room, Server Room, POS Room etc.	Available with all basic requirements.
Hybrid ETC System	Hybrid ETC System should be installed in all the lanes.	All the lanes are under Hybrid mode and are approved under COS.

Pictorial representation for present site conditions:

S. No.	Description	Site Status
1.	Toll Plaza is at Km 75+990 having 6 LHS+ 6 RHS lanes. All the lanes are under Hybrid Mode.	
2.	Toll booths are equipped with all the required systems/equipments.	
3.	All the required equipments are placed outside the toll booth.	

S. No.	Description	Site Status
4.	WIMs are installed in 6 LHS +6 RHS lanes. All WIMs are in working mode.	
5.	SWB are in 1LHS & 1RHS lanes. Both are installed and operational.	
6.	Underground tunnel is available for movement of staff between toll office and toll lanes. Its dimension is sufficient to accommodate the required wiring/cabling.	

S. No.	Description	Site Status
7.	Toll Management System (TMS) was installed by M/s Tollman International Pvt Ltd (TECHSTURE) in 2017 and even day to day operations as well as AMC is also taken care by the same Vendor.	
8.	TMS Server Room is equipped with all the required servers and switches.	

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.

- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 02 nos of Major Bridge of total length of 210 m having span arrangement of 3 x 20 + 5 x 30 is in good condition
- 06 nos. of Minor bridges having total length varies from 6.5 m to 52 m are generally found in good condition.
- 08 nos. of Vehicular Underpass having different span arrangement out of which are 6 nos are having span arrangement of 2 x 10 ,1 no having 1 x 11 and 1 nos 1 x 7 are found in good condition.
- 3 nos. of Railway over Bridges of total length of 173.2 m are in good condition
- 1 no of Flyover of total length of 105 m having span arrangement of 3 x 35 is found in good condition
- 256 (pipe/slab/box) nos. of culverts found at site

It is noted that 4 nos of Grade Separated Structures which are under construction by Contractor appointed by NHAI under separate EPC Contractor. Design / Construction has not been reviewed by AECOM.

6.4.2 Detailed Description of Structures

6.4.1 Major Bridges

Salient features of the 02 Major bridges are discussed here:

1. Major Bridge at Ch. 95+697 (On Ganga Canal)

It consists of newly constructed two carriageways of Major Bridge on Ganga Canal. It has a span arrangement of 1x20 + 3x30 + 1x20m. The superstructure comprises of RCC slab at end spans and PSC Precast Girder at intermediate spans with RCC circular pier and RCC wall type abutment. The foundation type is not visible. POT PTFE Bearings are adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS with some minor damages in expansion joint etc. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc.

A few pictures to ascertain the condition of Major Bridge are presented as follows:

Carriageway on LHS

Span Arrangement on LHS

Expansion Joint

Carriageway on RHS

Span Arrangement on RHS

Slope Protection in fair condition

Major Bridge at Ch. 95+697

2. Major Bridge at Ch. 98+653 (On Ganga Canal)

It consists of newly constructed two carriageways of Major Bridge on Ganga Canal. It has a span arrangement of 1x20 + 2x30. The superstructure comprises of RCC Deck slab supported by RCC Slab at one end span and PSC Precast Girders with RCC circular pier and RCC wall type abutment for substructure. The foundation type is not visible. POT PTFE Bearings are adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS with some minor damages in expansion joint etc. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc.

A few pictures to ascertain the condition of Major Bridge are presented as follows:

Carriageway on LHS

Span Arrangement on LHS

Drainage Spout in Fair condition

Expansion Joint

Carriageway on RHS

Span Arrangement on RHS

Major Bridge at Ch. 98+653

2.3.2.2 *Minor Bridge*

Salient features of the 06 Minor bridges are discussed here:

1. Minor Bridge at Ch. 65+520 (Additional)

It consists of a bridge on LHS and RHS both carriageways. It has a span arrangement of 2x7.0m with 45^0 skew. This comprises of 2 –cell RCC Box structure with raft foundation.

The bridge is generally in good condition and only requires regular repair works such as Repair of floor protection; drainage spouts etc.; cleaning of water-way, removal of excessive vegetation growth and periodic maintenance of slope pitching etc.

A few pictures to ascertain the condition of minor bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Minor Bridge at Ch. 65+520

2. Minor Bridge at Ch. 103+600 (Additional)

It consists of a bridge on LHS and RHS both carriageways. It has a span arrangement of 2 x 6.0m with 40^0 skew. This comprises of 2 –cell RCC Box structure with raft foundation.

The bridge is generally in good condition and only requires regular repair works such as Repair of floor protection, drainage spouts etc, removal of excessive vegetation growth and periodic maintenance of slope pitching etc.

A few pictures to ascertain the condition of minor bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Minor Bridge at Ch. 103+600

3. Minor Bridge at Ch. 109+260

It consists of two carriageways of Minor Bridge both sides. It has a span arrangement of 2 x 26m. The superstructure comprises of RCC Deck slab supported by PSC Precast Girder with RCC wall type abutments and rectangular pier for substructure. The foundation type is not known. POT PTFE Bearings are adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc. and cleaning of waterway.

A few pictures to ascertain the condition of Minor Bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Damaged Expansion Joint

Clogged/Blocked Drainage Spout

Minor Bridge at Ch. 109+260

4. Minor Bridge at Ch. 115+250

It consists of two carriageways of Minor Bridge both sides. It has a span arrangement of 1 x 8.80 + 1 x 8.90 + 1 x 9.90m. The superstructure comprises of RCC Slab with RCC wall type abutments and wall type piers for substructure. The foundation type is not known. Tar Paper Bearing is adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc. and cleaning of waterway.

A few pictures to ascertain the condition of Minor Bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Minor Bridge at Ch. 115+250

5. Minor Bridge at Ch. 117+700

It consists of two carriageways of Minor Bridge both sides. It has a span arrangement of 1 x 8.80 + 1 x 9.50m. Superstructure comprises of RCC solid Slab with RCC wall type abutments and wall type piers for substructure. The foundation type is not known. Tar Paper Bearing is adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc. and cleaning of waterway.

A few pictures to ascertain the condition of Minor Bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Damaged Slope Pitching

Water-way to be cleaned

Minor Bridge at Ch. 117+700

6. Minor Bridge at Ch. 123+440 (Additional and not in Schedule)

It consists of two carriageways of Minor Bridge both sides. It has a span arrangement of 1 x 6.50m. Superstructure comprises of RCC solid Slab with RCC wall type abutments for substructure. The foundation type is not known. Tar Paper Bearing is adopted for resting of superstructure.

The Bridge is generally in good condition for both LHS and RHS with some minor damages in Wing wall and settled approach Slab etc. It only requires regular periodic maintenance of bearing, expansion joints, drainage spout and stone pitching etc. and cleaning of waterway.

A few pictures to ascertain the condition of Minor Bridge are presented as follows:

Carriageway of Minor Bridge

Span Arrangement

Settled Aproach Slab on LHS

Damaged Wing Wall

Minor Bridge at Ch. 123+440

2.3.2.3 Grade Separators (Flyover)

Salient features of 01 Grade separators is discussed here:

1. Flyover at Ch. 70+800

This flyover is constructed on Right Carriageway only. It has a span arrangement of 3 x 35m. Superstructure comprises of RCC Deck slab supported by PSC Girders with RCC rectangular abutments and Piers for substructure. The foundation type is not known. Fixed Pin & Metallic guided Bearing with POT PTFE Bearings at each girder support are adopted for resting of superstructure.

The flyover is generally in good condition and only requires regular repair works such as painting and periodic maintenance of drainage spout, bearing, expansion joints, wearing course etc.

A few pictures to ascertain the condition of flyover are presented as follows:

Carriage way of Flyover

Span Arrangement

Pin Bearing in fair condition

Super Structure in Fair condition

Flyover at Ch. 70+800

2.3.2.4 Railway over Bridges (ROB)

Salient features of 03 Railway over Bridges are discussed here:

1. ROB at 69+490

The ROB is provided with the width of four lane configuration. It has a span arrangement of 1 x 48.60m. Superstructure comprises of RCC Deck slab supported by Steel plate Girder with RCC wall type abutments for substructure. The foundation type is not known. POT PTFE Bearings are adopted for resting of superstructure.

The ROB is generally in good condition and is being monitored by railway authority at regular intervals presuming the signed inspection report written at Abutment location. It only requires regular repair works such as painting and periodic maintenance of drainage spout, bearing, expansion joints, wearing course etc.

A few pictures to ascertain the condition of ROB are presented as follows:

Carriage way of ROB

Span Arrangement

Damaged Expansion Joint

Clogged/Blocked Drainage Spout

RE wall behind abutment in fair condition

Super Structure in fair condition

ROB at Ch. 69+490

2. ROB at 87+583

It consists of Old low height ROB on LHS carriageway. It has a span arrangement of 4 x 21.00m. Superstructure comprises of RCC Deck slab supported by RCC Precast Girders with RCC wall type abutment and Circular piers for substructure. The foundation type is not known. POT PTFE Bearings are adopted for resting of superstructure.

The Newly constructed ROB is there on RHS carriageway. It has a span arrangement of 1 x 12.00 + 2x30.00 + 1x12.00. Superstructure comprises of RCC Slab at ends and 2 Spans of PSC Girder at Centre

with RCC wall type abutment and circular piers for substructure. The foundation type is not known. POT PTFE Bearings are adopted for resting of superstructure.

The ROB is generally in good condition and is being monitored by railway authority at regular intervals presuming the signed inspection report written at Abutment location. It only requires regular repair works such as painting and periodic maintenance of drainage spout, bearing, expansion joints, wearing course etc.

A few pictures to ascertain the condition of ROB are presented as follows:

Carriage way of ROB

Span Arrangement on LHS

Span Arrangement on RHS

Expansion Joint

ROB at Ch. 87+583

3. ROB at 114+289

The ROB is provided with the width of four lane configuration. It has a span arrangement of 1 x 40.60m. Superstructure comprises of RCC Deck slab supported by PSC Precast I- Girder with RCC wall type abutments for substructure. The foundation type is not known. POT PTFE Bearings are adopted for resting of superstructure.

The ROB is generally in good condition. It only requires regular repair works such as painting and periodic maintenance of drainage spout, bearing, expansion joints, wearing course etc.

A few pictures to ascertain the condition of ROB are presented as follows:

Carriage way of ROB

Span Arrangement

Super Structure in fair condition

Girder System of ROB

ROB at Ch. 114+289

2.3.2.5 Vehicle Under-Passes (VUPs)

There is a total of 08 VUPs in the entire project road. All VUPs are Single/Double span RCC Box Structure with raft foundation. Clear Span and overall width of VUPs are given as follows:

S.No.	Chainage	Clear Span	Overall Width
1	58+775	2 x 10.00m	25.90m
2	61+775	2 x 10.00m	25.90m
3	66+875	2 x 10.00m	25.90m
4	78+815	2 x 10.00m	25.90m
5	87+400	1 x 7.00m	23.85m
6	95+100	1 x 11.00m	25.90m
7	118+550	2 x 10.00m	25.90m
8	122+175	2 x 10.00m	25.90m

All VUPs are generally in good condition and only requires regular repair works such as periodic maintenance of drainage spout, wearing coat etc. A few pictures to ascertain the conditions of VUPs are presented as follows:

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 58+775

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 61+775

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 66+875

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 78+815

Span Arrangement of VUP

Wing Wall in fair condition

VUP at Ch. 87+400

Span Arrangement of VUP

Wing Wall in fair condition

VUP at Ch. 95+100

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 118+550

Span Arrangement of VUP

RE Wall in fair condition

VUP at Ch. 122+175

2.3.2.6 Pedestrian Under-Passes (pups)

There is a total of 03 PUPs in the entire project road. All PUPs are single span RCC Box Structure with raft foundation. Clear Span of PUPs are given as follows

S.No.	Chainage	Clear Span
1	93+900	1 x 6.00m; Skew=60^0
2	97+070	1 x 6.00m
3	100+050	1 x 7.00m; Skew=30^0

All PUPs are generally in good condition and only requires regular repair works such as periodic maintenance of drainage spout, wearing coat etc. A few pictures to ascertain the conditions of PUP is presented as follows:

Carriageway of PUP

Span Arrangement

PUP at Ch. 93+900

Carriageway of PUP

Span Arrangement

PUP at Ch. 97+070

Carriageway of PUP

Span Arrangement

PUP at Ch. 100+050

6.4.3 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Structure Type	Side	Span	Carriageway Width (m)	Sufficiency of water way (Y / N)	EXisting Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Additional Remarks
							Foundation	Sub structure	Super structure	Bearings	EXpansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches	Drainage Spouts		
1	95.697	MJB	LHS	1 X 20 + 3 X 30 + 1 X 20	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 20 + 3 X 30 + 1 X 20	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
2	98.653	MJB	LHS	1 X 20+2 X 30	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 20+2 X 30	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
3	65.520 (Additional)	MNB	LHS	2 X 7.00	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 7.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
4		MNB	LHS	2 X 6.00	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-

Sn	Chainage	Structure Type	Side	Span	Carriageway Width (m)	Sufficiency of water way (Y / N)	EXisting Structure Condition										Projected Overall Stability of Structrue till the end of Concessio n period	Additional Remarks
							Foundation	Sub structure	Super structure	Bearings	EXpansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches	Drainage Spouts		
	103.600 (Additional)		RHS	2 X 6.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
5	109.260	MNB	LHS	2 X 26.00	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 26.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
6	115.250	MNB	LHS	1 8.8 + 1X8.9 + 1X9.9	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 8.8 + 1X8.9 + 1X9.9	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
7	117.700	MNB	LHS	1 X (8.8+9.5)	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	Pitching Damaged (2 Nos on LHS)
			RHS	1 X (8.8+9.5)	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
8	123.440 (Additional)	MNB	LHS	1X 6.50	10.50	Y	●	●	●	●	●	●	●	●	●	●	Stable	Wing wall and approach Slab damaged on LHS
			RHS	1 X 6.50	10.50		●	●	●	●	●	●	●	●	●	●	Stable	
9	70.800	GS	LHS	-			-	-	-	-	-	-	-	-	-	-	-	-
			RHS	3 X 35.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
10	69.490	ROB	LHS	1 X 48.60	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 48.60	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
11	87.583	ROB	LHS	4 x 21.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-

Sn	Chainage	Structure Type	Side	Span	Carriageway Width (m)	Sufficiency of water way (Y / N)	EXisting Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Additional Remarks
							Foundation	Sub structure	Super structure	Bearings	EXpansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches	Drainage Spouts		
			RHS	1 X 12+2 X 30 + 1 X 12	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
12	114.289	ROB	LHS	1 X 40.60	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 40.60	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
13	58.775	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
14	61.775	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
15	66.875	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
16	78.815	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
17	87.400	VUP	LHS	1 X 7.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 7.00	11.50		●	●	●	●	●	●	●	●	●	●	Stable	-
18	95.100	VUP	LHS	1 X 11.00	9.55		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 11.00	9.55		●	●	●	●	●	●	●	●	●	●	Stable	-

Sn	Chainage	Structure Type	Side	Span	Carriageway Width (m)	Sufficiency of water way (Y / N)	EXisting Structure Condition										Projected Overall Stability of Structrue till the end of Concession period	Additional Remarks
							Foundation	Sub structure	Super structure	Bearings	EXpansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches	Drainage Spouts		
19	118.550	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
20	122.175	VUP	LHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	2 X 10.00	10.50		●	●	●	●	●	●	●	●	●	●	Stable	-
21	93.900	PUP	LHS	1 X 6.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 6.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-
22	97.070	PUP	LHS	1 X 6.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 6.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-
23	100.050	PUP	LHS	1 X 7.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-
			RHS	1 X 7.00	9.00		●	●	●	●	●	●	●	●	●	●	Stable	-

Condition Summary of Culverts based on Visual Observation is presented below:

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
1	60/3	RCC Box	●	●	●	●	No	No	√	-	-
2	68/5	RCC Box	●	●		●	No	No	√	-	-
3	70/2	RCC Box	●	●		●	No	No	√	-	-
4	76/1	RCC Box	●	●		●	No	No	√	-	2 Nos.
5	76/2	RCC Box	●	●		●	No	No	√	-	-
6	77/1	RCC Box	●	●		●	No	No	√	-	-
7	78/1	RCC Box	●	●		●	No	No	√	-	-
8	78/6	RCC Box	●	●		●	No	No	√	-	2 Nos.
9	81/1	RCC Box	●	●		●	No	No	√	-	-
10	82/2	RCC Box	●	●		●	No	No	√	-	-
11	84/2	RCC Box	●	●		●	No	No	√	-	-
12	87/1	RCC Box	●	●		●	No	No	√	-	4 Nos.

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
13	91/1	RCC Box	●	●		●	No	No	√	-	-
14	91/2	RCC Box	●	●		●	No	No	√	-	-
15	93/1	RCC Box	●	●		●	No	No	√	-	-
16	93/2	RCC Box	●	●		●	No	No	√	-	-
17	94/1	RCC Box	●	●		●	No	No	√	-	2 Nos.
18	95/1	RCC Box	●	●		●	No	No	√	-	-
19	100/1	RCC Box	●	●		●	No	No	√	-	-
20	100/2	RCC Box	●	●		●	No	No	√	-	-
21	101/1	RCC Box	●	●		●	No	No	√	-	-
22	103/1	RCC Box	●	●		●	No	No	√	-	-
23	104/1	RCC Box	●	●		●	No	No	√	-	-
24	104/2	RCC Box	●	●		●	No	No	√	-	4 Nos.
25	105/1	RCC Box	●	●		●	No	No	√	-	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
26	106/1	RCC Box	●	●		●	No	No	√	-	-
27	106/2	RCC Box	●	●		●	No	No	√	-	-
28	106/3	RCC Box	●	●		●	No	No	√	-	-
29	106/4	RCC Box	●	●		●	No	No	√	-	-
30	107/1	RCC Box	●	●		●	No	No	√	-	-
31	108/1	RCC Box	●	●		●	No	No	√	-	-
32	114/1	RCC Box	●	●		●	No	No	√	-	2 Nos.
33	114/2	RCC Box	●	●		●	No	No	√	-	-
34	115/1	RCC Box	●	●		●	No	No	√	-	-
35	123/7	RCC Box	●	●		●	No	No	√	-	-
36	124/6	RCC Box	●	●		●	No	No	√	-	-
37	125/10	RCC Box	●	●		●	No	No	√	-	2 Nos.
38	128/3	RCC Box	●	●		●	No	No	√	-	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
39	129/7	RCC Box	●	●		●	No	No	√	-	-
40	131/1	RCC Box	●	●		●	No	No	√	-	-
41	131/2	RCC Box	●	●		●	No	No	√	-	-
42	53/2	HPC		●	●		Yes	No	√	√	4 Nos.
43	53/3	HPC		●	●		No	No	√	√	-
44	53/4	HPC		●	●		No	No	√	√	-
45	53/5	HPC		●	●		Yes	No	√	√	-
46	54/1	HPC		●	●		No	No	√	√	-
47	54/2	HPC		●	●		Yes	No	√	√	2 Nos.
48	54/3	HPC		●	●		No	No	√	√	-
49	54/4	HPC		●	●		No	No	√	√	-
50	55/1	HPC		●	●		No	No	√	√	-
51	55/2	HPC		●	●		No	No	√	√	4 Nos.

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
52	55/3	HPC		•	•		No	No	√	√	-
53	55/4	HPC		•	•		No	No	√	√	-
54	56/1	HPC		•	•		No	No	√	√	-
55	56/2	HPC		•	•		No	No	√	√	-
56	56/3	HPC		•	•		No	No	√	√	2 Nos.
57	56/4	HPC		•	•		No	No	√	√	-
58	56/5	HPC		•	•		No	No	√	√	-
59	56/6	HPC		•	•		No	No	√	√	-
60	57/1	HPC		•	•		No	No	√	√	-
61	57/2	HPC		•	•		No	No	√	√	-
62	57/3	HPC		•	•		No	No	√	√	2 Nos.
63	57/4	HPC		•	•		No	No	√	√	-
64	58/1	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
65	58/2	HPC		•	•		No	No	√	√	-
66	58/3	HPC		•	•		No	No	√	√	-
67	58/4	HPC		•	•		Yes	No	√	√	-
68	58/5	HPC		•	•		No	No	√	√	-
69	59/1	HPC		•	•		No	No	√	√	2 Nos.
70	59/2	HPC		•	•		No	No	√	√	-
71	59/3	HPC		•	•		No	No	√	√	-
72	59/4	HPC		•	•		No	No	√	√	-
73	60/1	HPC		•	•		No	No	√	√	-
74	60/2	HPC		•	•		No	No	√	√	-
75	60/4	HPC		•	•		No	No	√	√	-
76	60/5	HPC		•	•		Yes	No	√	√	4 Nos.
77	60/6	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
78	61/1	HPC		•	•		No	No	√	√	-
79	62/1	HPC		•	•		No	No	√	√	-
80	62/2	HPC		•	•		No	No	√	√	2 Nos.
81	62/3	HPC		•	•		Yes	No	√	√	-
82	62/4	HPC		•	•		No	No	√	√	-
83	63/1	HPC		•	•		No	No	√	√	-
84	63/2	HPC		•	•		Yes	No	√	√	-
85	63/3	HPC		•	•		No	No	√	√	-
86	63/4	HPC		•	•		No	No	√	√	-
87	64/1	HPC		•	•		No	No	√	√	4 Nos.
88	64/2	HPC		•	•		Yes	No	√	√	-
89	64/3	HPC		•	•		No	No	√	√	-
90	64/4	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
91	64/5	HPC		•	•		No	No	√	√	-
92	64/6	HPC		•	•		No	No	√	√	-
93	64/7	HPC		•	•		No	No	√	√	2 Nos.
94	65/1	HPC		•	•		No	No	√	√	-
95	65/2	HPC		•	•		No	No	√	√	-
96	65/3	HPC		•	•		No	No	√	√	-
97	65/4	HPC		•	•		Yes	No	√	√	-
98	65/5	HPC		•	•		No	No	√	√	2 Nos.
99	65/6	HPC		•	•		No	No	√	√	-
100	65/7	HPC		•	•		No	No	√	√	-
101	66/1	HPC		•	•		Yes	No	√	√	-
102	66/2	HPC		•	•		No	No	√	√	-
103	66/3	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
104	66/4	HPC		•	•		No	No	√	√	-
105	66/5	HPC		•	•		No	No	√	√	2 Nos.
106	66/6	HPC		•	•		No	No	√	√	-
107	66/7	HPC		•	•		Yes	No	√	√	-
108	66/8	HPC		•	•		No	No	√	√	-
109	66/9	HPC		•	•		No	No	√	√	-
110	67/1	HPC		•	•		No	No	√	√	-
111	67/2	HPC		•	•		No	No	√	√	4 Nos.
112	67/3	HPC		•	•		No	No	√	√	-
113	67/4	HPC		•	•		No	No	√	√	-
114	68/1	HPC		•	•		Yes	No	√	√	-
115	68/2	HPC		•	•		No	No	√	√	-
116	68/3	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
117	68/4	HPC		•	•		No	No	√	√	-
118	69/1	HPC		•	•		No	No	√	√	-
119	69/2	HPC		•	•		No	No	√	√	4 Nos.
120	69/3	HPC		•	•		No	No	√	√	-
121	69/4	HPC		•	•		No	No	√	√	-
122	70/1	HPC		•	•		No	No	√	√	-
123	75/1	HPC		•	•		Yes	No	√	√	-
124	77/2	HPC		•	•		No	No	√	√	-
125	78/3	HPC		•	•		yes	No	√	√	-
126	78/4	HPC		•	•		No	No	√	√	2 Nos.
127	78/5	HPC		•	•		No	No	√	√	-
128	79/1	HPC		•	•		No	No	√	√	-
129	79/2	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
130	80/1	HPC		•	•		No	No	√	√	-
131	80/2	HPC		•	•		No	No	√	√	-
132	80/3	HPC		•	•		No	No	√	√	-
133	80/4	HPC		•	•		No	No	√	√	-
134	81/1	HPC		•	•		No	No	√	√	-
135	81/2	HPC		•	•		No	No	√	√	2 Nos.
136	82/1	HPC		•	•		Yes	No	√	√	-
137	82/2	HPC		•	•		No	No	√	√	-
138	82/3	HPC		•	•		No	No	√	√	-
139	83/1	HPC		•	•		No	No	√	√	-
140	83/2	HPC		•	•		Yes	No	√	√	-
141	84/1	HPC		•	•		No	No	√	√	-
142	86/1	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
143	88/1	HPC		•	•		No	No	√	√	-
144	88/2	HPC		•	•		No	No	√	√	-
145	89/1	HPC		•	•		No	No	√	√	-
146	89/2	HPC		•	•		Yes	No	√	√	-
147	92/1	HPC		•	•		No	No	√	√	-
148	95/2	HPC		•	•		No	No	√	√	2 Nos.
149	96/1	HPC		•	•		No	No	√	√	-
150	96/2	HPC		•	•		No	No	√	√	-
151	97/1	HPC		•	•		No	No	√	√	-
152	97/2	HPC		•	•		No	No	√	√	-
153	99/2	HPC		•	•		Yes	No	√	√	-
154	110/2	HPC		•	•		No	No	√	√	-
155	110/3	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
156	111/1	HPC		•	•		No	No	√	√	-
157	111/2	HPC		•	•		No	No	√	√	-
158	112/1	HPC		•	•		No	No	√	√	2 Nos.
159	115/2	HPC		•	•		Yes	No	√	√	-
160	115/3	HPC		•	•		No	No	√	√	-
161	116/1	HPC		•	•		No	No	√	√	-
162	116/2	HPC		•	•		No	No	√	√	-
163	116/3	HPC		•	•		No	No	√	√	-
164	116/4	HPC		•	•		yes	No	√	√	-
165	116/6	HPC		•	•		No	No	√	√	-
166	116/7	HPC		•	•		No	No	√	√	-
167	116/8	HPC		•	•		No	No	√	√	-
168	117/1	HPC		•	•		No	No	√	√	2 Nos.

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
169	117/2	HPC		•	•		No	No	√	√	-
170	117/3	HPC		•	•		No	No	√	√	-
171	117/4	HPC		•	•		No	No	√	√	-
172	117/5	HPC		•	•		Yes	No	√	√	-
173	117/6	HPC		•	•		No	No	√	√	-
174	117/7	HPC		•	•		No	No	√	√	-
175	118/1	HPC		•	•		No	No	√	√	-
176	118/2	HPC		•	•		No	No	√	√	-
177	118/3	HPC		•	•		yes	No	√	√	-
178	118/4	HPC		•	•		No	No	√	√	-
179	118/5	HPC		•	•		Yes	No	√	√	2 Nos.
180	118/6	HPC		•	•		No	No	√	√	-
181	118/7	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
182	118/8	HPC		•	•		No	No	√	√	-
183	119/1	HPC		•	•		No	No	√	√	-
184	120/1	HPC		•	•		No	No	√	√	-
185	120/2	HPC		•	•		No	No	√	√	-
186	120/3	HPC		•	•		No	No	√	√	-
187	120/4	HPC		•	•		No	No	√	√	-
188	121/1	HPC		•	•		Yes	No	√	√	-
189	121/2	HPC		•	•		No	No	√	√	-
190	121/3	HPC		•	•		yes	No	√	√	2 Nos.
191	121/4	HPC		•	•		No	No	√	√	-
192	121/5	HPC		•	•		No	No	√	√	-
193	121/6	HPC		•	•		No	No	√	√	-
194	122/1	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
195	122/2	HPC		•	•		No	No	√	√	4 Nos.
196	122/3	HPC		•	•		No	No	√	√	-
197	122/4	HPC		•	•		No	No	√	√	-
198	122/5	HPC		•	•		Yes	No	√	√	-
199	122/6	HPC		•	•		No	No	√	√	-
200	122/7	HPC		•	•		No	No	√	√	-
201	122/8	HPC		•	•		No	No	√	√	-
202	123/1	HPC		•	•		No	No	√	√	2 Nos.
203	123/2	HPC		•	•		yes	No	√	√	-
204	123/3	HPC		•	•		No	No	√	√	-
205	123/4	HPC		•	•		No	No	√	√	-
206	123/5	HPC		•	•		No	No	√	√	-
207	123/6	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
208	123/8	HPC		•	•		No	No	√	√	2 Nos.
209	123/9	HPC		•	•		No	No	√	√	-
210	124/1	HPC		•	•		No	No	√	√	-
211	124/2	HPC		•	•		No	No	√	√	-
212	124/3	HPC		•	•		No	No	√	√	-
213	124/4	HPC		•	•		No	No	√	√	-
214	124/5	HPC		•	•		Yes	No	√	√	-
215	124/7	HPC		•	•		No	No	√	√	-
216	124/8	HPC		•	•		No	No	√	√	-
217	125/1	HPC		•	•		No	No	√	√	4 Nos.
218	125/2	HPC		•	•		No	No	√	√	-
219	125/3	HPC		•	•		No	No	√	√	-
220	125/4	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
221	125/5	HPC		•	•		No	No	√	√	-
222	125/6	HPC		•	•		No	No	√	√	-
223	125/7	HPC		•	•		No	No	√	√	-
224	125/8	HPC		•	•		No	No	√	√	-
225	125/9	HPC		•	•		No	No	√	√	-
226	125/11	HPC		•	•		No	No	√	√	-
227	126/1	HPC		•	•		Yes	No	√	√	4 Nos.
228	126/2	HPC		•	•		No	No	√	√	-
229	126/3	HPC		•	•		No	No	√	√	-
230	126/4	HPC		•	•		No	No	√	√	-
231	126/5	HPC		•	•		Yes	No	√	√	-
232	126/6	HPC		•	•		No	No	√	√	-
233	126/7	HPC		•	•		No	No	√	√	2 Nos.

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
234	126/8	HPC		•	•		No	No	√	√	-
235	127/1	HPC		•	•		No	No	√	√	-
236	127/2	HPC		•	•		No	No	√	√	-
237	127/3	HPC		•	•		No	No	√	√	-
238	127/4	HPC		•	•		No	No	√	√	-
239	128/1	HPC		•	•		No	No	√	√	-
240	128/2	HPC		•	•		Yes	No	√	√	4 Nos.
241	128/4	HPC		•	•		No	No	√	√	-
242	128/5	HPC		•	•		No	No	√	√	-
243	128/6	HPC		•	•		No	No	√	√	-
244	125/7	HPC		•	•		No	No	√	√	-
245	128/8	HPC		•	•		No	No	√	√	-
246	128/6	HPC		•	•		No	No	√	√	-

SNo	Structure No.	Type of Culvert	Existing Condition						Suggested Additional Repair/Maintenance Works		
			Substructures	Slab/Pipe/Box/Arch	Head Wall	Return Wall	Buried / Choked	Presence of Scour	Clearance of Vegetations	Removal of debris and silt from vent	Quadrant Pitching
247	129/1	HPC		•	•		No	No	√	√	-
248	129/2	HPC		•	•		No	No	√	√	-
249	129/3	HPC		•	•		No	No	√	√	-
250	129/4	HPC		•	•		Yes	No	√	√	-
251	129/5	HPC		•	•		No	No	√	√	-
252	129/6	HPC		•	•		No	No	√	√	-
253	130/1	HPC		•	•		No	No	√	√	-
254	130/2	HPC		•	•		No	No	√	√	4 Nos.
255	130/3	HPC		•	•		No	No	√	√	-
256	130/4	HPC		•	•		No	No	√	√	-

AECOM Imagine it. Delivered.

TECHNICAL DUE DILIGENCE REPORT

WALAYAR VADAKKENCHERRY EXPRESSWAYS PRIVATE LIMITED (WVEPL)

Report Number:

ACM-60657056-TDD-WTPL-001-R0

Date:

June 16, 2021

DISCLAIMER AND CONSENT FOR USE

The report has been prepared for the benefit of **Walayar Vadakkencherry Expressway Private Limited** and **Cube Highways and Transportation Assets Advisors Private Limited**, the proposed Project Manager to the **Cube Highways Trust** ("**Trust**"), for and in connection with initial offer of units representing an undivided beneficial interest in the Trust. In preparing this report, M/s AECOM India Pvt. Ltd, has relied, in whole or in part, on data and information provided by M/s **Walayar Vadakkencherry Expressway Private Limited (WVEPL)**, which M/s AECOM India Pvt, Ltd, has assumed to be accurate, complete, reliable, and current.

The report (including extracts) is for purposes of the initial offer of units of the Trust and may be shared with the placement agents and the advisers appointed for the initial offer of units in relation to reproduction and inclusion of the same in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust and may be made available for inspection in the manner specified therein, in connection with the aforesaid initial offer of units of the Trust. In addition to any extracts of the report that may be reproduced, the following details in relation to the Technical Consultant maybe included in the draft placement memorandum, the placement memorandum, the final placement memorandum and any other documents prepared in connection with the aforesaid initial offer of units of the Trust.

Technical Consultant:

AECOM INDIA PVT. LTD.
3rd Floor, Building No 8A
DLF Cyber City, DLF Phase 2
Gurgaon 122002

Contact Person of Consultant:

Shankar Raj Lohani
E-mail: shankar.lohani@aecom.com
Tel: 0124 4871 503

Quality information

Prepared by	Checked by	Verified by	Approved by
YSN	YSN	SRL	SCJ

Revision History

Revision	Revision date	Details	Authorized	Name	Position

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for:

Walayar Vadakkencherry Expressway Private Limited

1st Floor 1-2-6,
Domalguda, Himayat Nagar, Hyderabad,
Hyderabad 500029

Prepared by:

AECOM

AECOM India Private Limited
9th Floor
Infinity Tower C
DLF Cyber City
DLF Phase II
Gurgaon 122002
Haryana
India

CIN: U74210HR2008FTC038183

T: +91 124 4830100
www. aecom.com

© 2018 AECOM India Private Limited. All Rights Reserved.

This document has been prepared by AECOM India Private Limited (“AECOM”) for sole use of our client (the “Client”) in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM. This report is prepared based on document provided by the Client through virtual data room, thorough visual inspection and test report provided by the Client.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **2**

Project Background 2
Project Salient Features 2
Project Principle Participants 3
Project Operation and Maintenance Cost 3
Limitation of Scope 6

1. INTRODUCTION **7**

1.1 Project Background 7
1.2 AECOM 10
1.3 Scope of Works 10
1.4 Site Visit and Key Points covered during Site Visit 11
1.5 Data Shared by the Company 12

2.0 PAVEMENT EVALUATION AND FUTURE MAINTENANCE REQUIREMENTS **13**

2.1 General 13
2.2 Estimation of Design Traffic 14
2.3 Test Pit 15
2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique 16
2.5 Pavement Condition Survey using Network Survey Vehicle (NSV) 17
2.6 Roughness Survey using Network Survey Vehicle (NSV) 18
2.7 Pavement Condition Mapping 19
2.8 Determination of Pavement Major Maintenance 20
2.9 Base Year Pavement Rehabilitation Requirement 20
2.10 Future Maintenance Requirements 20

3.0 CAPEX REQUIREMENT **22**

3.1 CAPEX needs 22

4.0 MAJOR MAINTENANCE COST **23**

4.1 Major Maintenance Cycle 23
4.2 Major Maintenance Quantity 23
4.3 Unit Rate Analysis 24
4.4 Cost Estimate 26

5.0 OPEATION AND MAINTEANCE COST - OPEX **28**

5.1 O & M Requirement as per CA 28
5.2 O & M Strategy 31
5.3 Routine and Preventive Maintenance 31
5.4 Highway Lighting 32
6.5 ATMS and TMS Cost 32
5.5 Incident Management 33
6.7 Manpower Cost 33
6.8 Office Expenses 33

6.0 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT **35**

6.1 Reconnaissance Survey 35
6.2 Road Inventory and Condition Survey 35
6.3 Inventory and Condition Survey of Structures 50

LIST OF ABBREVIATION

AMC	Annual Maintenance Contract
ATMS	Advanced Traffic Management System
BC	Bituminous Concrete
BHS	Both Hand Side
BI	Bump Integrator
BOQ	Bill of Quantity
BT	Bituminous Top
CA	Concession Agreement
CAPEX	Capital Expenditures
CC	Control Centre
CCTV	Closed Circuit Television Systems
CMSA	Cumulative Million Standard Axles
COS	Change of Scope
COD	Commercial Operation Date
CUP	Cattle Underpass
DBM	Dense Bituminous Macadam
DG	Diesel Generator
DLC	Dry Lean Concrete
ECB	Emergency Call Box
EPC	Engineering, Procurement, and Construction
ESAL	Equivalent Standard Axle Load
ETC	Electronic Toll Collection
EW	East West
FO	Flyover
FOB	Foot Over Bridge
FWD	Falling Weight Deflectometer
GAD	General Arrangement Drawing
GSB	Granular Sub-base
GST	Goods and Services Tax
HSYD	High Yielding Strength Deformed
IE	Independent Engineer
INR	Indian Rupees
IRC	Indian Road Congress
ITM	Integrated Traffic Management
KVA	Kilo-Volt-Ampere
LCV	Light Commercial Vehicle
LED	Light Emitting Diode
LHS	Left Hand Side
LIU	Light Interface Units
LVUP	Light Vehicular Underpass
MAV	Multi Axle Vehicle
MCA	Model Concession Agreement
MCW	Main Carriageway
MDS	Metrological Data System
MET	Metrological
MIS	Management Information System
MJB	Major Bridge
MNB	Minor Bridge

MoRT&H	Ministry of Road Transport and Highways
MSA	Million Standard Axles
MT	Metric Ton
NH	National Highway
NHAI	National Highways Authority of India
NMS	Network Management System
NS	North South
NSV	Network Survey Vehicle
NVR	Network Video Recorder
O&M	Operation & Maintenance
OFC	Optical Fiber Cable
OPEX	Operational Expenditure
PCC	Plain Cement Concrete
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PCOD	Provisional Completion Certificate
PCU	Passenger Car Unit
PQC	Pavement Quality Concrete
PR	Project Road
PSC	Pre-Stressed Concrete
PUP	Pedestrian Underpass
RCC	Reinforced Cement Concrete
RAP	Reclaimed Asphalt Concrete
RHS	Right Hand Side
RMS	Radio Mobile System
ROB	Rail/Road Over Bridge
ROW	Right of Way
RUB	Rail/Road Under Bridge
SAN	Storage Area Network
SOR	Schedule of Rates
SPV	Special Purpose Vehicle
SQL	Structured Query Language
SR	Service Road
TB	Terabyte
TMS	Toll Management System
TTES	Travel Time Estimation System
UPS	Uninterruptible Power Supply
VDF	Vehicle Damage Factor
VIDS	Video Incident Detection System
VMS	Variable Message Signs
VUP	Vehicular Underpass
WIM	Weigh in Motion
WMM	Wet Mix Macadam
WVEPL	Walayar Vadakkancherry Expressway private Limited

DUE DILIGENCE REPORT

EXECUTIVE SUMMARY

Project Background

We understand that Cube Highways Fund Advisors Private Limited is the Investment Manager and Cube Highways and Transportation Assets Advisors Private Limited ("Cube Highways") is the proposed Project Manager of the Cube Highways Trust ("Trust" or "InvIT") and M/s Walayar Vadakkencherry Expressway Private Limited ("WVEPL") is proposed to be part of the initial portfolio assets of the Trust. The Trust is registered with Securities and Exchange Board of India ("SEBI") as an infrastructure investment trust under the SEBI InVIT Regulations.

Cube Highways and WVEPL (hereinafter the "Clients") have appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Salem to Kochi Section from Km 182+250 (D.Ch.182+250) to Km 240+000 (D.Ch.236+135) of NH 544 (Old NH-47) in the State of Kerala for a Concession Period of 20 years (hereinafter referred to as the Project) by National Highways Authority of India (NHAI). The project road was handed over on 20 Oct 2020 and concession period ends on 19 Oct 2050.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Client.

This report submission covers Cost Estimate for CAPEX for the work to be executed as per Schedule B of Concession Agreement in accordance with Schedule C, OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project.

Project Salient Features

Project salient features is described in the following table:

Project Corridor	Four Laning of Walayar – Vadakkanchery section in Kerala (Km 182/250 to Km 240/000 of NH47)-Package NS-2/BOT/KL-2-om DBFOT (Toll) basis under NHDP Phase II in the state of Kerala
Employer	National Highway Authority of India
Concessionaire	Walayar Vadakkanchery Expressway Limited
Independent Engineer (During O & M)	M/s K&J Projects Ltd.,
EPC Contractor	M/s KNR Constructions Ltd.,
Project Road Length	53.885 Km
Project Cost	682 crores as per CA
Grant	264.60 crore (Clause 25.1.1 of CA)
Date of Concession Agreement	17th September 2012 (LoA Date-30th September 2012)
Appointed Date	18th May 2013
Concession Period	20 years Including (2.5 Years of Construction Period)

Construction Period	2.5 years (910 Days)
Execution Type	Design Built Finance Operate and Transfer (Toll basis)
Schedule Date of Completion	13th November 2015
COD	31st October 2015
End of Concession Period	15TH March 2033
Expected end of concession period	15th March 2038 (as per information provided by Client)
Number of Toll Plaza	1 nos, Toll Plaza having 10 Hybrid lanes including Extra wide Lane

Project Principle Participants

Major project participants and their roles are as stated in the following table:

Sr. No	Role	Particulars
1	Employer	National Highways Authority of India
2	Concessionaire	Walayar Vadakkanchery Expressway Private Limited
3	Independent Engineer	K&J Projects Private Limited, Nagpur
4	Maintenance Contractor	1) Toll Operation (TBR Infra Pvt Ltd., Hyderabad), 2) Incident Management (TBR Infra Pvt Ltd., Hyderabad) 3) G4S Security Solutions India Pvt Ltd., For Security 4) Routine Maintenance- M/s TBR Infra 5) Preventive Maintenance- Inhouse (presently) 6) TMS-Metro Infrasys Pvt. Lt

Project Operation and Maintenance Cost

a) Capital Expenditure (CapEX)

The Concessionaire maintaining the road well, it is also learned that there no penalties towards Operation and maintenance for project. Since the CoD issued for the project it is learnt that there no pending/balance works as the scope of work defined in CA based on the available data and discussion at site.

b) Major Maintenance (MM) Cost

As per AECOM assessment based on pavement investigation data, traffic projection provided by the Company, Functional Overlay is required at every 7 year. The cost of major maintenance cost is projects is as below:

Sr. No	Year	Particular	Estimated Cost in crore
1.	2022/23	LHS – 40mm BC Overlay RHS – 30mm BC Overlay (Distress rectification as per NSV report) The above strategy is based on approval from IE.	73.76
2.	2028/29	30 mm BC in entire length + 5% DBM. 30 mm BC in 50% length and Micro surfacing in 50% length of Service Road	65.94
4.	2035/36	30 mm BC in entire length + 5% DBM. 30 mm BC in 50 % length and Micro surfacing in 50 % length of Service Road	91.43

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

Capacity Augmentation Cost

As per the concession agreement the designed capacity of the Four lane Project Highway is Average Daily traffic of 60,000 PCUs.

And the target date of 1 January 1, 2021 is estimated to be 35,772 PCU per day. Any shortfall or exceed in actual average daily traffic by 2.5% will lead to modifications of concession period as per Article 29. In the event of shortfall of 10.6% in target traffic, the concession period shall be increased by 15% thereof.

As per provision of contract, Authority shall do capacity augmentation from four to six laning through EPC contract. The cost towards capacity augmentation is to be borne by the Authority as per Article 29 of Concession Agreement. As per Cube Highway traffic assessment, the six laning of highway is projected in Year FY35 to FY 36

c) Operation and Maintenance (OpEX)

As per Schedule K, the Concessionaire shall be responsible for the improvement and Operation and Maintenance of Project Highway during the Concession Period. Thereafter, the length of Project Highway shall be transferred to National Highways Authority of India (NHAI). Schedule K elaborates the Operation and Maintenance (O&M) requirements of the Concession and Concessionaire shall comply with the O&M requirements covers the entire Concession Period. The Concessionaire shall

operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of >99 on cumulative basis. First year Operation and Maintenance Cost as per AECOM assessment as on Year 2022/23 is presented table below:

Sl. No.	Description	Remarks	Amount (in INR)
1	SPV staff and salaries	Includes salaries of SPV staff: Admin, F&A, Operation, Maintenance, Safety, IT, Secretarial etc.	1,07,00,649
2	Tolling Operations Services	Includes outsourced manpower related to toll collection - toll collectors, supervisors and associated expenses like uniform, printing rolls, food expense, accommodation etc.	1,45,33,057
3	Security Services	Includes manpower associated with security services.	74,10,537
4	Incident Management (IM) Services	Includes IM staff: RPV- driver, RPO, helper; Ambulance- driver, paramedic, helper; Recovery Vehicle- driver, helper and Incident manager. Also includes: RPV/Ambulance/Recovery Vehicle- running, maintenance, rent etc, Diesels expenses	2,11,09,476
5	Electricity Charges and Diesel Charges for DG	Includes electricity and diesel charges for lighting at operating toll plazas and streetlights.	1,14,93,246
6	TMS Related Expenses	Includes AMC's for TMS, IT/internet related expenses.	80,63,796
7	HTMS related Expenses	AMCs for HTMS and replacement of reequipment	-
8	Office Operating Expenses	Includes housekeeping, cleaning, printing/stationery and other miscellaneous costs	27,11,386
9	Vehicle Running Expenses	Rental of Vehicles for O&M, Fuels and Drivers cost	30,29,727
10	Professional Fee	Includes secretarial expenses, E&S expenses, F&A expenses, HR consultancy charges, deflection/roughness test, audits etc.	1,25,00,950
11	Community Development	Includes CSR related expenses.	11,89,936
12	Communication Expenses	Includes phone charges.	3,01,875
13	Conveyance Expenses	Includes boarding & lodging expense.	3,29,318
14	Project Insurance Expenses	Includes project insurance expenses.	1,28,43,409
15	IE Fees	Includes IE fees.	1,12,56,095
16	RoW Cleaning and Horticulture maintenance	Includes general cleaning of road, trimming of plants, cleaning of sign boards, toilet block cleaning, watering of median and avenue plants, pre and post monsoon cleaning	1,29,20,983
17	Pavement Repair and Maintenance	Routine maintenance related to pavement repairs like pothole repairs, crack sealing, patch works etc	53,42,534
18	Road Furniture and Highway related Repair and Maintenance	Replacement of road furniture's, repair of Kerbs, Kerbs painting, sign boards repair, drain repair, shoulder repair, Road Marking repair, replacement of Safety Barriers	1030490.433

Sl. No.	Description	Remarks	Amount (in INR)
19	Structural Repair and Maintenance	maintenance related to bridges and structures at project roads including bearing replacement, expansion joint replacement, grouting, RE wall repair	5,92,488
		O & M Cost (2022)	13,73,59,955
		O & M Cost (2022) in Crores	13.74

A total of Rs. 13.74 crore is estimated to be incurred by the Concessionaire as OpEX as on FY 2022/23.

Limitation of Scope

Asset condition and cost forecasting for Operation and Maintenance and Major Maintenance Cost for balance concession period is made based on thorough visual inspection, documents and test report provided by the Client. All data uploaded in data room are considered correct and authentic. Detail investigation report on structures were not provided during structures and as per discussion with Company all structures are in sound and safe till end of Concession period no major cost is considered for rehabilitation of structures.

For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Client. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

1. INTRODUCTION

1.1 Project Background

M/s Cube Highways (hereinafter "the Client") has appointed M/s AECOM India Private Limited (hereinafter referred as "Technical Consultant") to carry out Technical Due Diligence of operational asset of Four Laning of Walayar -Vadakkancherry section of From Tamil nadu Border to Kerala Km 182+250 to 240+000 on DBFOT Basis (Toll) under NHDT Phase II in the state of Kerala. (herein after refer as "the Project") which is being operated by "M/s Walayar Vadakkancherry Expressway Private Limited" (hereinafter refer as "the Concessionaire or Company or WVEPL"). Client acquired the project of Approx. Length 53.885 Km in Sep 2020, the project has started Commercial operation from May 2015 with concession period upto 2033 (i.e. 20 years including construction period of 910 Days)

In this context, M/s AECOM India Pvt. Ltd is appointed as Technical Consultant to carrying out Technical Study, CAPEX, OPEX and Major Maintenance Requirement (MMR) for the project for balance concession period. The project road was handed over on Oct 2020 (Press release on 30th Sep 2020) and concession period ends on 15th March 2033 as per CA.

The present condition of the Project Highway is reviewed based on physical site visit observations and the data; test report as shared by Cube Highways.

This report submission covers Cost Estimate for OPEX for collection of tolls and to satisfy Operation and Maintenance requirement as per Concession Agreement and Periodic to provide performance level as per requirement of the project. The Cost towards the Capex is zero since COD for the project is achieved.

Project Corridor

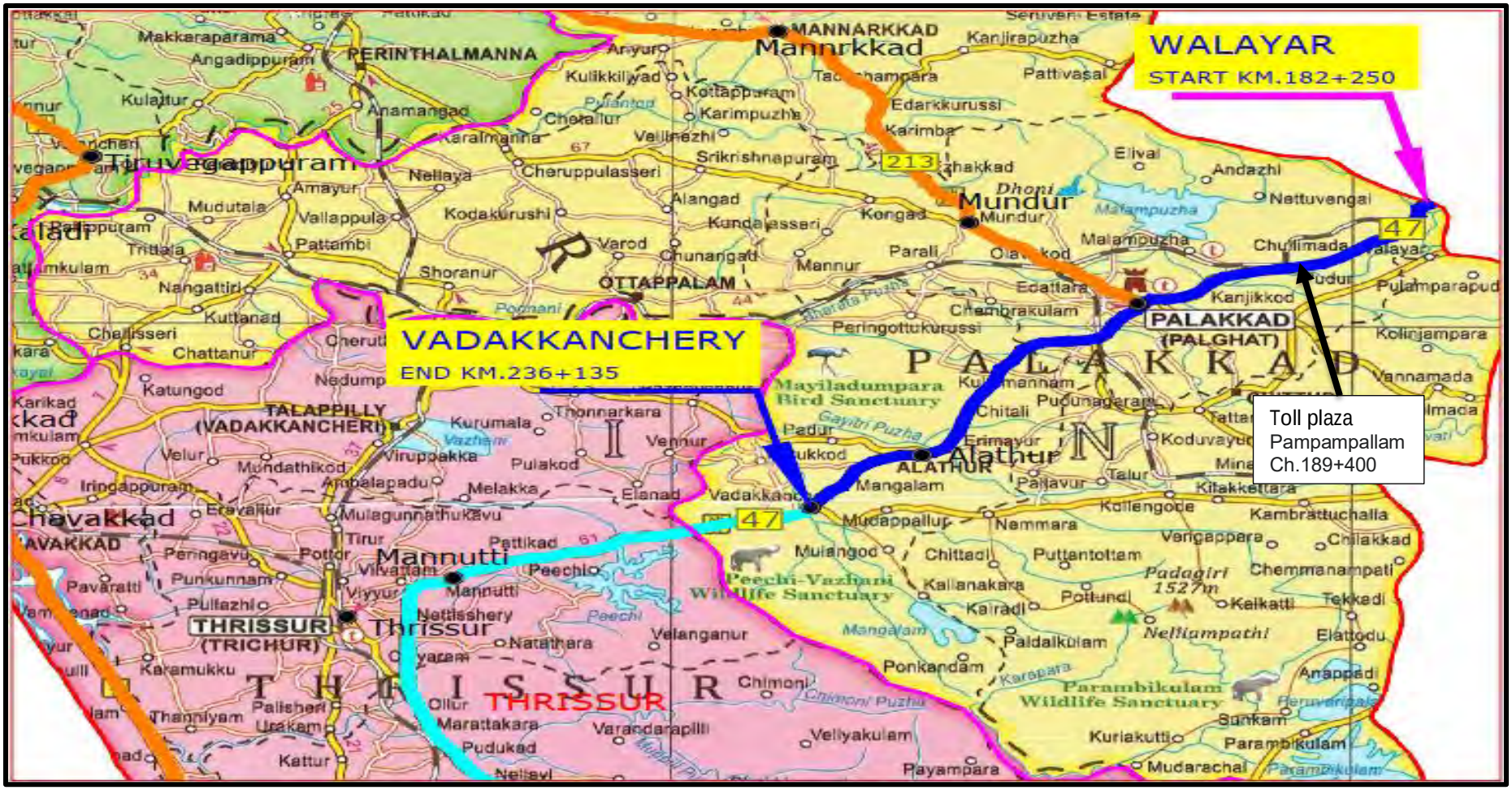
The project road is a section of National Highway 544, commonly referred to as NH 544, (old number NH 47) is a 340-kilometre-long (210 mi) National Highway in South India connecting Salem city in Tamil Nadu to the city of Kochi in Kerala. It is also called the Salem-Kochi Highway. The highway runs through the states of Kerala and Tamil Nadu, connecting various important cities mostly tier 2 and tier 3 cities and towns such as Salem, Coimbatore, Palakkad, Thrissur and Kochi. It is a spur of National Highway 44, which forms the North South Corridor of the National Highway network of India. It passes south of Coimbatore. It was formerly designated National Highway 47. The national highway consists of Toll plaza at these locations

- Vaikundam Toll Plaza (near Salem, Tamil Nadu)
- Vijayamangalam Toll Plaza (near Erode, Tamil Nadu)
- Kaniyur Toll Plaza (near Neelambur, Coimbatore, Tamil Nadu)
- (6 Toll Plazas on L&T Bypass - soon to be replaced)
- **Pampampallam Toll Plaza (near Walayar, Palakkad, Kerala)**

- Paliyekkara Toll Plaza (near Thrissur, Kerala)
- Kumbalam-Aroor Toll Plaza

All the Toll Plazas, are FasTag enabled, with dedicated lanes.

The project corridor is shown in map below



Project salient features is described in the following table:

Table 1.1 – Project Salient Features

a) Highway

Description	Project Features
Length of Project Highway	53.885 km
Carriageway	Four Lane (2 x 8.75 Paved Width)
Type of Pavement	Flexible Pavement (Except at Toll plaza locations Rigid Pavement provided)
Shoulder	1.5m earthen for MCW at Rural Area
Service Road / Slip Road	27.371km length LHS and 25.311 Km length on RHS having width of 7.0m
Major / Minor Junction	9 Major & 36 Minor
Median Opening	45 Nos
Toll Plaza	1 Nos – 10 lanes (5 + 5 lanes on each side)
Truck Lay-bys	Nil
Bus Bays with shelter	6 Bus bays with Shelter and 48 Bus bay.
Highway Lighting	15 Nos of Single arm and 1011 Nos of Double arm
High Mast	5 Nos
Highway Patrol	2 nos
Ambulance	1 nos
Crane	1 nos

b) Structure

Description	Project Features
Major Bridge	2 No
Minor Bridge	12 Nos
ROB and RUB	1 No ROB
VUP/PUP	7 VUP and 4 PUP's
Culverts	191 Nos

1.2 AECOM

AECOM is a world class multi-disciplinary consultancy engaged in development of infrastructure in the field of transport, airports, metro, tunnel, ports, water, environment to building industries. AECOM group is ranked as the #1 engineering design firm by revenue in Engineering News-Record magazine's annual industry rankings, AECOM is a premier, fully integrated infrastructure and support services firm, with a broad range of markets, including transportation, facilities, environmental, energy, water and government. With approximately 1,00,000 employees (URS is now part of AECOM) — including architects, engineers, designers, planners, scientists and management and construction services professionals — serving clients in more than 150 countries around the world, AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural and social environments.

AECOM India Pvt. Ltd.

AECOM India Pvt. Ltd., a group company of AECOM based in India, provides consulting, planning, engineering, program / construction management, design-build and operation and maintenance services to public and private clients on global basis.

AECOM has extensive experience in the following sectors

- Highways, Bridge and Tunnel Engineering
- Traffic and Transportation Engineering
- Metro / Railway Engineering
- Urban and Township Development
- Environmental engineering (Water Supply, Sewerage and Drainage)
- Environmental Management
- Civil Engineering / Infrastructure
- Geotechnical engineering
- Land Development
- Building Engineering (Structural and E&M)
- Materials Technology
- Maritime Engineering

1.3 Scope of Works

Scope of Work is divided into three phases:

a) Desk Study: review of documents, test report, review of Concession Agreement limited to Technical, pavement design report, IE MPR Determination of design traffic in terms of Million Standard Axles (MSA) for remaining Concession Period, calculation of remaining life of pavement.

b) Site Visit: through inspection of site visit to verify asset inventory, visual inspection to ascertain condition of the pavement, structures, Toll Plaza including Toll Management System, project facilities, safety features, highway traffic management system, collection local material rates.

c) CAPEX and OPEX: long term CAPEX (MM) based by analyzing FWD data validated with site visit data. Determination of OPEX considering performance requirement as set in CA and

industry practice till end of concession period. Discussion with Cube Highways and finalization of cost to align with Cube approach of operation and maintenance of highways.

The consultant is submitting this report covering all phases of work and outcome of discussion during finalization of CAPEX and OPEX.

1.4 Site Visit and Key Points covered during Site Visit

Site visit was made by the team of AECOM engineers in the month of January 2021. The following parameters were recorded during site visit:

- Detailed reconnaissance of the project area and recorded important features and that is importance in terms of operation & maintenance of the project
- Validation of project inventory provided in Schedule A with ground
- Consultant recorded following features of project
  - existing pavement condition
  - intersecting/Crossroads
  - major water bodies
  - major CD structures
  - bottlenecks in road alignment
  - operational Issue if any
- Visual inspection and assessment of the condition of the pavement surface
- Visual inspection and assessment of the condition of all major structures such as Bridges, ROBs, Flyovers, underpass, and cross drainage structures in accordance with IRC: SP 18
- Review and assessment of Highway Traffic Management System (HTMS) and Toll Management System (TMS) along with scope of WIM and ETC
- Inventory of various elements of TMS and HTMS systems along with their remaining life
- Collection of local material aggregates, sand, cement rates
- Review of construction sites where facilities (e.g. service road, flyover, toll plaza etc) are to be provided as per Schedule B of CA.

1.5 Data Shared by the Company

The following data were shared during study:

- Concession Agreement including Non-Technical Schedule
- Schedule A – existing project features
- Schedule B – minimum rehabilitation work to be carried out for pavement and structures.
- Schedule C – Specifications and Standard to be followed during Schedule B work
- Schedule K – Maintenance Requirement during Concession Period
- Pavement Design Report
- Axle Load Survey Data
- Existing Core Thickness
- FWD Survey Report
- Existing Pavement Crust Survey Report
- NSV Survey Data (Not available)
- MSA Calculation
- Monthly Electricity Bill
- ROW, Incident Management Maintenance Contract
- Tolling Manpower Supply Contract
- Independent Engineer Fees, Professional Fees, Insurance Premium
- Bitumen Rates forecast from 2022 onwards till end of Concession Period
- Price Escalation Factor

2.0 Pavement Evaluation and Future Maintenance Requirements

2.1 General

Pavement is an integral part of all highway projects. Pavement performance under prevailing as well as projected traffic and environmental conditions is considered to be crucial as it has a direct bearing on the economic returns from the project developments. An under-designed pavement will fail prematurely, resulting in the additional cost to the project. Hence it is necessary to ensure the pavement layer thicknesses, configurations and materials are adequately designed and require minimal maintenance under the anticipated traffic loading throughout the project life. To achieve this objective and thereby to predict the performance of any pavement structure, it is necessary to analyze material characteristics, traffic condition, present physical condition of the pavement layers, local environment and its impacts, probable modes of failure of existing pavement and technology available for reconstruction. In addition, it is also necessary to presume what level of performance and what pavement condition will be considered satisfactory in order to estimate the future operation and maintenance cost of the road. Due to the large number of variables involved, it is intricate task to determine exact level of pavement performance through the project life. But, based on the assessment of present condition of pavement, analysis of available survey data, traffic projections and estimations regarding the pavement life, future maintenance requirements can be estimated.

The present chapter contains the details about the series of field investigations and analysis carried out to find out the present condition of pavement as well as to determine the future maintenance requirements for sound pavement performance throughout the project life.

Objectives

- To assess the present physical and structural conditions of pavement layers.
- To formulate the rehabilitation/rectification proposal as required for damaged/poor sections.
- To determine the future maintenance requirement for sound performance (both structural and functional performance) of pavement layers throughout the concession period.

Table 3-1: Typical distress types associated with performance

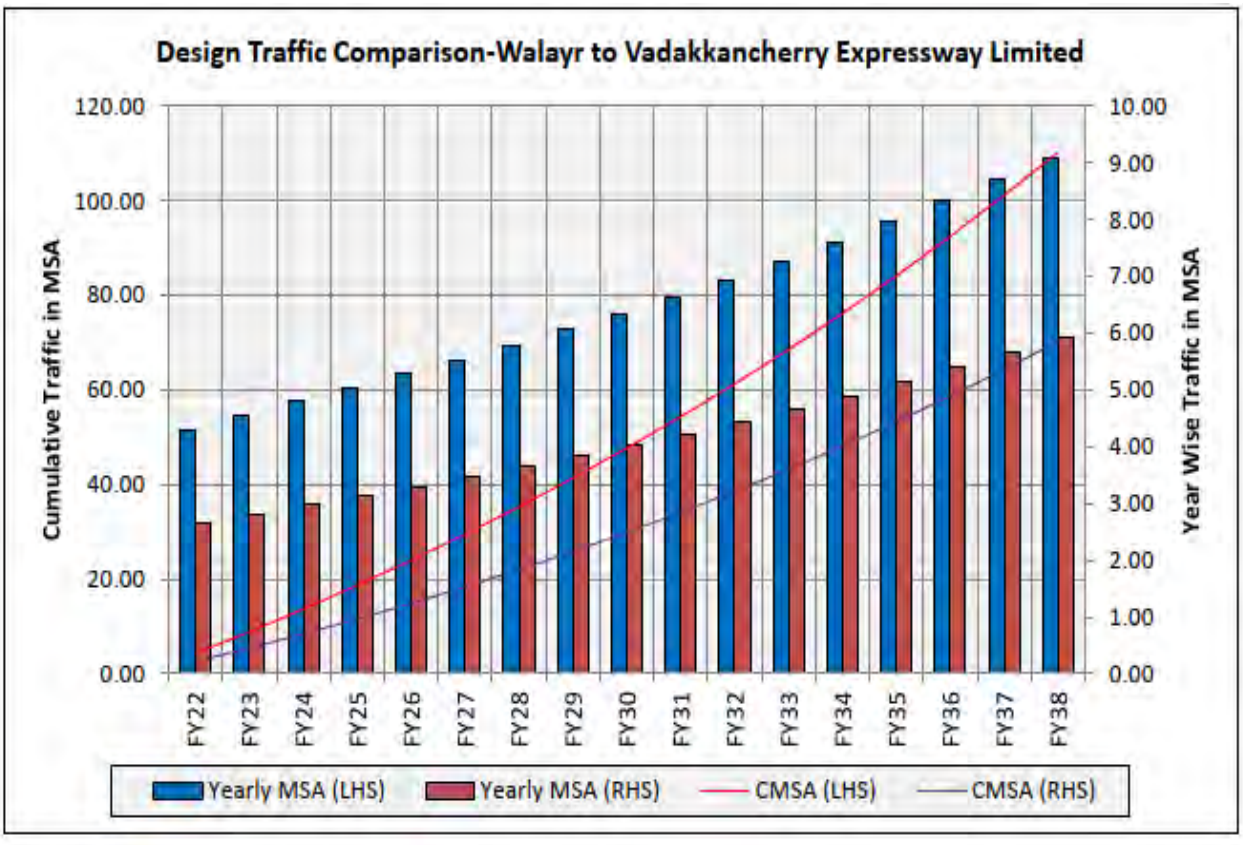
Performance Type	Performance Indicator
Functional	Riding Quality (Roughness and Rutting) Surface Distress (Cracking, Pothole, Raveling etc.) Skid resistance
Structural	Deflection, Elastic Modulus of Pavement Layers and Remaining Life

Information about pavement condition and performance is critical to the decision-making process for successful management of highway pavements. The objective of condition assessment of the pavement is to collect accurate and timely data, analyze the level of deterioration, identify maintenance and reconstruction needs, and determine maintenance costs both routine as well as periodic (major maintenance).

In this context, Cube Highways has carried out various investigations and data / analysis is provided to AECOM team for analysis to ascertain immediate pavement rehabilitation work and future overlay for balance concession period.

2.2 Estimation of Design Traffic

As per Design MSA provided by the Cube Highways, cumulative MSA till 2029 for MM design period for LHS 41.38 MSA & RHS 25.86 MSA whereas cumulative MSA upto FY 2038 is 110.28 MSA for LHS & 70.30 MSA in RHS. Year wise and cumulative MSA is presented in graph below:



2.3 Test Pit

To assess the existing pavement crust composition, thickness of pavement layers and engineering properties of subgrade, test pits of size (approx.) 1m x 1m x 1m have been excavated at interface of pavement edge and earthen shoulder. The test as shared by the Company is tabled below:

S:No	Location (Km.)	Side (LHS/RHS)	Type of Pit	4 Days Soaked CBR (%)
1	3	4	5	6
1	185+650	LHS	Subgrade	7.85
2	186+900	LHS	Subgrade	6.37
3	187+400	RHS	Subgrade	6.79
4	201+700	RHS	Subgrade	8.28
5	207+800	LHS	Subgrade	6.16
6	213+000	RHS	Subgrade	7.22
7	215+350	LHS	Subgrade	7.64
8	222+100	RHS	Subgrade	5.31
9	223+600	LHS-SR	Subgrade	6.37
10	228+000	RHS	Subgrade	5.94
11	236+100	LHS	Subgrade	6.24

Result of subgrade CBR is used while calculating remaining life of existing pavement and overlay calculation.

The existing bituminous pavement thickness as per test report provided by the Company is various from 150 mm to 230 mm and granular layer thickness varies from 450 mm.

2.4 Pavement Evaluation by Falling Weight Deflectometer (FWD) Technique

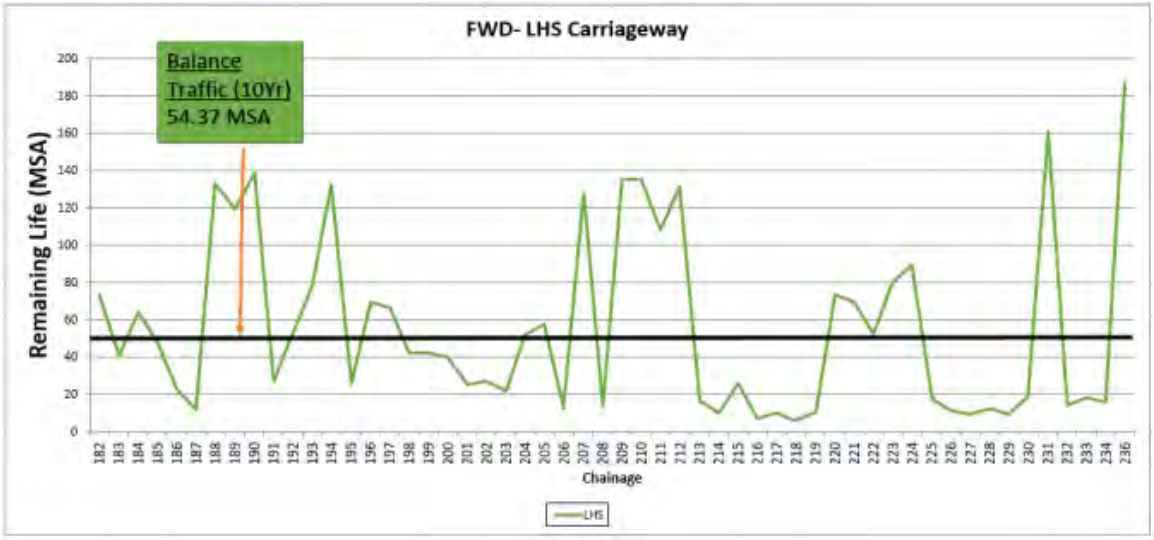
A Falling Weight Deflectometer (FWD) is used to measure the vertical deflection response of a surface to an impulse load. Precision load measurement and deflection sensors record the pavement surface characteristic, which is used to calculate pavement properties such as bearing capacity, elastic modulus and expected surface life.

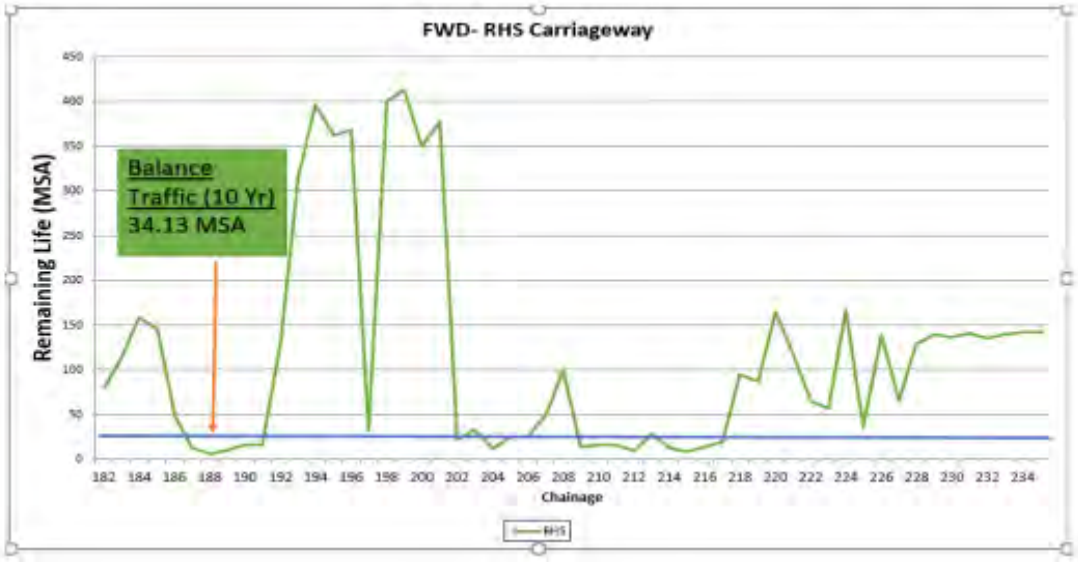
FWD survey conducted by the Company. The survey data along with analysis is provided by the company. The analysis is checked by AECOM and found to be in accordance with IRC Code. The summary of Test result is presented in table below:

Description	LHS	RHS
Less than 46.4 MSA	42.75	26.00
From 46.4 MSA to 65 MSA	11.15	16.90
Greater than 65 MSA		11.00
Total Length	53.90*	53.90*

*Total Length 53.885 Km

Based on remaining life of pavement, structural overlay is not required till end of concession period except Structural overlay as per FWD in 2021/22.





2.5 Pavement Condition Survey using Network Survey Vehicle (NSV)

Network Survey Vehicle (NSV) was carried out by the Company for assessment of detailed condition survey of existing pavement. Both extent and severity of different pavement distresses such as cracks, rutting, potholes, raveling, edge break, delamination, patching, shoving, bleeding etc. were recorded at 10m interval for each lane by the NSV. The pavement distresses were categorized into three levels of severity: Low, Medium, and High. Following types of pavement distresses and details were captured using NSV:

Sn	Distress	Details Captured and Yard Stick adopted for Classification
1	Cracks	- Type: Longitudinal, Transverse, Block, Alligator - Extent: % of Pavement Area Influenced by distress - Severity: High (> 3mm wide), Low (<3mm wide)
2	Pothole	- Extent: % of Pavement Area Influenced by distress - No. of Potholes - Depth Severity: Low (<25 mm), Medium (25 to 50), High (>50 mm)
3	Raveling	- Extent: % of Pavement Area Influenced by distress - Severity: Low (Significant Voids), Medium (Loss of Stones), High (Loss of Stone in depth)
4	Patching	- Extent: % of Pavement Area Influence by distress - Severity: Low (Minimal Distress), Medium (Continuing Distress), High (High Distress)
5	Shoving	- Extent: % of Pavement Area Influence by distress - Severity: Low (<15mm), High (>15mm)
6	Flushing/Bleeding	- Extent: % of Pavement Area Influence by distress

Sn	Distress	Details Captured and Yard Stick adopted for Classification
		- Severity: Low (5 - 10% Bitumen), Medium (10 - 15 % Bitumen), High (>15 % Bitumen)
7	Depression	- Extent: % of Pavement Area Influence by distress - Severity
8	Delamination	- Extent: % of Pavement Area Influence by distress - Severity: Low (<1 sq.m area), High (>1 sq.m area)
9	Edge Break	- Extent: % of Pavement Area Influence by distress - Severity: Low (20-75 mm), Medium (76-200mm), High (>200mm)
10	Pavement Missing	- Extent: % of Pavement Area Missing
11	Rutting	- Rut Depth

2.6 Roughness Survey using Network Survey Vehicle (NSV)

Roughness Survey was carried out to determine the riding quality of the existing pavement. Roughness Survey on the current project road was performed by NSV using the Laser Profilometer. During the run, IRI readings at 10m interval was recorded for each lane. Average value of IRI recorded for each kilometer was taken for calculating the BI using following relation from IRC: SP 16-2004:

$$BI = 630 (IRI)^{1.12}$$

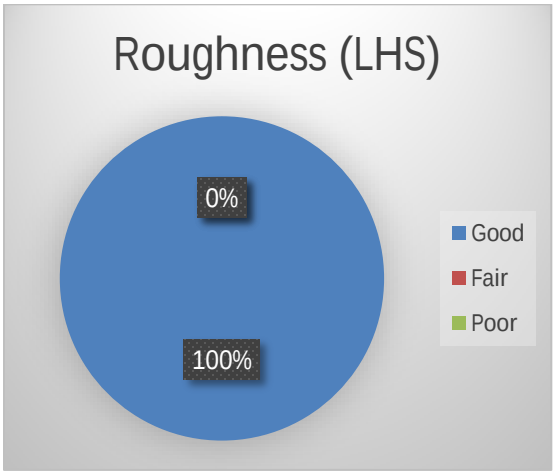
where, BI = Bump Integrator Roughness in mm/km

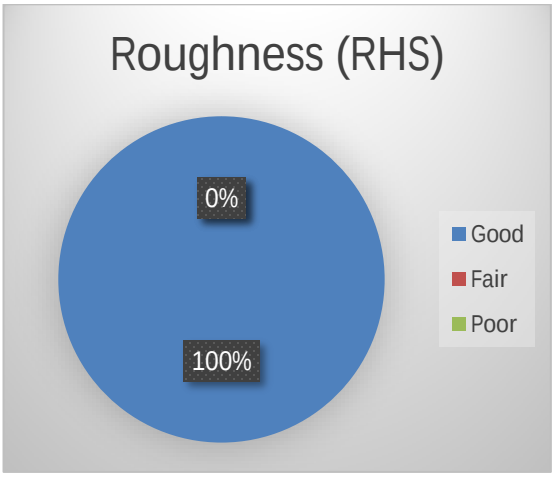
IRI = International Roughness Index

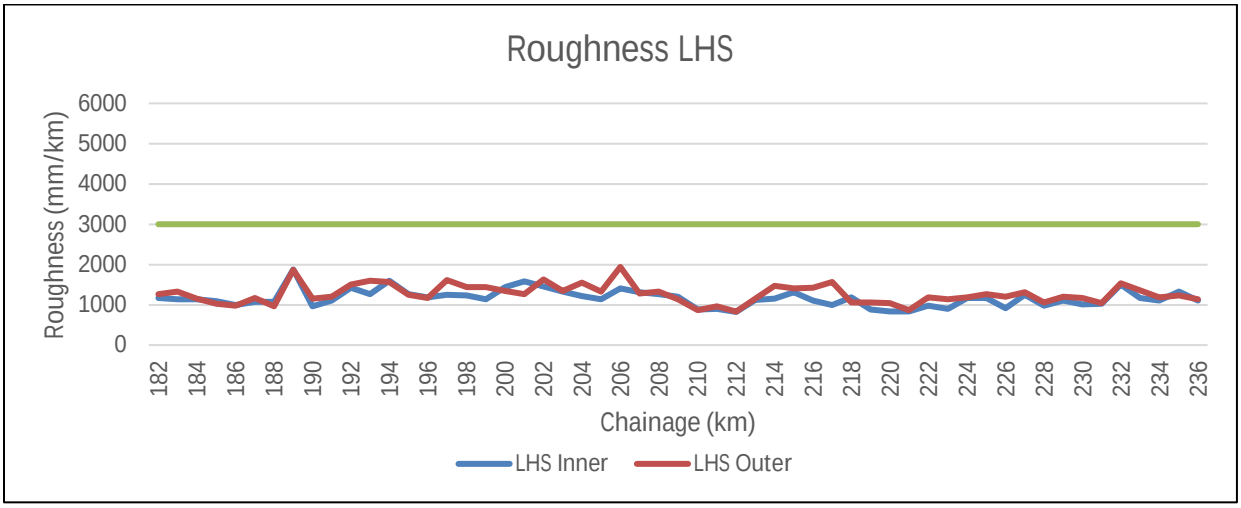
Based on the Roughness value, summary of project road was classified into following three categories and length on each category is tabled below:

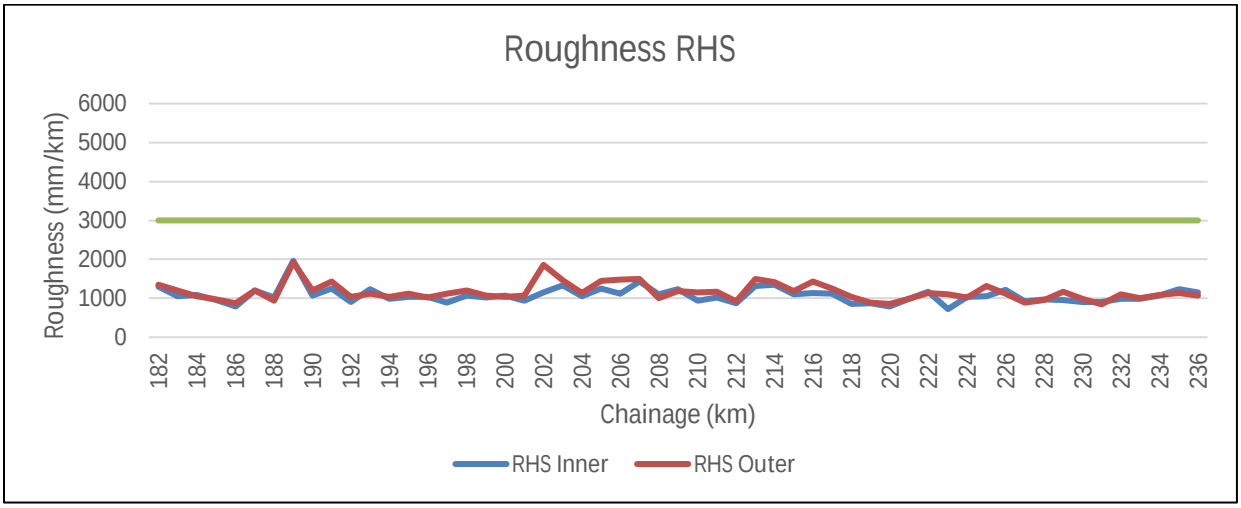
Ratings	Roughness Value (mm/km)	LHS in km*	RHS in km*
Good	<2000	53.9	53.9
Fair	2000 - 3000	0	0
Poor	>3000	0	0

Note: *Total Length is 53.885 Km


Roughness (LHS)
0%
100%
Good
Fair
Poor

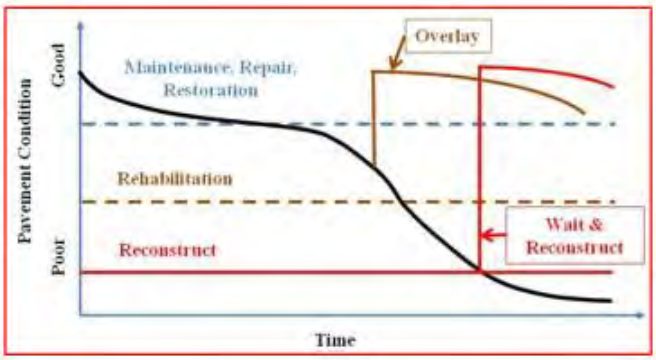

Roughness (RHS)
0%
100%
Good
Fair
Poor


Roughness LHS
Roughness (mm/km)
6000
5000
4000
3000
2000
1000
0
182 184 186 188 190 192 194 196 198 200 202 204 206 208 210 212 214 216 218 220 222 224 226 228 230 232 234 236
Chainage (km)
LHS Inner
LHS Outer


Roughness RHS
Roughness (mm/km)
6000
5000
4000
3000
2000
1000
0
182 184 186 188 190 192 194 196 198 200 202 204 206 208 210 212 214 216 218 220 222 224 226 228 230 232 234 236
Chainage (km)
RHS Inner
RHS Outer

2.7 Determination of Pavement Major Maintenance

The performance of a pavement is affected by the type, time of application, quality of the maintenance it receives. Preventive maintenance slows the rate of pavement deterioration due to traffic and environmentally applied loads. Delays in maintenance and deferred maintenance increase the quantity of defects and their severity so that, when corrected, the cost of repair is greater as shown in figure below:



Major Maintenance is required in order to comply requirement of Concession Agreement and to maintain performance level as defined in Schedule K. Due to traffic loading, weathering actions and oxidation of bitumen pavement surface to retain the pavement condition in good condition and to provide good riding quality, periodic maintenance (overlay) is required after at every 7 years interval with the assumption that Company shall provide appropriate maintenance in pavement as and when any distress is observed in pavement.

2.8 Base Year Pavement Rehabilitation Requirement

Based on pavement investigation data provided, structural overlay is required in the year 2021/22 as per FWD data. Structural overlay is required to bring down roughness value less than 2000 mm / km and to maintain performance requirement till next MM cycle.

40mm BC Overlay in LHS and 30mm BC overlay in RHS is proposed based on the approval by IE.

2.9 Future Maintenance Requirements

Periodic overlay is considered each 7 years considering 10 years design traffic so that minimum life of 3 years is available at the time of proposed overlay. The remaining life of pavement with overlay planned in Year 2021/22 is calculated using IIT Paved and it is found that Structural Overlay is considering after Based on pavement investigation data provided, structural overlay is not required however functional overlay of 30 mm is required to satisfy Schedule K requirement at all times.

As per Article 25, Authority shall do capacity augmentation under EPC contract once traffic exceeds 60,000 PCU for three consecutive accounting years and the average daily traffic per day is 35,772 PCU on 1st January 2021.

Handback Requirement

The Concessionaire shall bear and pay all costs incidental to divestment of all the rights, title and interest of the Concessionaire in the Project Highway in favor of the Authority upon Termination, save and except that all stamp duties payable on any deeds or Documents executed by the Concessionaire in connection with such divestment shall be borne by the Authority.

Recommended MM Cycle (Periodic Overlay)

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2022/23	Structural Overlay	LHS – 40mm BC Overlay RHS – 30mm BC Overlay (Distress rectification as NSV report) The above strategy is based on approval from IE.	Milling and filling with 30mm Overlay wherever required.
2	2028/29	Functional Overlay	30 mm BC in entire length + 5% DBM	50% Micro-surfacing+ 50% 30mm BC
3	2035/36	Functional Overlay	30 mm BC in entire length + 5% DBM	50% Micro-surfacing+ 50% 30mm BC

Structure Major Maintenance

a) Replacement of Wearing coat at each cycle after milling of existing wearing coat

3.0 CAPEX REQUIREMENT

As per Article 2 of the Concession Agreement, the scope of project is defined in Schedule A and Schedule B ("the Scope of Project") shall mean include, during the Concession Period (a) Tolling, operation, management, maintenance and transfer of the Project Highway subject to and in accordance with the provisions of this Agreement; and

(b) performance and fulfilment of all other obligations of the Concessionaire in accordance with the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

3.1 CAPEX needs

The Project achieved COD on May 2015 and the toll operation started, the completion certificate is issued on 31st Cot 2015 (as per O&M Manual). The concessionaire is maintaining the highway in accordance with the Schedule-K Requirements specified in CA.

Suring the site visit it is observed that the 21000 plants are missing in median plantation and 1500 avenue plantation is to be planted. The O&M Manager Cube Highway stated that the above trees are scheduled to be planted in this year as part of maintenance.

It is also learnt that the existing retained bridge bearing are to be replace/repaired, it is inculcated that the previous concessionaire M/KNR is agreed to do the future maintenance by its own cost during previous communication. The proposal is in discussion with client and concessionaire to consider it in Change of scope and it is not yet finalized. (source-discussion with O&M Manager/Toll manager at site during site visit).

With above facts the capex requirement is ruled out.

4.0 MAJOR MAINTENANCE COST

4.1 Major Maintenance Cycle

Major maintenance cost for following MM cycle as discussed in Chapter 3.10 of this report is calculated for the project:

S. No.	Year	Description	Recommended Overlay	
			MCW	Service Road
1	2022/23	Structural Overlay	LHS – 40mm BC Overlay RHS – 30mm BC Overlay (Distress rectification as per NSV report) The above strategy is based on approval from IE.	Milling and filling with 30mm Overlay wherever required.
2	2028/29	Functional Overlay	30 mm BC in entire length + 5% DBM	50% Micro-surfacing+ 50% 30mm BC
3	2035/36	Functional Overlay	30 mm BC in entire length + 5% DBM	50% Micro-surfacing+ 50% 30mm BC

4.2 Major Maintenance Quantity

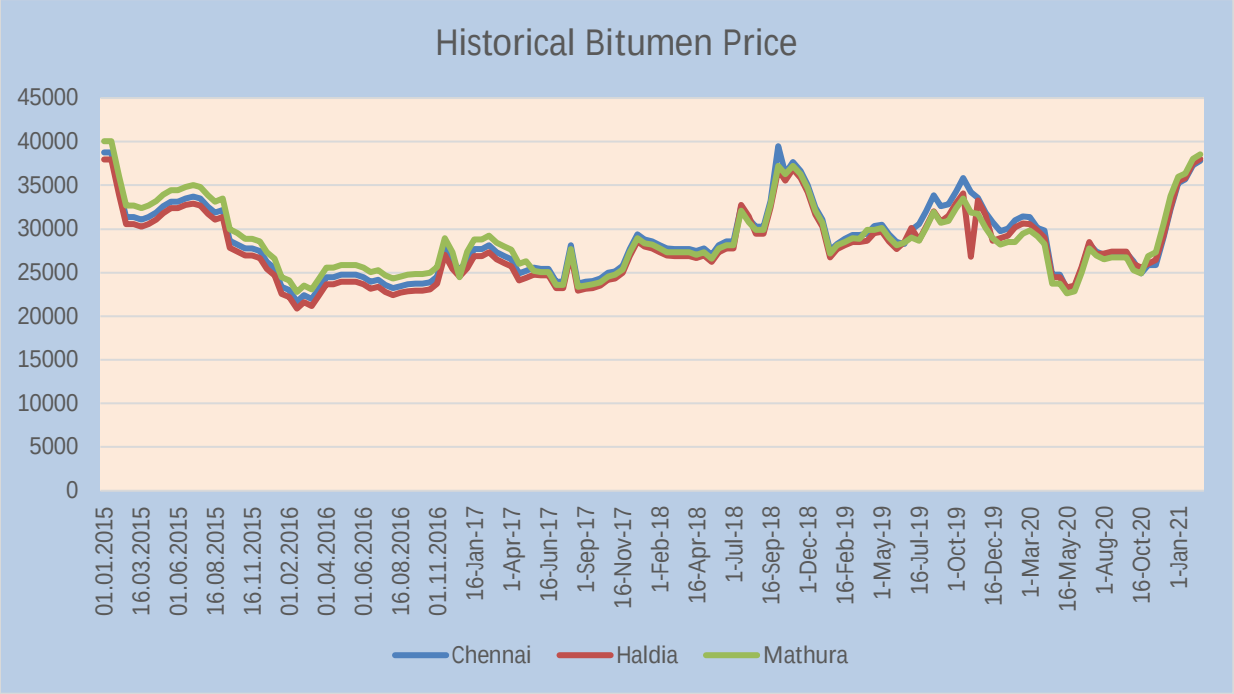
Quantity required for carrying out major maintenance is calculated under following items based on highway inventory carried out during site investigation and data provided by the Company:

- Tack Coat
- Bituminous concrete for MCW using VG-40
- Dense Bituminous Macadam for MCW using VG-40
- Bituminous concrete for Service / Slip Road using VG-30
- Dense Bituminous Macadam for MCW using VG-40
- Replacement of wearing coat after milling of existing wearing coat
- Micro surfacing
- Milling
- Joint Sealant for PQC
- Raising of Road Kerb
- Providing Road Studs
- Painting of road kerb and crash barrier
- Road Marking
- Median Filling

4.3 Unit Rate Analysis

The methodology adopted for cost estimate is as follows:

i) The historical bitumen price from year 2015 to till date is present in below graph.



ii) Bitumen rates provided by Client as follows applicable for Major Maintenance for the year FY 22:

Bitumen Price @ 1st March 2021	IOCL Chennai		
Bitumen	Base Price	Discount	Ex MI price
VG10	37271		37271
VG30	51752	5100	46652
VG40	55232	3800	51432

Note: For estimating Major Maintenance (MM) costs, we have used bitumen rates and escalation factor provided by Cube Highways. As per Client, bitumen prices have been range bound over the last five-six years (as depicted in 4.3. xii)) and hence bitumen price is assumed to be constant from FY 2024. We understand that bitumen prices are primarily dependent on crude oil prices and market demand and hence are likely to be very volatile and difficult to predict at this stage. Further, we have used escalation factor provided by the Client for estimating MM costs.

iii) Escalation in non-bituminous items is considered as per following escalation factor provided by the Company (Escalation factor applied only on Major Maintenance Cost).

Year	Growth Rate	Escalation Factor
FY-22	2.83%	1.000
FY-23	4.66%	1.047
FY-24	5.65%	1.106
FY-25	5.37%	1.165
FY-26	5.52%	1.229
FY-27	5.25%	1.294
FY-28	4.86%	1.357
FY-29	4.44%	1.417
FY-30	4.24%	1.477
FY-31	4.13%	1.538
FY-32	4.08%	1.601
FY-33	4.01%	1.665
FY-34	4.00%	1.732
FY-35	4.03%	1.801
FY-36	4.01%	1.874
FY-37	3.98%	1.948
FY-38	3.98%	2.026
FY-39	4.00%	2.107
FY-40	3.99%	2.191
FY-41	3.99%	2.278
FY-42	3.99%	2.369
FY-43	3.99%	2.464
FY-44	3.99%	2.562
FY-45	3.99%	2.664
FY-46	3.99%	2.771
FY-47	3.99%	2.881
FY-48	3.99%	2.996
FY-49	3.99%	3.116
FY-50	3.99%	3.240

iv) Equipment hire cost as per Standard Data Books published by MORTH

v) Labour rates as per minimum wages applicable.

Summary of Unit Rates, worked out using Standard Data Book, adopted for major items is given below

Sn	Items Description	Unit	Rates (Rs.) 2022
1	Dense Bituminous Macadam	Cum	10,277
2	Bituminous Concrete	Cum	12,066

Sn	Items Description	Unit	Rates (Rs.) 2022
3	Micro surfacing	Sqm	176
4	Replacement of Joint Sealant in PQC	m	220
5	Raising of Road Kerb	m	439
6	Road Marking	sqm	439
7	Kerb and Crash Barrier Painting	sqm	121
8	Shoulder Filling	sqm	50
9	Road Studs - Normal	nos	220
10	Road Studs - Solar	nos	1647

Note: above unit rates are excluding GST.

4.4 Cost Estimate

Cost estimate each cycle wise is presented below:

Detail calculation of MM works including rate analysis is provided in soft copy along with this report.

MM Cost is forecasted considering the extended concession period. i.e 15th March 2038.

Note: only MM Cost are escalated cost while all other costs are as of 2022 rates.

Sl. No.	Activity	Unit	Quantity			Unit Rate 2022	Unit Rate 2022#	Amount		
			2022	2028/29	2035/36			2022	2028/29	2035/36
	Main Carriageway - Flexible Pavement									
1	Tack Coat	Sqm	11,11,088	10,14,197	10,14,197	13	13	1,39,66,377	1,27,48,451	1,27,48,451
2	Bituminous Concrete - VG 40 / CRMB	Cum	15,363	30,426	30,426	12066	8939	18,53,66,799	27,19,71,315	27,19,71,315
3	Bituminous Concrete - PMB	Cum	22,451			13315		29,89,24,321		
4	Dense Bituminous Macadam - VG 40	Cum	1,886	2,535	2,535	10277	7727	1,93,82,988	1,95,90,652	1,95,90,652
5	Providing Insitu RAP	Cum				5500	5500	-	-	-
6	Milling of existing 40 mm BC	Sqm	51,222			77	77	39,44,094	-	-
7	Microsurfacing	Sqm				176	176	-	-	-
8	Crack Sealing	Sqm	30,000			20		6,00,000	-	-
									-	-
	Main Carriageway - Rigid								-	-
1	Joint sealant replacement every 5th Year (5 %)	m	8,417	8,417	8,417	220	220	18,51,827	18,51,827	18,51,827
									-	-
	Service Road							-	-	-
1	Tack Coat	Sqm	70,000	1,85,787	1,85,787	13	13	8,79,900	23,35,343	23,35,343
2	DBM - VG 30	Cum						-	-	-
3	BC - VG 30	Cum	2,100	5,574	5,574	11297	8170	2,37,23,574	4,55,35,279	4,55,35,279
4	Microsurfacing	Sqm		1,85,787	1,85,787	176	176	-	3,26,98,512	3,26,98,512
								-	-	-
	Structure(Including Flyover,Elevated,VUP,PUP and bridges)								-	-
1	Tack Coat	Sqm	24809	24809	24809	13	13	3,11,854	3,11,854	3,11,854
2	Bituminous Concrete - VG 40 / CRMB	Cum	744	744	744	12066	8939	89,80,471	66,53,002	66,53,002
3	Dense Bituminous Macadam VG-40	Cum				10277	7727	-	-	-
4	Milling of existing Wearing Coat	Sqm	24809	24809	24809	77	77	19,10,326	19,10,326	19,10,326
5	Painting of Crash Barrier	sqm	10896	10896	10896	121	121	13,18,431	13,18,431	13,18,431
6	Microsurfacing	Sqm				176	176	-	-	-
									-	-
	Other Works							-	-	-
1	Raising of Road Kerb	m	67,451		1,03,771	439	439	2,96,11,140	-	4,55,55,601
2	Replacement of Road Studs							-	-	-
	Road Studs	Nos	40,000	41,186	41,186	220	220	88,00,000	90,60,920	90,60,920
	Solar Studs	Nos	7,644	7,644	7,644	1647	1647	1,25,89,668	1,25,89,668	1,25,89,668
3	Painting of Road Kerb	Sqm	62,000	25,943	25,943	121	121	75,02,000	31,39,066	31,39,066
4	Road Marking - MCW	Sqm	39605	42799	42799	439	439	1,73,86,804	1,87,88,834	1,87,88,834
5	Shoulder Filling (40 to 50 mm)	Sqm	215540	190200	190200	22	22	47,41,880	41,84,400	41,84,400
6	Median Filling	Cum	1686		2594	439	439	7,40,279	-	11,38,890
7	Cost for fixing Other CA Issue at Handback Time - 5 % of above cost	LS							-	-
8	PMC Cost for Overlay @ 20 lakh per month	Month	8	8	8	20,00,000	20,00,000	1,60,00,000	1,60,00,000	1,60,00,000
	Major Maintenance Cost Per Year							65,85,32,732	46,06,87,879	50,73,82,370
	Major Maintenance Cost Per Year with GST							73,75,56,660	51,59,70,425	56,82,68,254
							Amount in Crore	73.76	51.60	56.83
	Escalation Factor							1.00	1.42	1.87
	Esclated Amount keping Bitumen Component w/o Escalation							73.76	65.94	91.43

5.0 OPEATION AND MAINTEANCE COST - OPEX

5.1 O & M Requirement as per CA

The Concessionaire shall Operate and Maintain the Project Highway in accordance with Article 17 – Operation & Maintenance & Schedule – K Maintenance Requirements of Concession Agreement. The obligation of Concessionaire as per Article 17 is as follows:

- permitting safe, smooth and uninterrupted flow of traffic on the Project Highway during normal operating conditions; collecting and appropriating the Fee.
- minimizing disruption to traffic in the event of accidents or other incidents affecting the safety and use of the Project Highway by providing a rapid and effective response and maintaining liaison with emergency services of the State.
- carrying out periodic preventive maintenance of the Project Highway.
- undertaking routine maintenance including prompt repairs of potholes, cracks, joints, drains, embankments, structures, pavement markings, lighting, road signs and other traffic control devices.
- undertaking major maintenance such as resurfacing of pavements, repairs to structures, and repairs and refurbishment of tolling system and other equipment.
- preventing, with the assistance of concerned law enforcement agencies, any unauthorized use of the Project Highway
- preventing, with the assistance of the concerned law enforcement agencies, any encroachments on the Project Highway
- protection of the environment and provision of equipment and materials therefore
- operation and maintenance of all communication, control and administrative systems necessary for the efficient operation of the Project Highway
- maintaining a public relations unit to interface with and attend to suggestions from the Users, government agencies, media and other agencies; and
- Complying with Safety Requirements in accordance with Article 18.

Performance requirement of maintenance is provided in Schedule K. The Concessionaire shall operate and maintain the Project Highway such that from O&M Handover date, lane availability at the end of each year of the Concession will be minimum of 99% on cumulative basis. For this purpose, lane availability at the end of each year will be computed as follows:

{(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date) - ∑ (lane length closed x number of days for which closed)}/ {(Length of Project Road X Number of Lanes X Number of days since O&M Handover Date).

The requirement during Concession period in terms of operation and maintenance, traffic management and lane closure, implementation of asset management and maintenance criteria has elaborated in Schedule K of Concession Agreement.

The Concessionaire shall procure that at all times during the Concession Period; the Project Highway conforms to the maintenance requirements set forth in Schedule-K (the "Maintenance Requirements"). The Maintenance requirement as per Schedule K is as follows:

The Concessionaire shall take all such actions and do all such things, including without limitation, Organizing itself, adopting measures and standards, executing procedures such as inspection procedures, highway patrols, engaging and managing contractors, agents, and employees, as will secure:

a. The safety of users of the Project Highway, workers, or other persons on the Project Highway and/or facilities there on;
b. Unimpaired performance of statutory duties and functions of the NHAI and other Authorities in relation to the Project Highway and/or other adjoining roads and facilities; and, subject to paragraphs a) and b) above, ensure that:
    i) Adequate safety measures taking into account 'Schedule-L' are taken up on the construction zone during the O&M period.
    ii) Delay to users of the Project Highway and of adjoining roads or facilities is minimised.
    iii) Risk of adverse effects on the environment and on the amenity enjoyed by the owners and occupiers of property and/or land adjacent to the Project Highway, adjoining roads and facilities is minimised.
    iv) Accidents and emergencies on the Project Highway and facilities thereon are responded to as quickly as possible and their adverse effects minimised.
    v) Risk of disturbance or damage or destruction to property of third party is minimised.
    vi) Members of the public are treated with due courtesy and consideration.
    vii) Users are given adequate information and forewarning of any event on or any other matter affecting the Project Highway which will enable them to minimise any adverse consequences on them of that event or matter.
    viii) Members of the public and others are given adequate opportunity to bring to the attention of the Concessionaire any matters affecting its ability to meet the O&M Requirements.
    ix) Traffic data and data relating to the operation and maintenance of the Project Highway and its facilities and events on the Project Highway are collected and disseminated such that the NHAI and other persons or bodies with statutory duties or functions in relation to the Project Highway or adjoining roads are able to perform those duties and functions efficiently.
    x) The project facilities shall be operated and maintained in order to fulfil the requirements set forth in the Concession Agreement and in this Schedule-K.
    xi) The Scope for Operation and Maintenance includes but not limited to following:
        - Improvement – this includes improvement of the existing assets as per requirement of this Agreement and safety audit
        - Road Maintenance – this includes routine maintenance, preventive maintenance, periodic maintenance, disaster maintenance, exigencies and inspections
        - Traffic Management – this includes enforcement of regulations together with the relevant authorities. This also includes hazard response, information gathering and dissemination, Road patrols and ATMS surveillance

- Safety – this includes accident prevention, after care, user education, enforcement, data collection and analysis
- Facility management – this includes periodic inspections, routine maintenance, Rehabilitation and expansion planning
- Road property management – this includes management of access, encroachment and ribbon development
- General responsibilities – this includes budgeting, compliance with legal and accounting requirements, and public relations
- Maintaining public relations unit to interface with and attend to suggestions from users of the highway, the media, Govt. agencies and other external agencies.

The broad limit of responsibilities of the Concessionaire shall be as described below:

a) In general, the limit of the Concessionaire's responsibility is to maintain all areas within the Right of way of the Project Highway inclusive of all features such as interchanges, toll plaza, street lighting facilities, traffic light facilities, ATMS and other facilities present within the Project Highway.
b) Limit of Maintenance by the Concessionaire for another road joining or crossing the concession limit shall be according to the following condition:
    i. Where the other road crosses an underpass the Concessionaire shall be responsible to maintain the crossing structure, viz., culverts, bridges and their abutments and related facilities. such as drainage, turfing, etc.
    ii. The Concessionaire shall be responsible for maintenance of the road surface, or the roadside drains of the other roads that are within 100m beyond the Right of Way of Project Highway.
c) The Concessionaire shall operate and maintain all the street lighting, traffic light system, structures, roadway surface and the related facilities such as drainage, turfing etc. within the interchanges, and such maintenance shall be extended until the end of the flare and the deceleration and acceleration lanes of the interchanges.
d) The Concessionaire shall be responsible for maintaining all crossroads indicated in Schedule-B up to Right of Way of the Project Highway and their flares to junctions at any interchange within the Project Highway, whichever is more.
e) For setting out the limit of maintenance for the Concessionaire, National Highways Authority of India shall be responsible for negotiating with the local authorities or where required, with other relevant third parties. The Concessionaire shall maintain all the drainage system within the Right of Way including the culvert crossings and the drains. However, the Concessionaire shall not be liable to maintain rivers and the streams under the jurisdiction of Irrigation Department except when such Maintenance of Project Highway is required as a result of exceptional discharge.

Concession agreement do not specify any specific requirement of manpower category. Concessionaire is free to ascertain requirement of staff for operation and maintenance as long as Concessionaire maintain level of service defined under Schedule K. Optimized staff requirement at

Toll plaza ground staff, office staff and monitoring staff at site level and HQ level have discussed with CUBE Highways Team and considered accordingly.

AECOM has classified O & M requirement in following heading and cost estimated is done accordingly:

1. Preventive Maintenance
2. Routine Maintenance
3. Highway Lighting
4. ATMS and TMS
5. Corridor Management
6. Site Management and Supervision Manpower
7. Toll Collection Manpower
8. Operation and Maintenance Cost including Professional Fees, Insurance Premium, IE Fees etc.

5.2 O & M Strategy

The Company has adopted following strategy to meet requirement of CA:

Sn	Activity	Strategy
1	Routine Maintenance	Outsource
2	Preventive Maintenance	Outsource
3	Management and Supervision Staff	In-house
4	Operation cost of Toll Plaza and Administration Building	In-house
5	Tolling Manpower	Outsource
6	Security of Toll Plaza and Cleaning	Outsource
7	Maintenance of ATMS / TMS	Outsource, AMC
8	Corridor Management	Outsource

AECOM also recommend same strategy.

5.3 Routine and Preventive Maintenance

Routine maintenance encompasses work that is performed in reaction to an event, season, or over all deterioration of the transportation asset. This work requires regular and reoccurring in nature. Routine Maintenance is essential to maintain the condition of the highway asset or to respond to specific conditions or events that restore the highway system to a functional state of operation

The routine maintenance covers maintenance of following assets:

- Cleaning of Main Carriageway, service road, bridge deck
- Pruning of median plantation, watering
- Maintenance of Avenue Plantation
- Cleaning of debris from carriageway and shoulder
- Plantation and Landscaping
- ROW Cleaning
- Cleaning of all road asset, Toll Plaza

The average cost towards Routine Maintenance is Rs. 20,183 / km / month excluding GST.

Preventive Maintenance: the cost towards following items is considered under this category:

- Repair cost of pavement as and when pavement distress occurred
- Repair of road kerb, crash barrier, metal beam crash barrier and guard rail
- Repair of faded road marking
- Fixing of damaged sign boards, KM stones
- Shoulder maintenance
- Repair and maintenance of structure – bearing, expansion joint
- Repair of crossroad junction
- Maintenance of Truck lay-bys

The average cost towards Preventive Maintenance is Rs. 14,245 / km / month excluding GST.

5.4 Highway Lighting

Electricity charge and maintenance cost of highway lighting is calculated as follows:

a) Each lighting post has counted from site and considered having 180-watt LED light (as per information provided by the Company) will be operated for 12 hours a day round the year
b) Electricity cost is considered 10.11 Rs / Kwh based on monthly electricity bill.

The calculated electricity cost for existing lighting system is tabled as below

Sn	Description of items	Unit	Quantity	Unit Rate	Amount in crore
1	Spare Parts for highway lighting (AMC)	KM	20.47	98,795	20,22,047
2	Highway Lighting Electricity Charge	Kwh	15,27,562	5.49	83,84,230
3	Operation and Maintenance of DG Set	Nos	1	1,12,188	1,12,188
4	Solar Blinker	Nos	36	3,293	1,18,555
5	Office Building Electricity Charge	LS			8,56,227
	Total				11,493,246*

*10% additional to update cost of April 2022

6.5 ATMS and TMS Cost

O and M cost for ATMS and TMS has calculated based on recommendation provided by manufacturer as follows:

a) Annual Maintenance cost as per AMC provided by Vendor.
b) 70 % of equipment installed under TMS and ATMS shall be replaced in every seven years

Average O & M Cost as per AECOM calculation is 0.80 crore per year and additional cost of 0.79 crore for replacement of equipment at every 7 (seven) years.

5.5 Incident Management

The following equipment's along with operation manpower is required to provide as per CA:

a) 1 nos of Crane of 30 MT as per Sub-clause 17.5 of CA
b) Traffic Aid Post with 2 nos of route patrol vehicle as per Article 17 at each toll plaza
c) 1 nos of Ambulance as per Sub-clause 21.1 of CA with Medical Aid post building with 2 Residential quarters as per CA 21.2.

O & M Cost estimated towards incident management with operation manpower is Rs. 2.11 crore per year including GST.

6.7 Manpower Cost

The requirement of manpower is worked out to function all activity at project road for compliance of CA requirement, toll collection and security of asset. Requirement of manpower is classified into following broad division:

1) Management, Administration / HR and Supervision Staff: in-house manpower
2) Toll Operation Manpower: outsource for providing 24-hour uninterrupted traffic flow at toll plaza and collection of tolls. Due to Nationwide implementation of Hybrid-ETC System, it is expected drop in toll collection manpower. However, where collection of overloading is expected, manpower for toll collection is not possible at this stage. Company is expecting revenue from overloading in this asset therefore curtailment of toll collector is not expected.
3) The Toll manpower is considered based on the ETC payment collection. i.e. more than 90% FASTTAG.

The cost of manpower is estimated as Rs. 3.06 core (FY 22) per year.

6.8 Office Expenses

Cost towards operation of office, insurance premium, profession fees for carrying out traffic, asset condition survey etc., IE fees, AMC for equipment installed at office, communication charge, conveyance cost etc. is considered under Office Expenses. The cost estimated is Rs. 3.63 crore (FY 22) per year.

Year wise O & M Cost (OPEX) is presented in next pages

Operation and Maintenance Cost

O and M Cost including GST											
Abstract of Cost for Operation & Maintenance Cost -KWTPL											
Year in Nos	Year	OPEX - AECOM									
		Preventive Maintenance	Routine Maintenance	Highway Lighting	ATMS / TMS Routine	Corridor Management Outsource	Project Support Team at Head Office	Toll Operation Manpower	Transportation Cost	Other Office Operation Cost	Yearly O & M Cost
1	2021-22										-
2	2022-23	69,65,513	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,73,59,955
3	2023-24	94,51,703	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,98,46,145
4	2024-25	1,09,83,910	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	14,13,78,352
5	2025-26	1,21,68,330	1,29,20,983	1,14,93,246	1,60,43,853	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	15,05,42,829
6	2026-27	46,63,398	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,50,57,840
7	2027-28	69,65,513	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,73,59,955
8	2028-29	94,51,703	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,98,46,145
9	2029-30	1,09,83,910	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	14,13,78,352
10	2030-31	1,21,68,330	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	14,25,62,772
11	2031-32	1,33,47,399	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	14,37,41,841
12	2032-33	46,63,398	1,29,20,983	1,14,93,246	80,63,796	2,11,09,476	17,78,318	3,06,94,650	30,29,727	4,13,04,246	13,50,57,840
	Total	10,18,13,106	14,21,30,817	12,64,25,703	9,66,81,818	23,22,04,237	1,95,61,498	33,76,41,145	3,33,27,000	45,43,46,703	1,54,41,32,026
Total Cost in Crore		10.18	14.21	12.64	9.67	23.22	1.96	33.76	3.33	45.44	154.41

6.0 HIGHWAY AND STRUCTURE INVENTORY AND CONDITION ASSESSMENT

6.1 Reconnaissance Survey

This project road is a Walayar to Vadakkancherry section of NH 44 (NH 544) from Salem to Kollam. Project road starts from Km 182+250 to Tamilnadu Border to Km 240+000 near Vadakkancherry in the state of Kerala. The total length of the project road is 53.885 km located in plain/rolling terrain. The project road has been visited by Consultant's team of Engineers in the month of Jan 2021 and made detailed assessment of road features, pavement, toll plazas, structures etc. Separate teams comprising of Highway Engineers and Bridge Engineers from Consultant have carried out Inventory & Condition of Road, road furniture, Structures, and other facilities. The project stretches and length is given as below:

Project Name	Start Chainage	End Chainage	Length (km)	Remarks
Four Laning of Walayar – Vadakkancherry Section in Kerala from Km. 182.250 (Design Chainage Km. 182.250) to Km. 240.000 (Design Chainage Km. 236.135) of NH-47 – Package NS-2/BOT/KL-2 on DBFOT (Toll) Basis under NHDP Phase II.	182+250 (182+250)	240+000 (236+135)	53.885	

6.2 Road Inventory and Condition Survey

Detailed road inventory survey of the project road was carried out by the Consultant's Team consisting of Highway Engineers, Quantity Surveyors and Assistant Engineers to make detailed assessment of highway features.

Following items were reviewed during the inventory survey:

- Cross sectional elements, Embankment Height
- Terrain and land use pattern along the project corridor
- Toe Wall, Retaining Wall, RE Wall and other retaining structures
- Bus Bay, Truck Lay bye, Rest Areas, Lighting and other project facilities
- Toll Plaza and associated facilities
- Safety barriers and Guard Rails
- Junctions and crossroad details, Drainage details
- Sign Board, Traffic Safety Devices and other Roadside Furniture items
- Landscaping and Plantation details along the project corridor
- Various key features along the project road such as slope protections, median openings, Site inventory data have been enclosed.

Start Point of Project Road at Km 182+350	End Point of Project Road at Km 236+135

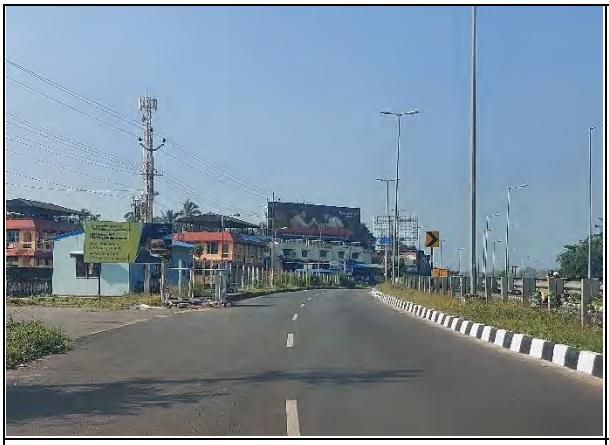
Salient features of the project road observed during the reconnaissance survey/inventory, in comparison with CA are provided in the table below:

COMPARISON OF PROJECT HIGHWAY COMPONENTS

Sn	Particulars	As per Schedule-A	As per Site Condition
1	Project Road Start	Km 182+250 at Walayar of NH-44 (Old NH-7)	Km 182+250 at Walayar of NH-44 (Old NH-7)
2	Project Road End	Km 236+135 at Vadakkancherry of NH-44 (Old NH-7)	Km 236+135 at Vadakkancherry of NH-44 (Old NH-7)
3	Project Length	53.885Km	53.885Km
6	Carriageway	4 lane highway with paved width 8.75 m on either side	4 lane highway with paved width 8.75 m on either side
7	Shoulders	1 .5 m earthen for MCW	1 .5 m earthen for MCW
8	Median	4.50 m wide in rural areas and 1.5 m in Urban Stretches.	4.50 m wide in rural areas and 1.5 m in Urban Stretches.
9	Service Roads	49.882 Km	LHS: 27.371 Km RHS: 25.311 Km, including 2.85Km SR under CoS
10	Major Bridge	2 No.	2 No.
11	Minor Bridge	12 Nos.	12 Nos.
12	Pipe, Box & Slab Culverts	191 Nos.	191 Nos.
13	Major/Minor Junctions	9 Major and 36 Minor	9 Major and 36 Minor
14	Underpass	2 Grade Separator, 4 VUP and 4 PUP	7 VUP and 4 PUPS
15	ROB/RUB	1 No	1 No
16	Toll Plazas	1 No	1 No
17	Truck Lay-byes/Truck Parking	1 No	1 No
18	Bus Shelter	49 Bus Bays	6 Bus Bay & Shelter and 48 Bus Shelter

6.3 Cross Sectional Elements

Details of various cross-sectional elements of highway were taken during the visual road inventory survey. Physical measurement of different cross-sectional elements such as carriageway, shoulder, median, service road, separators, footpath etc. was carried out. Kilometer stones available at site were used for the chainage reference.

<table>
<tr><td>  </td><td> </td></tr>
<tr><td>Typical Cross Section having Service Road</td><td>Typical Section of Approach</td></tr>
<tr><td> </td><td> </td></tr>
<tr><td>Typical Rural Section</td><td>Toll Plaza</td></tr>
</table>

6.3.1 Pavement Type

Both Flexible and Rigid pavement has provided along the entire length of project road. As per visual inspection condition of pavement if Fair. Rutting has been observed on many location & cracks observed on rigid pavement.

S.N.	Chainage		Pavement Type		Length Km
	From	To	LHS	RHS	
1	182+250	189+220	BT	BT	6.97
2	189+220	189+580	CC	CC	0.36
3	189+580	236+135	BT	BT	46.555

Flexible Pavement	Rigid Pavement

6.3.2 Service Roads

As per Schedule A of CA 49.882 Km of service road has been constructed at Urban stretches and grade separated structure to segregate the local and diverging traffic from main carriageway. But 52.734 Km length of service road has been observed on site. Condition of service road is fair.

6.3.3 Median

Median width of 4.5 m and 1.5 m were observed in the Rural and approach of underpass / FO, built-up stretches respectively. Plantation has provided along entire median in fair to poor condition.

45 nos. of authorized Median Openings are found along project road. Most of median openings are not having storage lane and blinkers and railing/safety barrier at narrow median near median opening throughout the project is not provided except at few locations.

Typical 1.5 m wide median	4.5m wide Median

Median Opening with Solar Blinker	Medain Opening with Solar Blinker

6.3.4 Roadside Drain

Drains are to be constructed at the project road to have a good drainage. Lined drains are provided at the sides of the Service Road and at some locations covered lined Drains are provided at the separators between the Main Carriageway and Service Road. Median Cut Drains are provided at the Super elevations. Drainage condition of project road is in order, silt deposit need to be removed through routine maintenance. Total 11.2 Km of covered/open line side drain is found on site. The condition of the same is good to fair.

RCC Covered Drain at Project Road	Median Cut Drain at Project Road

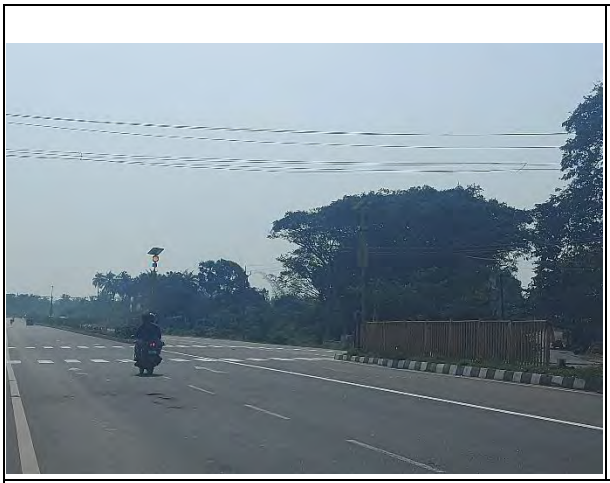
6.3.5 Major and Minor Junctions

As per the site inventory, 9 Major and 36 minor junctions are present in project road. Minor junctions were generally present for access to nearby villages, towns, or agricultural areas.

Major Junction	Major Junction

6.3.6 Safety Barriers

Metal Beam Crash barriers were present at carriageway edges at high embankment areas and at some locations in the median at Minor Junctions. Pedestrian Guard Rails are Present at the carriageway edges between the Service Road and Service Road.



PGR and W-Beam present on the project road

6.3.7 Toll Plaza and Other Facilities

There is one existing Toll plaza at KM 189+400 at Nanguneri with the configuration 2 x (5+1). This has 9Toll booths, Canopy, user fee boards. The existing toll plaza do not have comply requirements of NHAI latest circular integration of Weigh-in-motion with Static Weight Bridge, PQC on tapper portion..

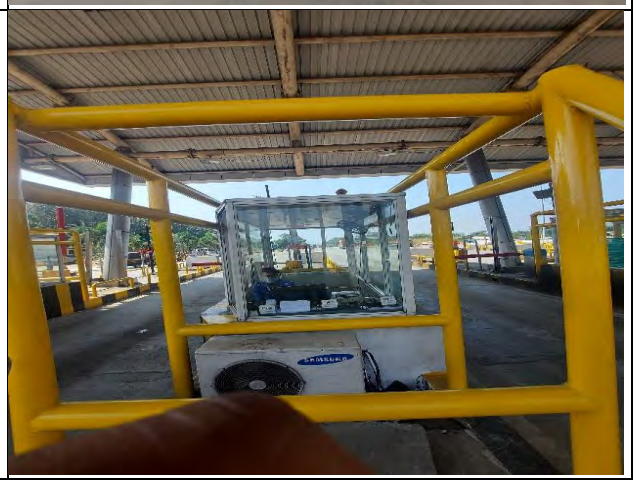
The Details of Toll plaza are given below.

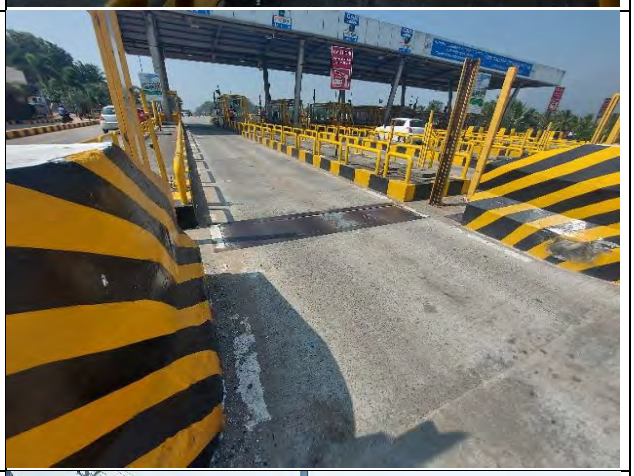
1. Centre of Toll Plaza : Km 189+400.
2. Start of Taper : Km 189+220
3. Start of Straight : Km 189+375
4. End of Straight : Km 189+425
5. End of Taper : Km 189+580
6. Taper in Length : 155.0m
7. Taper Out Length : 155.0m
8. Total Length of Toll Plaza : 360m (Including Rigid Pavement)
9. Lanes at Toll Plaza : 1+4+4+1 (10 Lanes, 5X lanes in each carriageway)

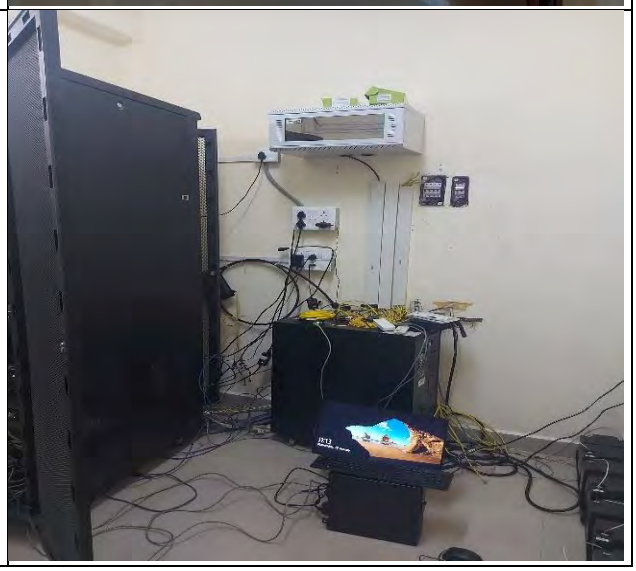
The Concessionaire has running the operation at the toll plaza with temporary iron cabins as there is no admin building in the project highway.

Toll Plaza Taper	Toll Plaza -Toll lane

Pictorial representation for present site conditions for Pampampallam Toll Plaza at Km 189+400

S. No.	Description	Site Status
1.	Toll Plaza is at Km 189+400 has 5 LHS+ 5 RHS lanes.	
2.	Toll booths are equipped with all the required systems/equipment's.	

S. No.	Description	Site Status
3.	All the required equipment's are placed outside the toll booth.	
4.	WIMs are installed in 4 LHS +4 RHS lanes. (Overloading charges is not being collected due to parallel roads)	
5.	There are 2 nos. Static Weigh Bridges; one in each direction of travel.	

S. No.	Description	Site Status
6.	Toll Management System (TMS)	
7.	TMS Server Room is equipped with all the required servers and switches.	

6.3.8 Highway Lighting

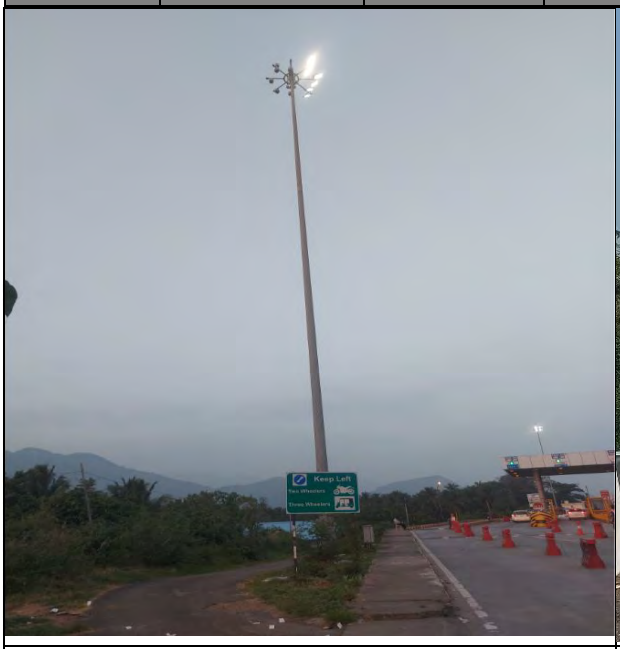
Highway Lighting has been provided at approaches to toll plaza and urban section near Nanguneri city. Additionally, 5 High Mast has provided at Toll Plaza, major junction, and flyover. 15 Nos. Double Arm poles has been provided at site and as per 1011nos. of lighting shall be provided.

Highway Lighting Location

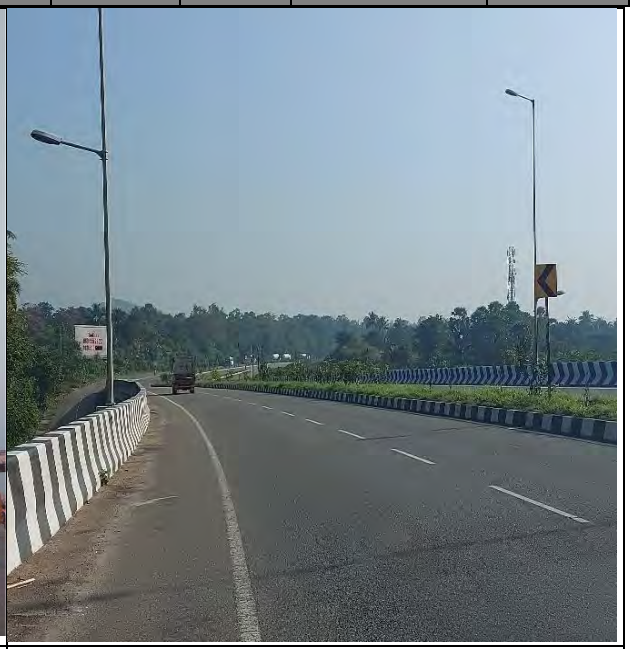
Sl No	Design Chainage		Length (M)	Side	Single arm	Double arm	High Mast
	From (km)	To (Km)					
As per Site							
1	183+250	183+950	700	LHS	15		

Sl No	Design Chainage		Length (M)	Side	Single arm	Double arm	High Mast
	From (km)	To (Km)					
2	183+250	183+950	700	MEDIAN		15	
3	183+950	184+600	650	LHS		22	
4	183+950	184+600	650	MEDIAN		22	
5	187+250	187+450	200	LHS		7	
6	187+250	187+450	200	RHS		7	
7	189+600			BHS			4
8	191+000	191+600	600	MEDIAN		34	
9	191+700	192+340	640	RHS		23	
10	191+700	192+340	640	LHS		20	
11	191+340	192+980	1640	LHS		26	
12	191+340	192+980	1640	RHS		21	
13	192+980	193+620	640	LHS		20	
14	192+980	193+620	640	RHS		22	
15	193+620	194+470	850	LHS		20	
16	193+620	194+470	850	RHS		21	
17	195+400	196+040	640	LHS		20	
18	196+040	196+680	640	LHS		19	
19	196+680	197+200	520	LHS		19	
20	197+230	198+240	1010	LHS		30	
21	196+040	196+940	900	RHS		30	
22	196+040	196+300	260	RHS		28	
23	195+300	196+300	1000	RHS		27	
24	194+800	198+830	4030	LHS		2	
25	194+800	198+830	4030	RHS		2	
26	200+300	201+100	800	MEDIAN		24	
27	201+100	202+000	900	MEDIAN		14	
28	202+100	203+400	1300	LHS		30	
29	203+100	203+400	300	RHS		42	
30	203+400	203+920	520	RHS		15	
31	203+400	203+850	450	LHS		10	
32	203+700						1
33	202+900	203+700	800	MEDIAN		44	
34	206+300	207+000	700	LHS		28	
35	206+300	207+000	700	RHS		30	
36	209+300	209+400	100	RHS		4	
37	209+300	209+400	100	LHS		4	
38	213+500	214+020	520	LHS		28	
39	213+500	214+020	520	RHS		25	
40	215+630	216+437	807	LHS		4	
41	215+630	216+437	807	RHS		9	
42	217+400	217+600	200	LHS		5	

Sl No	Design Chainage		Length (M)	Side	Single arm	Double arm	High Mast
	From (km)	To (Km)					
43	217+400	217+600	200	RHS		5	
44	225+400	226+060	660	LHS		16	
45	223+100	223+600	500	LHS		19	
46	225+400	226+060	660	RHS		15	
47	223+100	223+600	500	RHS		16	
48	226+060	226+800	740	RHS		28	
49	223+600	223+650	50	LHS		34	
50	222+400	222+720	320	RHS		13	
51	222+400	222+720	320	LHS		12	
52	226+060	226+800	740	LHS		17	
53	223+600	224+650	1050	RHS		26	
54	234+300	235+000	700	LHS		19	
55	234+300	235+000	700	RHS		18	
			40934	Total	15	1011	5



High Mast Light



Highway Lighting

6.3.9 Bus Bays and Bus Shelter

There are 6 Bus Bay & Shelter and 48 Bus Shelter along the project road. All bus shelters present in the project road are in fair condition.

Bus Shelter	Bus Bay with Bus Shelter

6.3.10 Signage and Marking

Road Signs

359 nos. of Traffic Sign boards were observed during the inventory of project road. The condition of most sign boards was found to be Fair condition.

Road marking along the carriageway

Road Marking

Road Marking along the project corridor was found to be in Good condition. Junctions and the Pedestrian Crossings are marked in proper way.

Road marking along the carriageway	

6.3.11 Landscaping and Tree Plantation

Median plantation has provided at 4.5 m median and narrow median. Condition of median plantation is Not good in 4.5 m median and fair condition at 1.5 m median. Avenue plantation has provided within available ROW.

Avenue Plantation along the project Road	Plantation at 4.5 m Median

6.4 Inventory and Condition Survey of Structures

6.4.1 General

A team consisting of Senior Bridge Engineers and Engineer carried out detailed inventory investigation and condition survey of bridges, cross drainage and other structures. All the structures were thoroughly inspected, and a condition assessment was made covering all parameters as per inspection standard format. This was compared with the details available in the SCHEDULE-B. The following data were recorded during the site investigations.

- Type of structure, details of span, vent height etc. and the visual condition of sub structure and super structure including parapets, wearing course, expansion joints, drainage spouts and bearings.
- Existing width of roadway and total width.
- Type and condition of protection work, if any, and information regarding scour and erosion.
- Adequacy / inadequacy of waterway, signs of silting and blockage of the vent way, over-topping of the structure, observed scour level etc.
- Type of foundation
- Type and size of culverts.
- Material used for construction.

Data collected during the detailed inspection of bridges were analyzed properly to assess the adequacy of waterway, structural adequacy and serviceability. Bridges free from any defect and those needing attention, for which maintenance works are needed were categorized.

Repair of bearing and expansion joint and removal of vegetation growth at Abutments in some locations is required as they are in need of maintenance to extend their design life.

As per site inspection it has been observed that

- 2 no of Major Bridges having span arrangement of 4 x 26.60 + 8 x 21.40 are in good condition
- 12 nos. of Minor bridges having total length varies from 9 m to 49.2 m are generally found in good condition.
- 8 nos. of Underpass having span single arrangement are found in good condition.
- 1 nos. of Single Span Railway over is in good condition
- 195 (pipe/slab) nos. of culverts found at site

6.4.2 Detailed Description of Structures

Major Bridges

a) Major bridge – CH.198+870

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 4x26.8m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. The general condition of the bridge is good. It requires periodic maintenance such as replacement of joint and wearing coat after the appropriate time span from the date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Major Bridge at Ch. 198+870

b) Major Bridge – CH.207+900

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 8x21.40m. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment and pier. Cleaning of drainage spouts is required, and median wall is recommended. Other conditions of the bridge are good. It requires periodic maintenance such as replacement of joint and wearing coat after the definite time span from the date of construction. A few pictures to ascertain the conditions of Major Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 207+900

Minor Bridge

Salient features along with condition of 12 Minor bridges are discussed.

c) Minor Bridge – CH.182+237

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 182+237

d) Minor Bridge – CH.190+970

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x16.50m. The super structure comprises of RCC Girder. Superstructure is resting on RCC wall type abutment. During inspection it was observed that all drainage spouts are blocked, slope pitching and floor protection work is fair. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

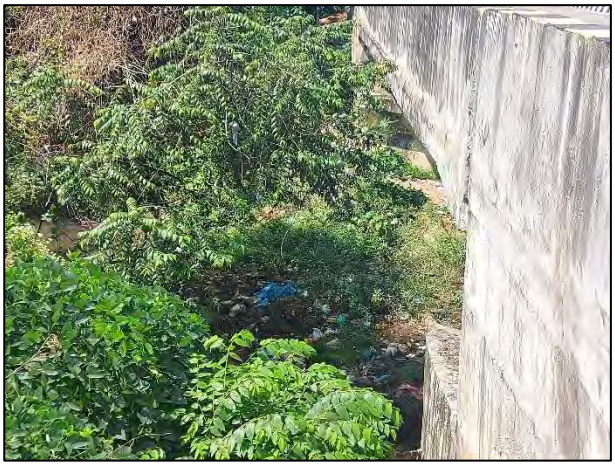
Span Arrangement

Minor Bridge at Ch. 190+970

e) Minor Bridge – CH.194+470

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x22.00m. The super structure comprises of PSC Girder. Superstructure is resting on RCC wall type abutment. During inspection it was observed that all drainage spouts are blocked, slope pitching and floor protection work is fair, Wearing Coat and expansion joint needs minor repair, Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway



Span Arrangement

Minor Bridge at Ch. 194+470

f) Minor Bridge – CH.204+680

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x21.40m. The super structure comprises of PSC Girder. Superstructure is resting on

RCC wall type abutment. During inspection it was observed that Wearing Coat and expansion joint needs minor repair. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span arrangement

Expansion joint in poor condition

Minor Bridge at Ch. 204+680

g) Minor Bridge – CH.213+160

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x20.00m. The super structure comprises of PSC Girder. Superstructure is resting on RCC wall type abutment. During inspection it is observed that, Wearing Coat, Expansion joint and RCC railing needs minor repair. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span Arrangement

Pitching in fair condition

Minor Bridge at Ch. 213+160

h) Minor Bridge – CH.214+272

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x13.50m. The super structure comprises of RCC Girder. Superstructure is resting on RCC wall type abutment. During inspection it was observed that drainage spouts are blocked, Wearing Coat needs minor repair. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span Arrangement (LHS)

Span Arrangement (RHS)

Minor Bridge at Ch. 214+272

i) Minor Bridge – CH.219+570

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 1x9.0m. The super structure comprises of RCC Slab. Superstructure is resting on RCC wall type abutment. During inspection it was observed that minor repair is required in median wall, Slope pitching is completely covered by vegetation. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

Span Arrangement (LHS)

Span Arrangement (RHS)

Minor Bridge at Ch. 219+570

j) Minor Bridge – CH.222+165

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 3x9m. The super structure comprises of RCC Girder. Elastomeric Bearing are used for resting of superstructure on RCC wall type abutment and pier. During inspection it was observed that drainage spouts are blocked, Wearing Coat needs minor repair, expansion joint are filled with dust, repairing and painting of railings. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of Carriageway

Span Arrangement

Minor Bridge at Ch. 222+165

k) Minor Bridge – CH.224+902

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 3x16.40m. The super structure comprises of RCC Girder. Elastomeric Bearing are used for resting of superstructure on RCC wall type abutment and pier. During inspection it was observed that drainage spouts are blocked, Wearing Coat needs minor repair, expansion joints are filled with sand, Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriage way

Span Arrangement

Minor Bridge at Ch. 224+902

l) Minor Bridge – CH.235+180

It consists of bridge on both side (LHS and RHS) carriageways. Both the bridges have span arrangement of 3x16.40m. The super structure comprises of RCC Girder. Elastomeric bearings are used for resting of superstructure on RCC wall type abutment and Pier. During inspection it was observed that drainage spouts are blocked, Poor expansion joint and Poor Slope Pitching. Other conditions of the bridge are good. A few pictures to ascertain the conditions of Minor Bridge are presented as follows:

View of carriage way

Span Arrangement

Minor Bridge at Ch. 235+180

Under-Passes (UPs)

There is a total of 08 Ups. All UPs are single span with RCC Box Type structure.

UPs are generally in good condition with some minor damages.

A few pictures to ascertain the conditions of PUPs are presented as follows:

View of RCC Plank Type Superstructure

Span Arrangement

UP at Ch. 187+350

Super structure in fair condition

Span Arrangement

UP at Ch.205+600

Super structure in fair condition

Span Arrangement

UP at Ch. 223+910

Railway over Bridge (ROBs)

ROB at Ch. 208+975

It consists of bridge on LHS and RHS on over railway tracks. The super structure comprises of PSC Girder. POT-PTFE bearings are adopted for resting of superstructure on RCC wall type abutment.

It requires repairing of drainage spouts. Slope pitching is in good condition. Other Conditions of the bridge is good. Only periodic maintenance within the time frame is to be done.

A few pictures to ascertain the conditions of ROB are presented as follows: -

View of Carriageway

Span Arrangement

Span Arrangement

Super structure in fair condition

ROB at Ch. 208+975

Culverts:

There are 195 numbers of culverts in entire project corridor.

The general condition of the culverts is good. It requires regular repair works such as painting and fixing of crash barrier/railing/headwall, stone pitching, median protection, cleaning of vent.

1.3.1 Structures Condition Summary

Condition Summary of Structures based on Visual Observation is presented below:

Rating	Overall Condition	Repair and Maintenance Requirement
●	Good	No immediate Repair / Maintenance Works Required
●	Fair / Satisfactory	Minor Repair Works Required
●	Poor	Major Repair Works or Replacement of components Required
N/A	Not Applicable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
1	198+870	LHS	4x26	12.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	4x26	12.0			●	●	●	●	●	●	●	●	●		●	Stable	
2	207+900	LHS	8x21	12.0	MJB	Y	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS	8x21	12.0			●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
3	182+237	LHS	3x19.5	12.0	MNB	Y													
		RHS	3x19.5	12.0															
4	190+970	LHS	1x16.50	12.0	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x16.50	12.0			●	●	●		●	●	●	●	●		●	Stable	
5	194+470	LHS	1x22.00	12.0	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x22.00	12.0			●	●	●		●	●	●	●	●		●	Stable	
6	201+295	LHS	1x11.20	12.0	MNB	Y													
		RHS	1x11.20	12.0															
7		LHS	1x21.40	12.0	MNB	Y	●	●	●	●	●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
	204+680	RHS	1x21.40	12.0			●	●	●	●	●	●	●	●	●		●	Stable	
8	209+950	LHS	2x13.00	12.0	MNB	Y													
		RHS	2x13.00	12.0															
9	213+160	LHS	1x20.00	12.0	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x20.00	12.0			●	●	●		●	●	●	●	●		●	Stable	
10	214+272	LHS	1x13.50	12.0	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	1x13.50	12.0			●	●	●		●	●	●	●	●			Stable	
11	219+570	LHS	1x9.00	12.0	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x9.00	12.0			●	●	●		●	●	●	●	●		●	Stable	
12	222+165	LHS	3x9.00	12.0	MNB	Y	●	●	●		●	●	●	●	●		●	Stable	
		RHS	3x9.00	12.0			●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition										Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts	
13	224+902	LHS	3x16.40	12.0	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	3x16.40	12.0			●	●	●		●	●	●	●	●			Stable	
14	235+180	LHS	3x16.40	12.0	MNB	Y	●	●	●		●	●	●	●	●			Stable	
		RHS	3x16.40	12.0			●	●	●		●	●	●	●	●			Stable	
15	197+930	LHS	1x17.50	23.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x17.50	23.5			●	●	●		●	●	●	●	●		●	Stable	
16	209+076	LHS	1x13.50	17.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x13.50	17.5			●	●	●		●	●	●	●	●		●	Stable	
17	217+310	LHS	1x25.00	23.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x25.50	23.5			●	●	●		●	●	●	●	●		●	Stable	
18	216+400	LHS	1x17.50	23.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	

Sn	Chainage	Side	Span	Overall Width (m)		Sufficiency of water way	Existing Structure Condition											Overall Condition	Remarks
							Foundation	Sub structure	Super structure	Bearings	Expansion joints	Protection works	Safety Barriers	Wearing Coat	Approaches		Drainage Spouts		
		RHS	1x17.50	23.5			●	●	●		●	●	●	●	●		●	Stable	
19	222+680	LHS	1x12.0	23.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x12.0	23.5			●	●	●		●	●	●	●	●		●	Stable	
20	223+530	LHS	1x12.0	23.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x12.0	23.5			●	●	●		●	●	●	●	●		●	Stable	
21	219+800	LHS	1x12.0	12.5	UP	NA	●	●	●		●	●	●	●	●		●	Stable	
		RHS	1x12.0	12.5			●	●	●		●	●	●	●	●		●	Stable	
22	208+975	LHS		12.0	ROB	NA	●	●	●	●	●	●	●	●	●		●	Stable	
		RHS		12.0			●	●	●	●	●	●	●	●	●		●	Stable	

ANNEXURE C

TRAFFIC REPORTS

(*The remainder of this page is intentionally left blank*)

Final Report
April 2022

Project Transit: Traffic Due Diligence for Delhi Agra Toll Road Private Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Delhi Agra Toll Road Private Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer ..... **ix**

Glossary Items ..... **xi**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Key economic activities 9

Alternate routes 10

3 Traffic Description **12**

Introduction 12

Historical trends 12

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes 15

Data collection and validation 20

Key findings of the TVC data analysis 21

Key findings of origin-destination analysis 23

Trip length analysis 36

Conclusions 39

4 Socio Economic Context **40**

Introduction 40

Population growth 40

Economic growth 41

5 Traffic growth analysis **45**

Introduction 45

Estimation of background elasticities 45

Forecasts for background elasticities 50

Forecasts for growth drivers 51

6 Forecast: Base year AADT and Impacts 53

Introduction 53

Seasonality Correction factors 54

Base year FY22 AADT estimates 55

Analysis of potential impacts 56

Revenue forecasting assumptions 66

Traffic and Revenue forecasts 68

Upside and Downside Cases 77

Traffic and Revenue Forecasts-Upside case 79

Traffic and Revenue Forecasts-Downside case 86

Summary outlook 94

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4

Figure 2.1: Asset location in the regional network context 6

Figure 2.2: Asset context 7

Figure 2.3: Typical cross-section of the Asset, toll plaza and alternate road near Mathura connecting with Yamuna Expressway (bottom right) 9

Figure.2.4: Alternate routes to the Asset 10

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- KM74 14

Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2- KM164 15

Figure 3.3: Traffic evolution of KM74 16

Figure 3.4: Percentage of Traffic via FastTag, Mar 2022 18

Figure 3.5: : Ticket-segmentation for CJV at TP1 (KM74) 18

Figure 3.6: Ticket-segmentation for MAV at TP1 (KM74) 19

Figure 3.7: Ticket-segmentation for CJV at TP2 (KM164) 19

Figure 3.8: Ticket-segmentation for MAV at TP2 (KM164) 20

Figure 3.9: WADT (km46, km 74, km94, km164) 21

Figure 3.10: Comparison between TVC and TMS daily traffic data on TP1 km74 Srinagar 22

Figure 3.11: Comparison between TVC and TMS daily traffic data on TP2 km164 Mahuvan 22

Figure 3.12: Comparison between vehicle shares from TVC and TMS WADTs 23

Figure 3.13: Zonal influence, km46 Prithila 25
Figure 3.14: Zonal influence, km74 Srinagar 26
Figure 3.15: Zonal influence, km94 Kotwan 26
Figure 3.16: Zonal influence, km164 Mahuvan 27
Figure 3.17: Internal-external distribution, km46 Prithila 27
Figure 3.18: Internal-external distribution, km74 Srinagar 28
Figure 3.19: Internal-external distribution, km94 Kotwan 28
Figure 3.20: Internal-external distribution, km164 Mahuvan 29
Figure 3.21: Commodity distribution, km46 Prithila (Total) 30
Figure 3.22: Commodity distribution, km46 Prithila (towards Palwal) 31
Figure 3.23: Commodity distribution, km46 Prithila (towards Ballabhgah) 31
Figure 3.24: Commodity distribution, km74 Srinagar (Total) 32
Figure 3.25: Commodity distribution, km74 Srinagar (towards Hodal) 32
Figure 3.26: Commodity distribution, km74 Srinagar (towards Faridabad) 33
Figure 3.27: Commodity distribution, km94 Kotwan (Total) 33
Figure 3.28: Commodity distribution, km94 Kotwan (towards Hodal) 34
Figure 3.29: Commodity distribution, km94 Kotwan (towards Mathura) 34
Figure 3.30: Commodity distribution, km164 Mahuvan (Total) 35
Figure 3.31: Commodity distribution, km164 Mahuvan (towards Khurja) 35
Figure 3.32: Commodity distribution, km164 Mahuvan (towards Aligarh) 36
Figure 3.33: Trip length distribution, km46 Prithila 37
Figure 3.34: Trip length distribution, km74 Srinagar 37
Figure 3.35: Trip length distribution, km94 Kotwan 38
Figure 3.36: Trip length distribution, km164 Mahuvan 38
Figure 4.1: Evolution of Delhi's and Uttar Pradesh's state GDP and national GDP 41
Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP 42
Figure 4.3: Sectoral contribution to Delhi's GSDP 43
Figure 5.1: Relationship between CJV traffic and Uttar Pradesh/Delhi GSDP 47
Figure 5.2: Relationship between LCV+2A/Bus combined traffic and Uttar Pradesh/Delhi GSDP 48
Figure 5.3: Relationship between 3A+MAV combined traffic and India's GDP 49
Figure 5.4: GDP-GSDP forecast 52
Figure 6.1: Alternate routes and Asset route shown against the regional network context 57

Figure 6.2: Toll costs (INR) of Delhi long-distance CJV traffic for Asset vs expressway route.... 63

Figure 6.3: Toll costs (INR) of North-of-Delhi long-distance CJV traffic for Asset vs expressway route 64

Figure 6.4: Toll costs (INR) of Delhi long-distance MAV traffic for Asset vs expressway route . 64

Figure 6.5: Toll costs (INR) of North-of-Delhi long-distance MAV traffic for Asset vs expressway route 65

Figure 6.6: Traffic and growth rates for forecast PCUs - Background and final, km74 Srinagar 75

Figure 6.7: Traffic and growth rates for forecast PCUs - Background and final, km164 Mahuvan 75

Figure 6.8: Traffic and growth rates for forecast PCUs - Background and final, km46 Prithila.. 76

Figure 6.9: Traffic and growth rates for forecast PCUs - Background and final, km94 Kotwan . 76

Figure 6.10: Traffic and growth rates for forecast PCUs - Background and final, km164 (new) 77

Tables

Table 2-1: Summary of concession 8

Table 2-2: Vehicle wise toll rates (INR), FY22 8

Table 2.3: PCU factors..... 11

Table 3-1: Historical evolution in AADT by vehicle class at TP1 KM74 13

Table 3-2: Typical ticket types sold at NHAI plazas 17

Table 3-3: Timeline of national ETC implementation 18

Table 3-4: Data collection schedule..... 20

Table 3-5: Sample rates for OD data 24

Table 3-6: Zone aggregations for zonal influence analysis 24

Table 3-7: Aggregate commodity categories..... 29

Table 4-1: CAGR of population in India 40

Table 4-2: Population Growth in India (2001 – 2011) 41

Table 5-1: Vehicle-wise growth and CAGR (%), km74 Srinagar 45

Table 5-2: Vehicle-wise growth and CAGR (%), km164 Mahuvan 46

Table 5-3: Identified growth drivers to model traffic growth 46

Table 5-4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 50

Table 6-1: Key intermediate and final outputs in the forecast..... 53

Table 6-2: Seasonality correction factors for TP1 Km74 Srinagar 54

Table 6-3: Seasonality correction factors for TP2 Km164 Mahuvan 54
Table 6-4: Monthly MADT and Adopted AADT for FY22 – TP1 Srinagar 55
Table 6-5: Monthly MADT and Adopted AADT for FY22 – TP2 Mahuvan 55
Table 6-6: Estimation factors and FY22 AADT at Km46 and Km94 56
Table 6-7: Assumptions for share (%) of exemptions and violations on Asset TPs 56
Table 6-8: List of network/other developments 58
Table 6-9: Impacts due to continued diversion from NH48-SH31 59
Table 6-10: Impacts due to construction-related movement for Jewar Airport and Metro 59
Table 6-11: Combined impact due to completion of Delhi-Mumbai Expressway for Indore and Mumbai/South India region markets 60
Table 6-12: Impact due to upgrade of Palwal-Tappal-Aligarh 61
Table 6-13: Combined impact due to completion of Ganga Expressway for Delhi/west and Northwest of Delhi region markets 62
Table 6-14: Summary of impact assessments 65
Table 6-15: WPI growth forecast assumptions 66
Table 6-16: Toll estimation overview 67
Table 6-17: Toll segmentation for the base year of long-term forecasts FY22 TP1, Km74 67
Table 6-18: Toll segmentation for the base year of long-term forecasts FY22 TP2, Km164 67
Table 6-19: Final traffic forecast, km46 Prithila 68
Table 6-20: Background traffic growth rates (%), km46 Prithila 68
Table 6-21: Final revenue forecast (INR crores), km46 Prithila 69
Table 6-22: Revenue growth rates (%), km46 Prithila 69
Table 6-23: Final traffic forecast, km94 Kotwan 69
Table 6-24: Background traffic growth rates (%), km94 Kotwan 70
Table 6-25: Final revenue forecast (INR crores), km94 Kotwan 70
Table 6-26: Revenue growth rates (%), km94 Kotwan 71
Table 6-27: Final traffic forecast, km164 Mahuvan (new) 71
Table 6-28: Background traffic growth rates (%), km164 Mahuvan (new) 71
Table 6-29: Final revenue forecast (INR crores), km164 Mahuvan (new) 72
Table 6-30: Revenue growth rates (%), km164 Mahuvan (new) 72
Table 6-31: Final traffic forecast, km74 Srinagar 73
Table 6-32: Background traffic growth rates (%), km74 Srinagar 73
Table 6-33: Final traffic forecast, km164 Mahuvan 73

Table 6-34: Background traffic growth rates (%), km164 Mahuvan 74
Table 6.35: Summary of Macro Assumptions for upside and downside cases 77
Table 6.36: Summary of impacts on the Assets..... 78
Table 6.37: Summary of impacts on the Assets..... 79
Table 6.38: Traffic forecast (With Upside Impacts) for KM 74: Srinagar..... 79
Table 6.39: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 74: Srinagar 80
Table 6.40: Revenue forecast (With Upside Impacts) for KM 74: Srinagar (In Cr) 80
Table 6.41: Revenue growth (With Upside Impacts) CAGR (%) for KM 74: Srinagar 80
Table 6.42: Traffic forecast (With Upside Impacts) for KM 164: Mahuvan..... 81
Table 6.43: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 164: Mahuvan 81
Table 6.44: Revenue forecast (With Upside Impacts) for KM 164: Mahuvan (In Cr) 82
Table 6.45: Revenue growth (With Upside Impacts) CAGR (%) for KM 164: Mahuvan 82
Table 6.46: Traffic forecast (With Upside Impacts) for KM 46: Prithila..... 82
Table 6.47: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 46: Prithila 83
Table 6.48: Revenue forecast (With Upside Impacts) for KM 46: Prithila (In Cr)..... 83
Table 6.49: Revenue growth (With Upside Impacts) CAGR (%) for KM 46: Prithila 83
Table 6.50: Traffic forecast (With Upside Impacts) for KM 94: Kotwan..... 84
Table 6.51: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 94: Kotwan 84
Table 6.52: Revenue forecast (With Upside Impacts) for KM 94: Kotwan (In Cr) 84
Table 6.53: Revenue growth (With Upside Impacts) CAGR (%) for KM 94: Kotwan 85
Table 6.54: Traffic forecast (With Upside Impacts) for KM 164 85
Table 6.55: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 164..... 85
Table 6.56: Revenue forecast (With Upside Impacts) for KM 164 (In Cr)..... 86
Table 6.57: Revenue growth (With Upside Impacts) CAGR (%) for KM 164..... 86
Table 6.58: Traffic forecast (With Downside Impacts) for KM 74: Srinagar..... 87
Table 6.59: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 74: Srinagar 87
Table 6.60: Revenue forecast (With Downside Impacts) for KM 74: Srinagar (In Cr) 87
Table 6.61: Revenue growth (With Downside Impacts) CAGR (%) for KM 74: Srinagar..... 88
Table 6.62: Traffic forecast (With Downside Impacts) for KM 164: Mahuvan..... 88
Table 6.63: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 164: Mahuvan .. 88
Table 6.64: Revenue forecast (With Downside Impacts) for KM 164: Mahuvan (In Cr) 89
Table 6.65: Revenue growth (With Downside Impacts) CAGR (%) for KM 164: Mahuvan 89

Table 6.66: Traffic forecast (With Downside Impacts) for KM 46: Prithila 89
Table 6.67: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 46: Prithila 90
Table 6.68: Revenue forecast (With Downside Impacts) for KM 46: Prithila (In Cr) 90
Table 6.69: Revenue growth (With Downside Impacts) CAGR (%) for KM 46: Prithila 90
Table 6.70: Traffic forecast (With Downside Impacts) for KM 94: Kotwan 91
Table 6.71: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 94: Kotwan 91
Table 6.72: Revenue forecast (With Downside Impacts) for KM 94: Kotwan (In Cr) 92
Table 6.73: Revenue growth (With Downside Impacts) CAGR (%) for KM 94: Kotwan 92
Table 6.74: Traffic forecast (With Downside Impacts) for KM 164 92
Table 6.75: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 164 93
Table 6.76: Revenue forecast (With Downside Impacts) for KM 164 (In Cr) 93
Table 6.77: Revenue growth (With Downside Impacts) CAGR (%) for KM 164 93
Table 6-78: 7-day TVC counts at Km74 Srinagar 111
Table 6-79: 7-day TVC counts at Km46 111
Table 6-80: 7-day TVC counts at Km94 111
Table 6-81: Commodity distribution towards Hodal for Km74 Srinagar 114
Table 6-82: Commodity distribution towards Faridabad for Km74 Srinagar 114
Table 6-83: Commodity distribution towards Mathura for Km164 Mahuvan 114
Table 6-84: Commodity distribution towards Agra for Km164 Mahuvan 115
Table 6-85: Commodity distribution towards Palwal for Km46 Prithala 115
Table 6-86: Commodity distribution towards Ballabhgarh for Km46 Prithala 116
Table 6-87: Commodity distribution towards Hodal for Km94 Kotwan 116
Table 6-88: Commodity distribution towards Mathura for Km94 Kotwan 116
Table 6-89: Trip length distribution at Km74 Srinagar 117
Table 6-90: Trip length distribution at Km164 Mahuvan 117
Table 6-91: Trip length distribution at Km46 Prithala 117
Table 6-92: Trip length distribution at Km94 Kotwan 118

Appendices

A Detailed Forecasts

B Top OD Pair

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on Delhi Agra Tollway Limited (the "Asset").

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including - Background growth, - Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers - Zonal influence and top OD pairs - Commodity distribution - Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including - Toll segmentation and trip factors, - Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line based on forecasts provided by the client.

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these traffic and revenue forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from FY13 to FY22 (December 2012 to March 2022).
  - Concession agreement and toll notifications.
  - Previous studies.
- Steer-commissioned TVC counts from 20th to 26th March 2021
- Steer conducted OD surveys on behalf of the client in September 2019.
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client.
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each asset/plaza/toll class to forecast year-on-year traffic growth from FY21 to the end of each concession period.

- Investigating the elasticity of historic traffic growth compared to state (GSDP) and national (GDP) growth. Where historic data is limited, we have benchmarked the asset against our Steer knowledge base (e.g., similar asset types in the same state), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of toll, network, or other exogenous factors specific to the asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India on 24 March FY20, the Central government announced a nationwide 25-day lockdown which was extended for another three weeks until May 3rd. Further extensions until May 17th and again until May 31 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all highways in India was stopped between 25th March and 20th April for national highways. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued to a lesser extent due to a need to supply essential goods such as food, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

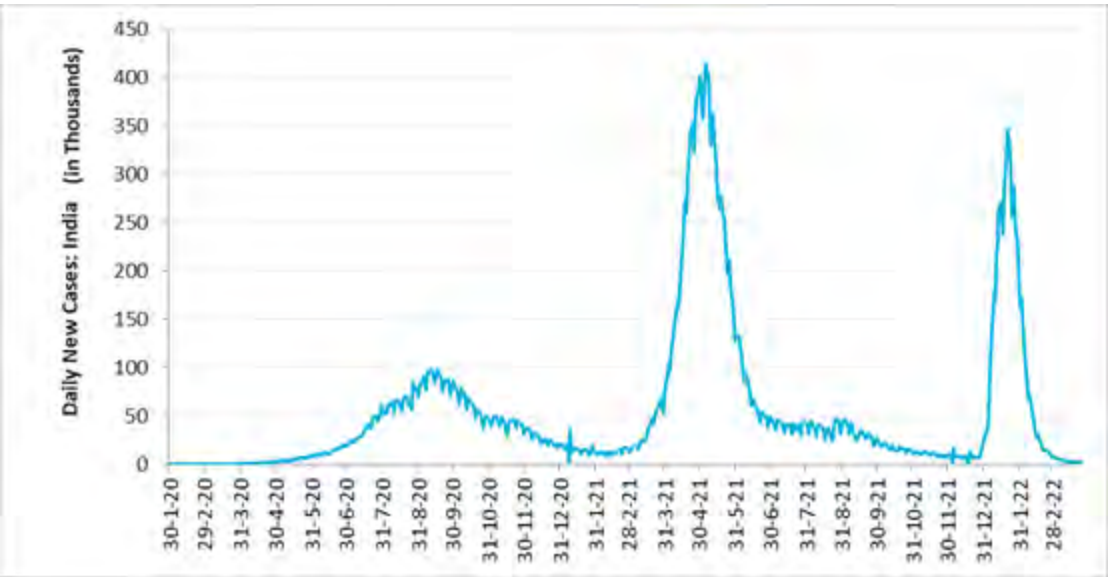
1.11 Data from various roads across the country indicates that the largest impact on traffic was experienced between the months of March 2020 and May 2020, with the rest of the months showing volumes surpassing FY20 levels for most months of FY21. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic

recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., are more stable and are driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to February 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as the first wave when the whole country went under strict lockdown for two quarters. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe on the health, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.16 Now that COVID-19 has an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network. This

shift is expected to sustain and continue in the short term as such perception shifts for longer periods of time could result in more permanent changes in passenger choices. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 summarises the growth analysis used to estimate elasticities for baseline growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

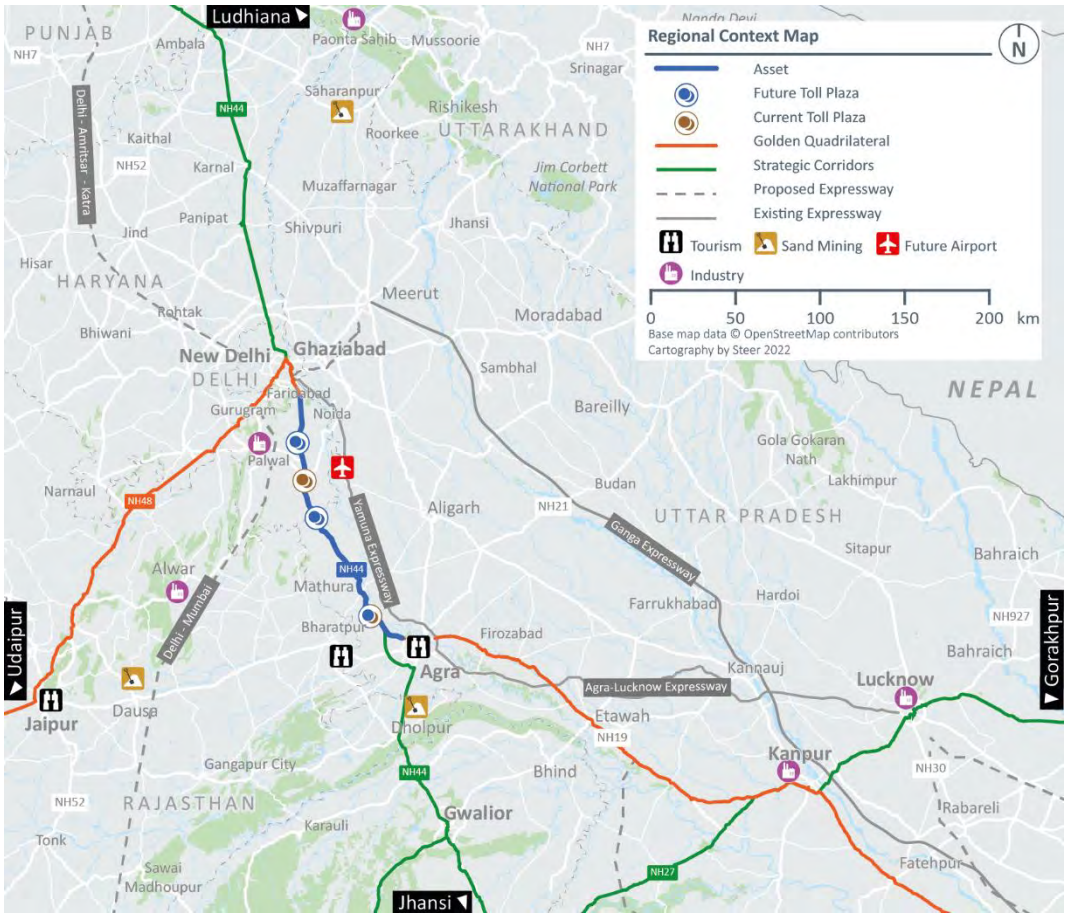
Introduction

2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the states of Delhi, Haryana and Uttar Pradesh, connecting the Central National Capital Region (NCR; comprising Delhi state) to Agra in the south, via Palwal and Mathura. The figure below shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



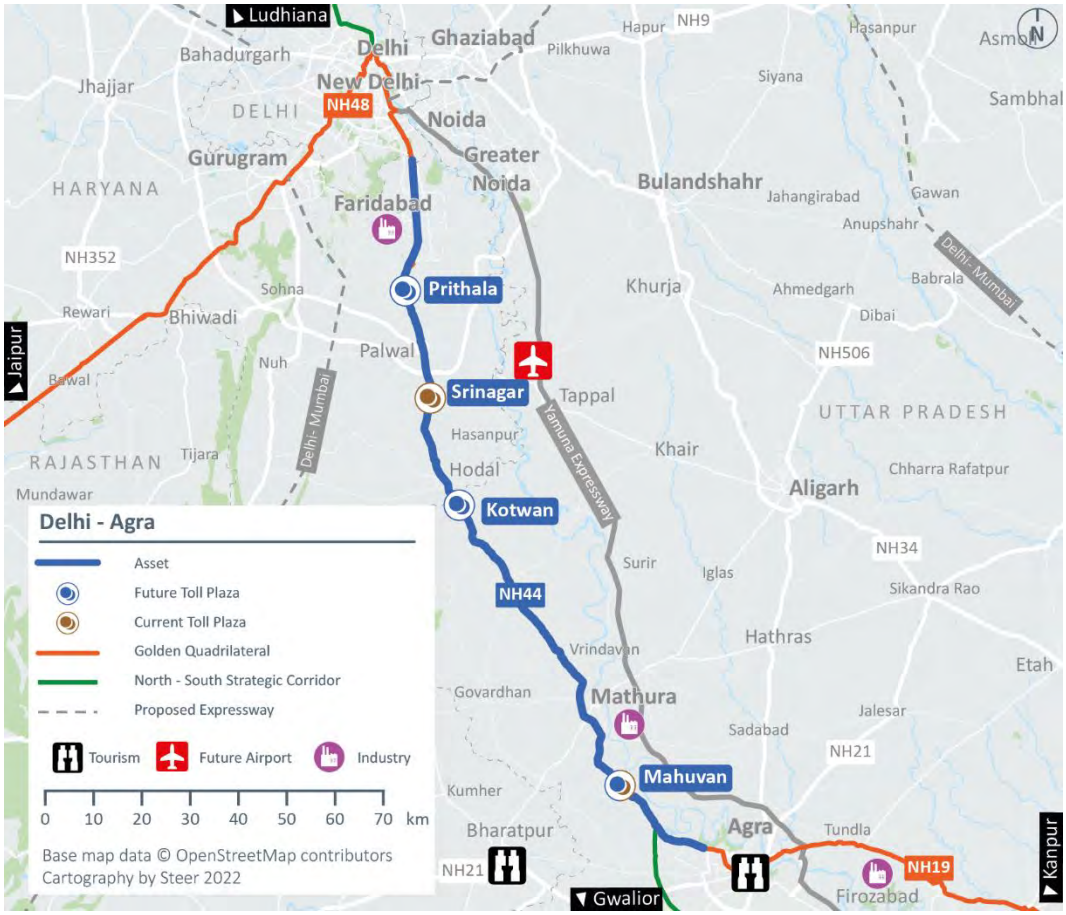
Source: Steer cartography using OpenStreetMap data

2.3 The Asset forms part of one of Asia's longest road corridors – the Grand Trunk Road – which is part of Asian Highway (AH) 1. It primarily caters to the following different types of movements, by virtue of its strategic location:

- **East-west long-distance movement** from Kashmir in North India to the India-Bangladesh border. This route originally connected Kabul in Afghanistan to Chittagong in Bangladesh.
- **North-south long-distance movement** connecting the Srinagar in Kashmir (northernmost state) to Kanyakumari in Tamil Nadu (southernmost state in mainland India).
- **Medium-distance movement** as part of being located one of the primary corridors connecting Delhi and Lucknow via Agra.
- **Short-distance inter-urban movement** between towns and cities in and around Delhi, Palwal, Mathura and Agra.

2.4 The Asset is a 179.5-km toll road which forms a part of the NH 19 (Old NH 2) in Delhi, Haryana and Uttar Pradesh. This is a four-lane road with two toll plazas operational as of FY21 - Srinagar (km74 closer to Delhi) and Mahuvan (km164 closer to Agra). Upon achieving full commercial operations date (COD) in May 2022, the toll plaza at km74 (Srinagar) would be split into two toll plazas Prithila (km46) and Kotwan (km94). The figure below provides a closer view of the Asset in context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer cartography

Concession and tolling

2.5 The toll plazas on the Asset have been operational since December 2012 and the Client is in the process of acquiring the Asset and taking over the operations. There are still 17 years left in the concession period with FY39 being the last year of concession. The following table presents a summary of the concession.

Table 2-1: Summary of concession

Particulars	Details
State	Delhi, Haryana, Uttar Pradesh
Highway and lane configuration	NH 19 four lane
Toll plazas	Existing/operational • km74, Srinagar • km164, Mahuvan Upcoming (May 2022 onwards) • km46, Prithala • km94, Kotwan • km164, Mahuvan
Length (km) as per concession agreement, applicable	• km74: 89.75 km • km164: 89.75 km Upcoming (May 2022 onwards) • km46: 47.28 km • km94: 63.22 km • km164: 69.00 km
Commencement of operations*	• km74: December 2012 • km164: December 2012
Operated by Client since	FY20
Concession period	26 years
Last year of concession	FY39

Source: Concession agreement

2.6 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2-2: Vehicle wise toll rates (INR), FY22

Type of Vehicle	Single Journey Fee (INR)	
	TP 1 km74 Srinagar	TP2 km164 Mahuvan
CJV	110	110
LCV	180	180
Bus/Truck	375	375
3A/MAV	590	590
HCM/EME/OSV	715	715

Source: NHAI Revision of User fee Rate w.e.f 01.04.2021

2.7 The following figures show a typical cross section on the Asset and its toll plazas.

Figure 2.3: Typical cross-section of the Asset, toll plaza and alternate road near Mathura connecting with Yamuna Expressway (bottom right)

Source: Steer site visits

Key economic activities

2.8 As mentioned earlier, the Asset connects the National Capital Territory (NCT) of Delhi at the north and the world-renown tourist city of Agra in the south. Therefore, the Asset sees a very high influx of all types of traffic including but not limited to:

- Daily commuters and tourists, in terms of passenger movement; and
- Industry supplies manufactured and agricultural products, with a considerable share of consumption-based commodities, in terms of goods movement.

Tourism

2.9 Several major tourist attractions exist on and around the Asset, with both Delhi and Agra being two of the three nodes part of the Golden Triangle – one of India's most popular tourist packages for international tourists. Delhi, Agra, Fatehpur Sikri and other towns in the region are home to several historical monuments and heritage sites, including the famed Taj Mahal (Agra). Religious tourism and pilgrimage sites include Surajkund, Badkhal Lake, Shivling at Hodal, Shani Dham Temple, ISKON temple (all in and around Central NCR), and Banke Bihari and other major temples of Mathura and Vrindavan.

2.10 The upcoming toll plaza at Palwal will serve a large share of local and regional commuter traffic given its location near Faridabad.

Industry

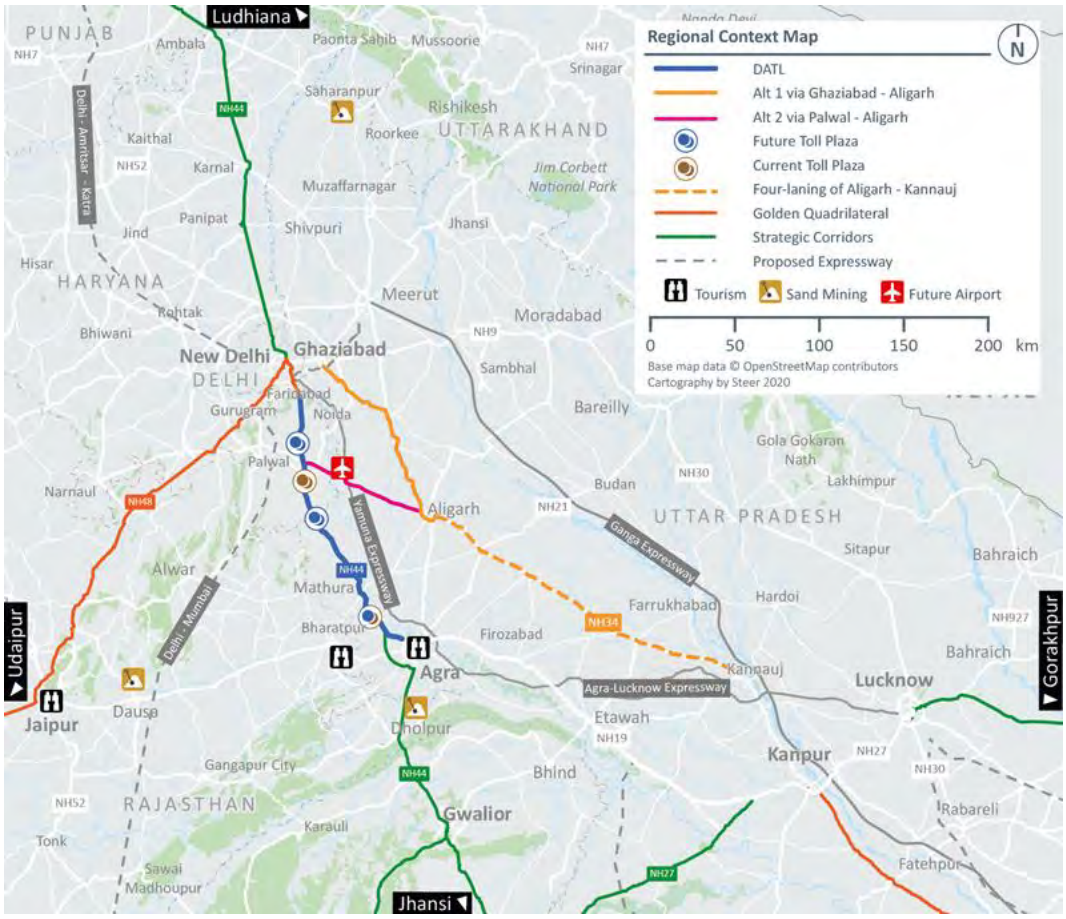
2.11 Major industrial and commercial centres are located at the northern end of the Asset located between Okhla, Badarpur, Saidabad, Faridabad, Ballabhgarh and Palwal, which are connected via the Delhi-Faridabad (DF) Skyway and the Asset. This includes India's largest inland port and container transhipment terminal at Badarpur called ICD Tughlakabad. At the southern end, the Agra-Lucknow is a traditionally industrial corridor with industries like leather and textile (Agra and Kanpur) and Faizabad (glassmaking).

2.12 At the southern end, the Agra-Lucknow corridor is a traditionally industrial one with industries like leather and textile located in Agra and Kanpur and glassmaking located in Faizabad. Mathura has an Indian Oil Corporation (IOCL) oil refinery with a capacity of 8.0 mmtpa[1].

2.13 As a result, the Asset has a distinct industrial character with a large share of traffic movements being good vehicles serving many of these industries.

Alternate routes

Figure.2.4: Alternate routes to the Asset



Source: Steer Cartography

2.14 This Asset lies on the strategically important east-west movement between Delhi and north-western India at one end, and Uttar Pradesh and eastern India at the other end. The figure

[1] https://iocl.com/AboutUs/MathuraRefinery.aspx, accessed on 15 April 2021

above illustrates other alternate routes available to users while travelling between Delhi and Lucknow. As shown in the map above, the alternate routes are:

- Asset route: Delhi – Faridabad - Agra (via NH 19) – Kanpur - Lucknow.
- Alternate 1 route: Delhi - Ghaziabad (via NH 34) – Aligarh – Kannauj - Lucknow.
- Alternate 2 route: Palwal – Tappal – Aligarh – Kannauj - Lucknow.
- Alternate 3 route: Delhi- Yamuna Expressway-Agra Lucknow Expressway-Lucknow

2.15 Yamuna Expressway, with higher toll costs, primarily caters to leisure and tourist car trips, apart from a smaller share of truck volumes. (Chapter 6 provides further detail on why the expressway does not pose a diversion threat to the Asset.) There are also several state highways which have been upgraded, thereby improving the overall quality of local network and as a result, providing cheaper alternatives to road users.

2.16 The Asset is also located on the strategically key north-south corridor that connects some of the northernmost and southern parts of the country. As shown in the figure above, there is one major alternative to the Asset for traffic with one trip end in South India (Bengaluru):

- Asset route: Delhi – Faridabad – Agra (via NH 19) – Gwalior – Hyderabad/Solapur
- Alternate route (NH 48): Delhi – Jaipur – Chittorgarh – Aurangabad -Solapur

2.17 Under the 'Analysis of potential impacts' section in Chapter 6, we have discussed potential impacts on traffic due to upgrades on the east-west corridor. However, there is no brownfield development in the north-south corridor that may have an impact on the Asset. There is an upcoming expressway between Delhi and Mumbai that is expected to compete with long-distance north-south traffic on the Asset. This has again been discussed in Chapter 6.

PCU factors considered for reporting

2.18 Please refer the PCU factors considered in the below table as per IRC64 1990. Based on the discussion with client, for reporting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5 as defined in IRC64 1990.

Table 2.3: PCU factors

Vehicle category	PCU Factor
CJV	1.0
Mini LCV	1.5
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.3
OSV	4.5

Source: Steer analysis and IRC64,1990

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trends

3.4 The following tables indicate the historical variation in traffic volume at the toll plaza, in terms of vehicle shares and total AADT. The traffic data was available for the period of December 2012 to March 2022.

3.5 As can be seen in the figures and tables below, the Asset saw almost no growth from FY13 to FY17, with a significant increase in traffic thereafter. We believe that is attributed to a combination of network and regulatory changes, namely:

- Opening of EPE and KMP in FY19 has provided access to long distance through traffic to NH3. Further the Kalindi Kunj bridge has also opened for use.
- The corridor of NH3 is complete (early FY20) thereby acting as an alternate for NH8 for the long-distance movement between Delhi and Mumbai.
- The completion of the NH7/44 corridor has also contributed to the traffic that is destined to Nagpur, Bangalore and south using the Asset.
- Construction completion (expansion from 4 to 6 lanes) to the tune of 95% on the Asset has resulted in improved level of service for the Asset – this was previously resulting in supressed/no growth in the earlier years of this Asset's traffic history.
- Implementation of BSVI emission norms by the Supreme Court which meant all BSIII category vehicles had to be sold by 31st March 2017, this meant a rapid pick up of activity in FY18. A similar BSVI implementation will be commissioned in FY21.
- Stricter implementation of the overloading restrictions by the UP-state government since April 2017.

3.6 The Asset observes caters to both passenger traffic and goods vehicles as it connects two major regions, NCT of Delhi and Agra, in addition to being a long-distance connector between

the northern regions of Delhi, Punjab, Haryana and rest of the country. Therefore, the Asset carries a healthy mix of both passenger and truck volumes. CJVs' contribution to the total traffic volume is higher than other vehicles since there are major religious worship places located in Mathura, Vrindavan and Taj Mahal in Agra which witness both domestic and international tourist. Additionally, presence of leather, textile industry and Indian Oil refinery of Mathura contribute to the MAVs on the Asset. The below table presents the evolution of historical traffic on KM74.

Table 3-1: Historical evolution in AADT by vehicle class at TP1 KM74

Class	FY13*	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	6,962	6,665	6,650	7,012	7,295	8,324	9,935	10,150	10,393	16,253
LCV	1,169	1,175	1,124	1,120	1,192	1,062	1,195	1,179	982	1,259
2A	1,337	1,349	1,269	1,163	1,273	1,625	1,913	2,118	2,079	2,763
MAV	1,491	1,540	1,729	1,854	2,196	2,595	3,110	3,591	3,484	4,671
Total	**10,959**	**10,729**	**10,772**	**11,150**	**11,955**	**13,606**	**16,153**	**17,038**	**16,938**	**24,945**
PCU	**17,694**	**17,604**	**17,905**	**18,359**	**20,215**	**23,437**	**27,827**	**30,235**	**29,710**	**41,991**

Source: Steer analysis of the Client data (FY13 includes December 2012 to March 2013, MAV includes 3A, and Bus includes 2A, FY21 data includes the operational days of April 2020)

3.7 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Class	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR (FY13-20)	CAGR (FY16-20)	CAGR (FY20-22)
CJV	5.5%	4.0%	14.1%	19.4%	2.2%	2.4%	56.4%	5.5%	9.7%	26.5%
LCV	(0.3%)	6.4%	(10.9%)	12.5%	(1.4%)	(16.7%)	28.1%	0.1%	1.3%	3.3%
2A	(8.4%)	9.4%	27.7%	17.7%	10.7%	(1.8%)	32.9%	6.8%	16.2%	14.2%
MAV	7.2%	18.4%	18.2%	19.8%	15.5%	(3.0%)	34.1%	13.4%	18.0%	14.1%
Total	**3.5%**	**7.2%**	**13.8%**	**18.7%**	**5.5%**	**(0.6%)**	**47.3%**	**6.5%**	**11.2%**	**21.0%**
PCU	**2.5%**	**10.1%**	**15.9%**	**18.7%**	**8.7%**	**(1.7%)**	**41.3%**	**8.0%**	**13.3%**	**17.8%**

3.8 The reporting of CJV's have significantly improved post implementation of FASTag at the end of FY21, hence there is a visible jump in CJV volumes observed in FY22. Overall, the Asset has outperformed in historical growth upto FY22 registering a 10%+ PCU CAGR since FY18, primarily due to several network completions and growth of cities such as Delhi, Agra among other reasons.

3.9 As discussed previously for TP1, a similar traffic trend is observed on TP2. The CJVs have shown a healthy growth with contribution of CJVs in total AADT increasing from 49% in FY13 to 51% in FY22. Additionally, post FASTag implementation the reporting of vehicles has improved which has positively affected the CJV traffic share on the toll plaza, as Mini LCV are now being correctly recorded in CJV. The MAVs contribution has also increased from 22% in FY13 to 27% in FY22.

Table 3.2: Historical evolution in AADT by vehicle class at TP2 KM164

Class	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	5,938	5,832	5,805	6,275	6,182	6,942	7,451	7,736	9,813	11,156

Class	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
LCV	1,583	1,622	1,575	1,593	1,567	1,527	1,505	1,348	1,080	1,294
2A	1,944	1,961	1,858	1,741	1,738	2,238	2,595	2,913	2,744	3,551
MAV	2,648	3,041	3,134	3,292	3,294	3,867	4,463	4,926	4,646	5,922
Total	**12,113**	**12,457**	**12,373**	**12,902**	**12,781**	**14,574**	**16,014**	**16,924**	**18,282**	**21,922**
PCU	**22,966**	**24,281**	**24,185**	**24,857**	**24,719**	**28,828**	**32,362**	**34,911**	**35,141**	**43,477**

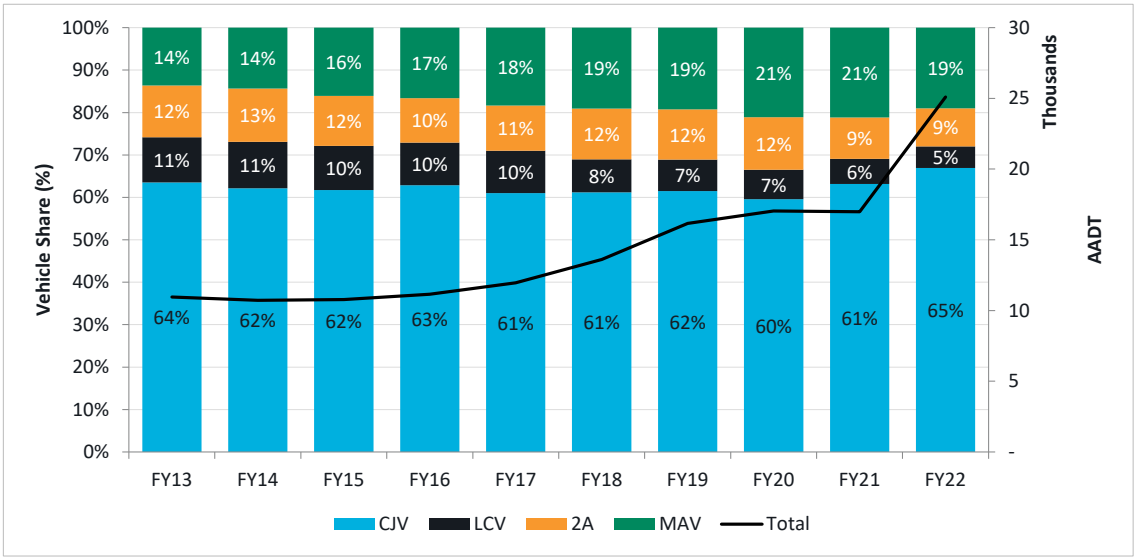
Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days of April 2020)

3.10 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Class	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR (FY13-20)	CAGR (FY16-20)	CAGR (FY20-22)
CJV	8.1%	(1.5%)	12.3%	7.3%	3.9%	27.1%	13.4%	3.9%	5.4%	20.0%
LCV	1.1%	(1.7%)	(2.5%)	(1.4%)	(10.3%)	(19.8%)	19.4%	(2.2%)	(4.1%)	(2.1%)
2A	(6.3%)	(0.2%)	28.8%	16.0%	12.3%	(22.8%)	29.4%	6.0%	13.8%	(0.1%)
MAV	5.1%	0.0%	17.4%	15.4%	10.4%	(5.5%)	27.1%	9.3%	10.6%	9.6%
Total	**4.3%**	**(0.9%)**	**14.0%**	**9.9%**	**5.7%**	**5.3%**	**19.3%**	**4.9%**	**7.0%**	**13.8%**
PCU	**3.1%**	**(0.4%)**	**17.3%**	**13.0%**	**8.6%**	**(3.4%)**	**23.8%**	**6.2%**	**8.9%**	**11.6%**

3.11 The figure below presents the vehicle shares as they have evolved from FY13 upto FY22 for TP1.

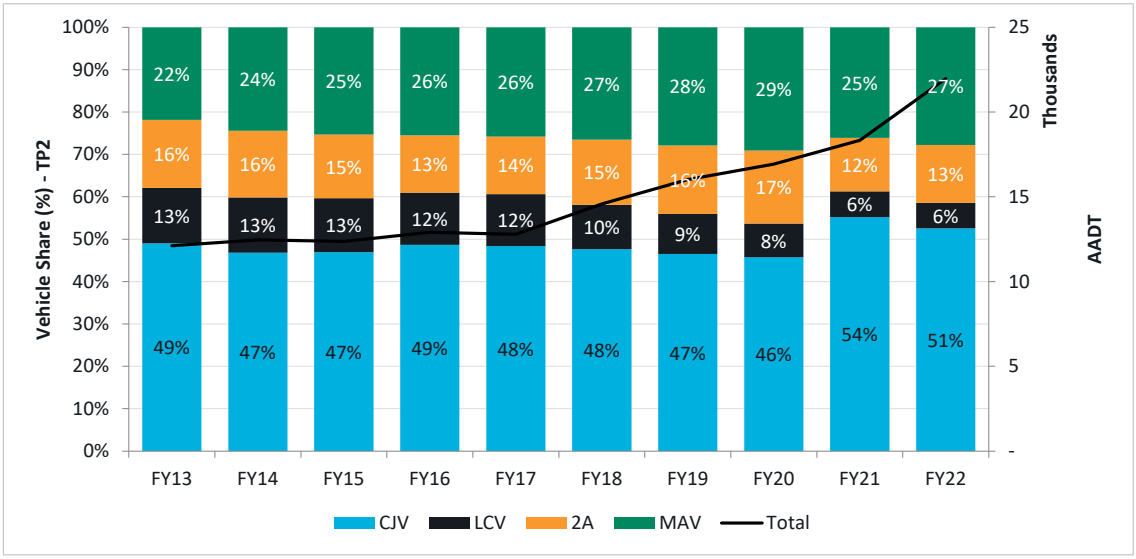
Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- KM74



Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days of April 2020)

3.12 The figure below presents the vehicle shares as they have evolved from FY13 upto FY22 for TP2.

Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2- KM164



Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days of April 2020)

3.13 The table below presents the reported revenue (INR, Cr) of the Asset for FY22.

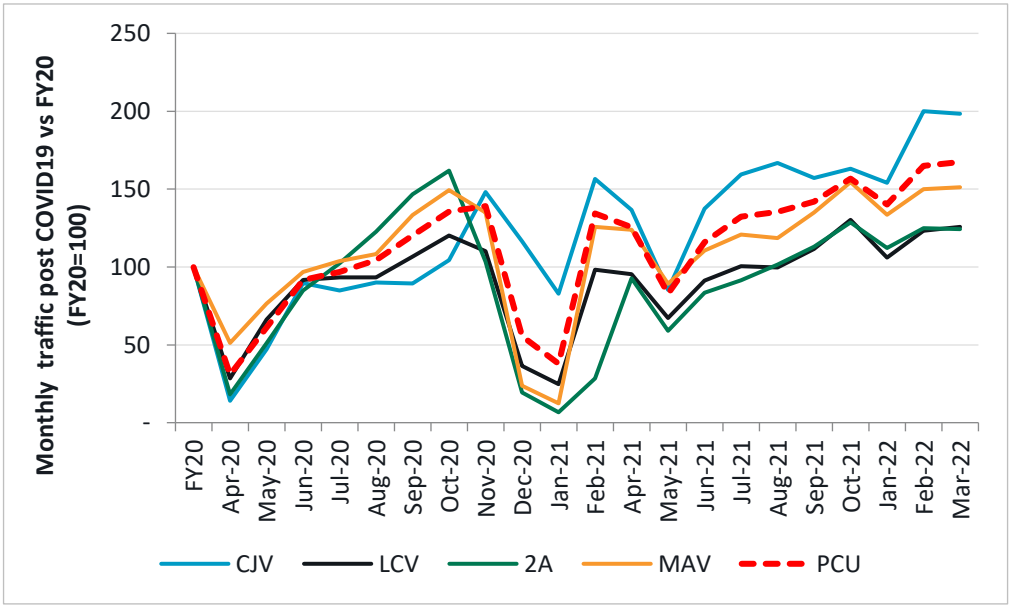
	FY17	FY18	FY19	FY20	FY21	FY22	CAGR (FY17-20)	CAGR (FY20-22)
Annual Revenue (INR Cr)	171.3	217.2	264.9	301.7	297.9	393.8	21%	14%

Source: Steer analysis of the Client data

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

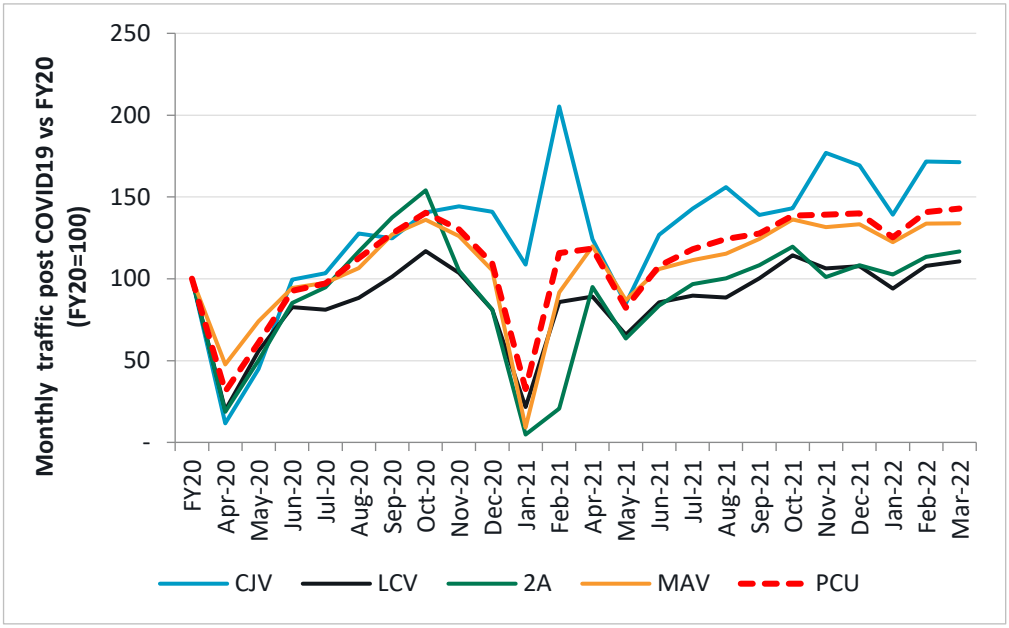
3.14 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. 2nd wave of COVID-19 resulted in regional lockdowns in Q1 and Q2 FY22, while the 3rd wave of COVID-19 impacted traffic volumes in Q4 of FY22. The evolution of traffic FY20 onwards is presented below:

Figure 3.3: Traffic evolution of KM74



Source: Steer analysis of the Client data

Figure 3.1: Traffic evolution of KM164



Source: Steer analysis of the Client data

3.15 As we can see from the figure above, by end of Q4FY21 the Asset reached the FY20 PCU levels, with the full FY21 being impacted by COVID-19 related restrictions. The impact of 2nd wave of COVID-19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to goods traffic.

3.16 In December 2020 we can the dip in traffic volumes which can be attributed to the Farmer's protest and the resultant closure of several roads.

Toll Frequencies

3.17 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.18 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this varies from asset to asset or even toll plaza to toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.19 The following are the types of tickets being sold at the plazas of the Asset.

Table 3-2: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Daily pass for crossing the toll plaza multiple times within 24 hours. Charged 1.5 times the single toll
Monthly	Discounted entry ticket for users who undertake multiple trips within a month can buy the monthly pass.
Local Personal	Discounted monthly pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.20 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation

FASTag implementation

3.21 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via “FASTag”. The timeline of ETC implementation is presented in the following table.

Table 3-3: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.22 The increased use of FASTag in FY20-21 ensured efficient tolling operations as well as increased compliance. By March 2022, FASTag penetration increased significantly across various vehicle types. The table below presents the reported percentage of traffic via FASTag.

Figure 3.4: Percentage of Traffic via FastTag, Mar 2022

Toll Plaza	CJV	LCV	2A	Bus	MAV
TP1 KM74	95%	97%	100%	99%	100%
TP2 KM164	96%	98%	100%	99%	100%

Source: Steer Analysis

3.23 As can be seen in the following figure, in FY22 the share of single tickets was 35% for CJVs, with the remainder made up of 41% return, 13% local personal and 11% violation and exemptions. A higher share of return trips is reasonable as more commuter trips take place near large urban centres. For MAV vehicle type, the single ticket type share has decreased by around 6% from FY20 to FY22 and as a result the return ticket type share has increased by 7%.

Figure 3.5: : Ticket-segmentation for CJV at TP1 (KM74)

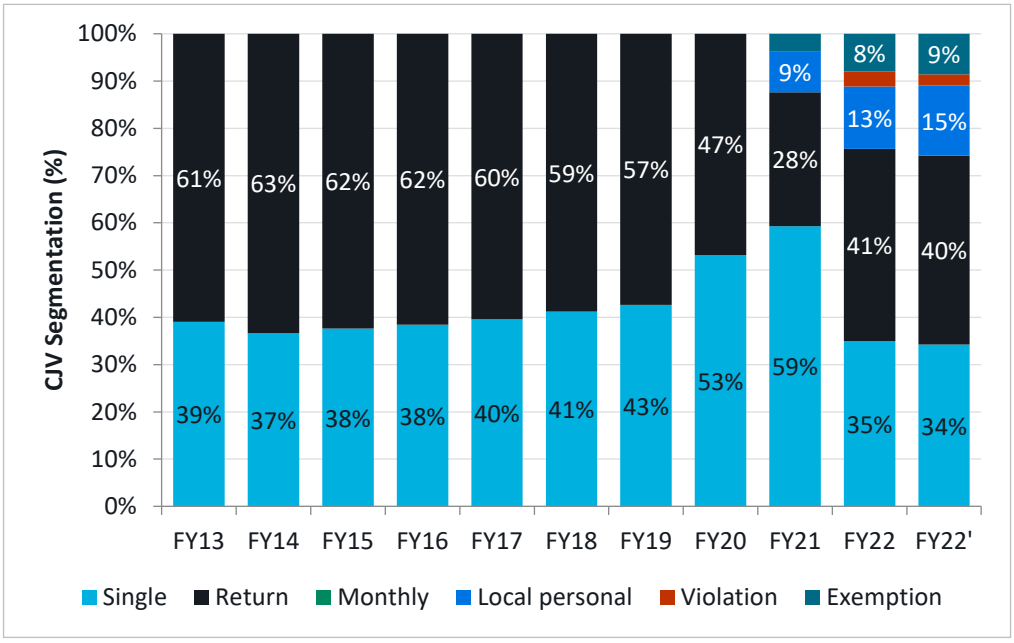
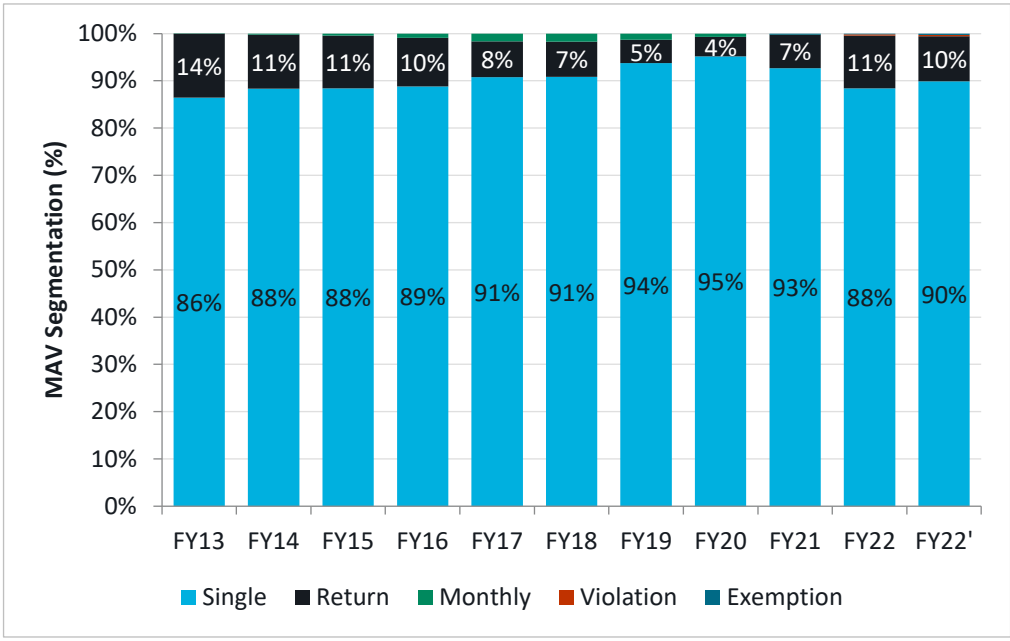


Figure 3.6: Ticket-segmentation for MAV at TP1 (KM74)



Source: Steer analysis of the Client TMS data

3.24 Similarly, on TP2, the major ticket type sold to CJVs was single ticket type in FY21 and in FY22 it is return ticket. A decline of around 20% was observed in single ticket share and an increase of around 20% in return ticket was observed. This change can be attributed to increasing adoption of FASTag and travel patterns returning to FY19 levels.

3.25 For MAVs, we observe the same trend s CJVs. The increase in return ticket by 4% is equal to the 4% decline in single ticket share from FY21 to FY22.

Figure 3.7: Ticket-segmentation for CJV at TP2 (KM164)

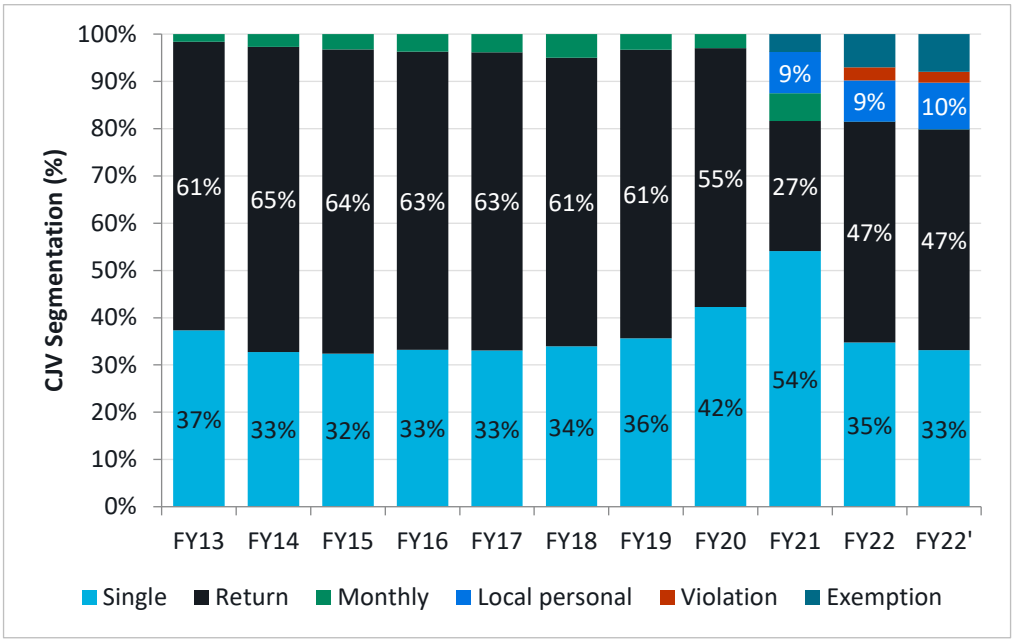
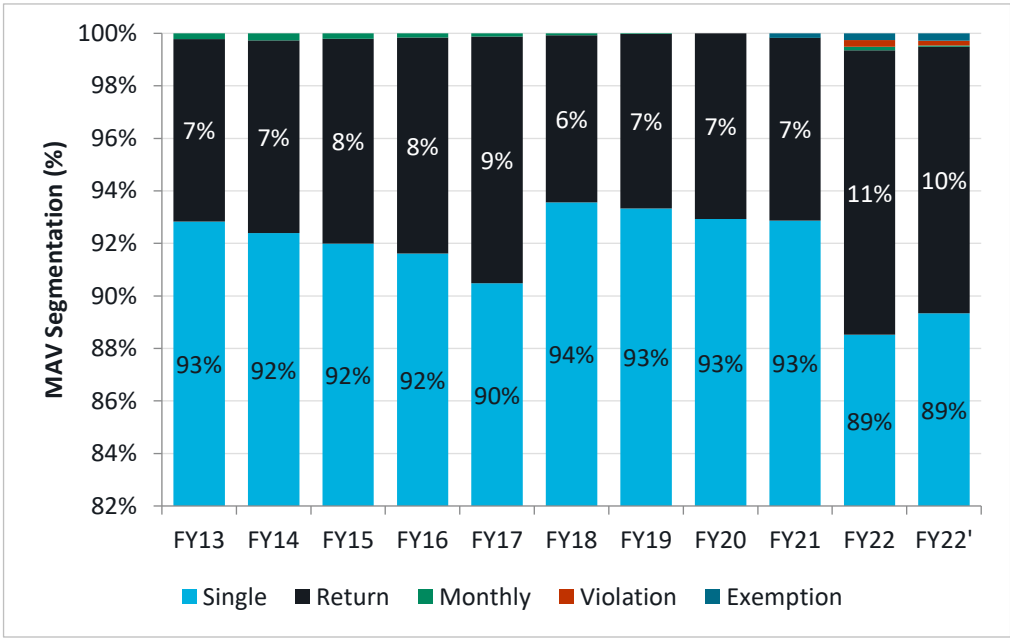


Figure 3.8: Ticket-segmentation for MAV at TP2 (KM164)



Data collection and validation

Overview

3.26 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3-4: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	State time
TP1 km74 Srinagar	05 Mar 2021	11 Mar 2021	0000-2359	05 Nov 2019	0900 hours
TP2 km164 Mahuvan	05 Mar 2021	11 Mar 2021	0000-2359	04 Nov 2019	0900 hours
Km46 Prithila	05 Mar 2021	11 Mar 2021	0000-2359	07 Nov 2019	0900 hours
Km94 Kotwan	05 Mar 2021	11 Mar 2021	0000-2359	06 Nov 2019	0900 hours

Source: Steer analysis

3.27 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

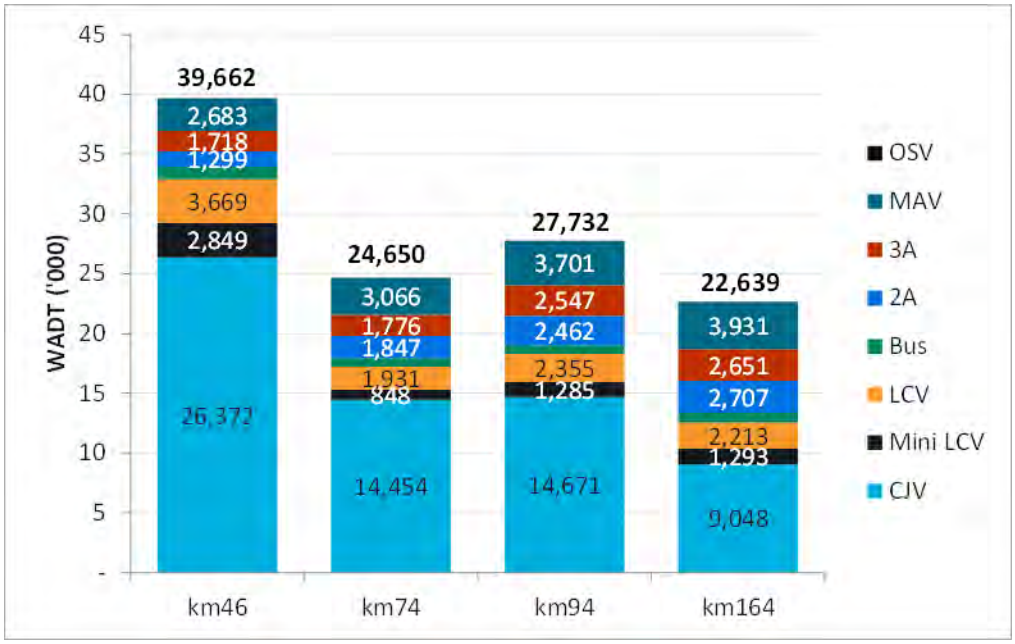
WADT estimates

3.28 Taking a simple average of the seven-day TVC count data provided by the Client, we obtained the weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicle, government vehicle and other vehicle types officially allowed as 'exempted' under the concession agreement.

3.29 The following figure shows the WADT by vehicle type at each of the toll plazas, including the upcoming two new toll plazas at km46 and km94. As seen in the Client TMS data, CJVs are the largest vehicle category – 26,372 at km46 and decreasing to 9,048 at Km164. This is followed by 3A/MAVs. In terms of passenger traffic, the very high number of CJVs at km46 is due to the urban nature of the toll plaza location in Faridabad.

3.30 In terms of goods traffic, we observe that the upcoming toll plaza location km94 shows similar traffic profile compared to the southernmost km164. Further, km74 shows differences to km94. This is due to the presence of the MDR-131 at Hodal that connects the Asset to the region west. This provides an alternate route for medium- to long-distance traffic to bypass km74. Therefore, the new toll plaza location km94 is expected to capture the traffic bypassing km74. Similarly, km46 is expected to capture local traffic movements in and around Faridabad that km74 wasn't earlier capturing.

Figure 3.9: WADT (km46, km 74, km94, km164)



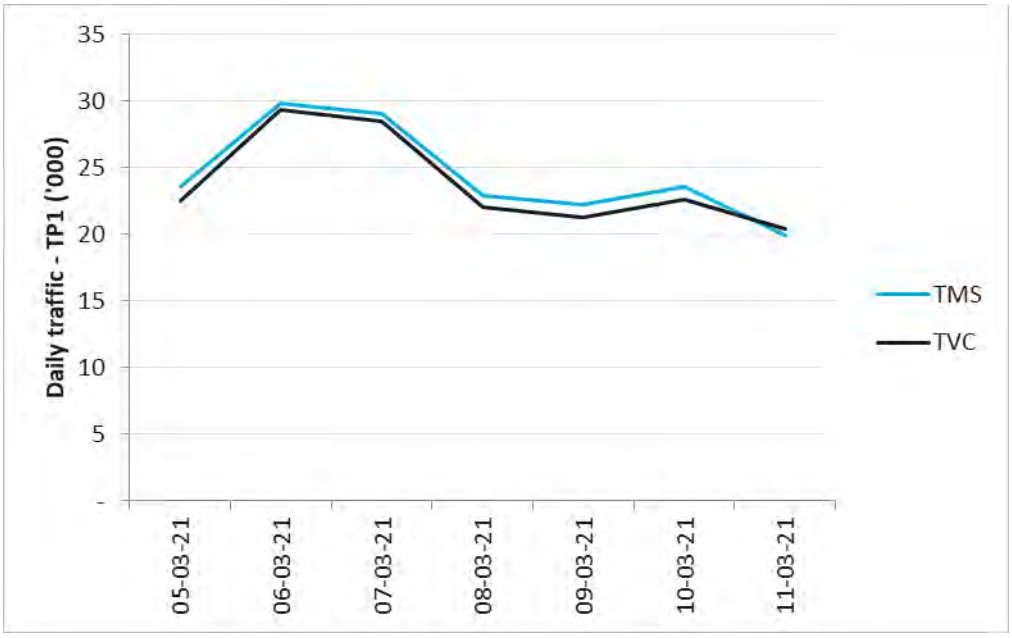
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.31 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those particular days, as provided by the Client.

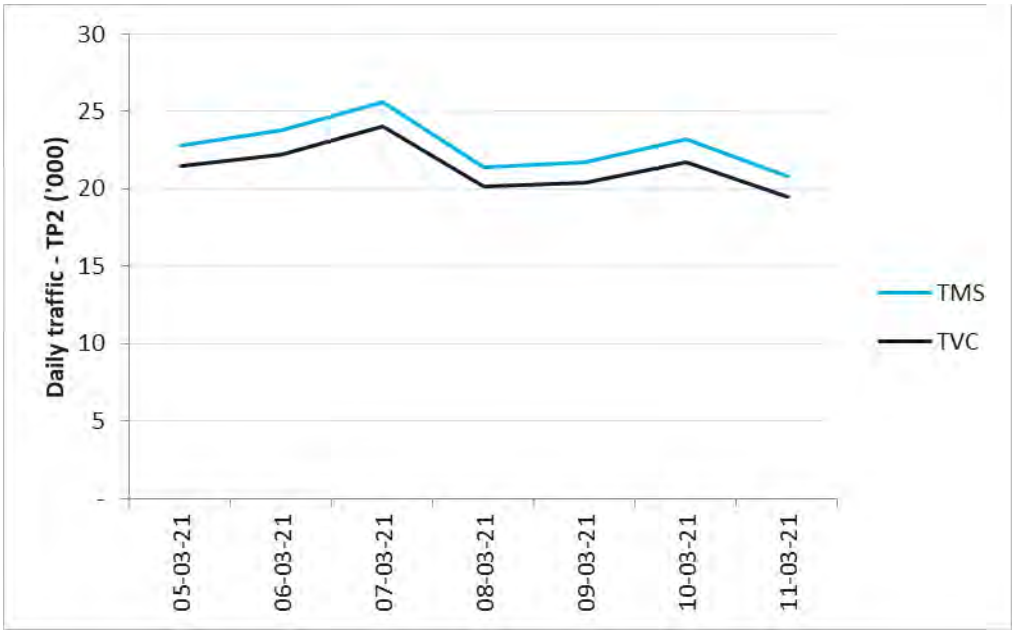
3.32 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas (TP1 km74 Srinagar, TP2 km164 Mahuvan).

Figure 3.10: Comparison between TVC and TMS daily traffic data on TP1 km74 Srinagar



Source: Steer analysis of TVC and Client TMS data

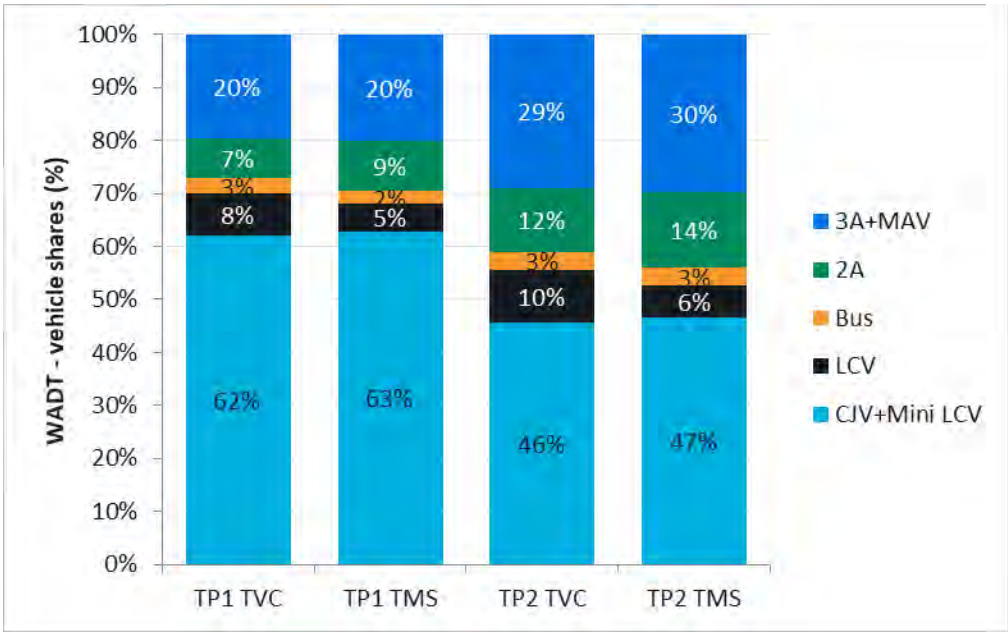
Figure 3.11: Comparison between TVC and TMS daily traffic data on TP2 km164 Mahuvan



Source: Steer analysis of TVC and Client TMS data

3.33 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. As can be seen, whilst the share of CJVs and 2As is higher for TMS as compared to TVC, it is vice-versa for other vehicle categories. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.12: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.34 Given the overall good fit of the data at a WADT level and minimal variation between the TVC and TMS data for the largest revenue generator (3A and MAV), we believe that the base year traffic calculated using the Client TMS data forms a robust base year traffic estimate. Please note that a separate exercise to estimate exemptions and violations at all four plazas has been presented in Chapter 6.

Key findings of origin-destination analysis

Overview

3.35 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in November 2020. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred in this period.

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.36 While zonal analysis and list of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.37 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TVC data) during the same time period.

The table below presents the sample rates for key vehicle type categories at both the toll plazas. We believe that the sample rates of the OD data are reasonable.

Table 3-5: Sample rates for OD data

Vehicle type	Km46 Prithila	km74 Srinagar	Km94 Kotwan	km164 Mahuvan
CJV	5.3%	31.8%	6.8%	5.3%
Bus + Mini-bus	54.1%	46.5%	30.7%	54.1%
LCV	42.9%	63.0%	29.3%	42.9%
2A	50.4%	70.6%	30.2%	50.4%
3A	26.4%	65.9%	36.9%	26.4%
MAV	33.9%	62.4%	45.3%	33.9%

Source: Steer analysis of OD data

Zone categories

3.38 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the following table. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3-6: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
Immediate area of influence (IAOI)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Uttar Pradesh	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Central NCR	Delhi, Gurgaon, Noida.
Rest of Haryana	Haryana
North India	Uttarakhand, Jammu & Kashmir, Himachal Pradesh
Madhya Pradesh	Madhya Pradesh
Rajasthan	Rajasthan
Punjab	Punjab
Uttarakhand	Uttarakhand
Gujarat	Gujarat
East and Northeast India	West Bengal, Orissa and Northeast Indian states
South India	Andhra Pradesh, Tamil Nadu, Karnataka, Kerala

Source: Steer analysis

Zonal influence

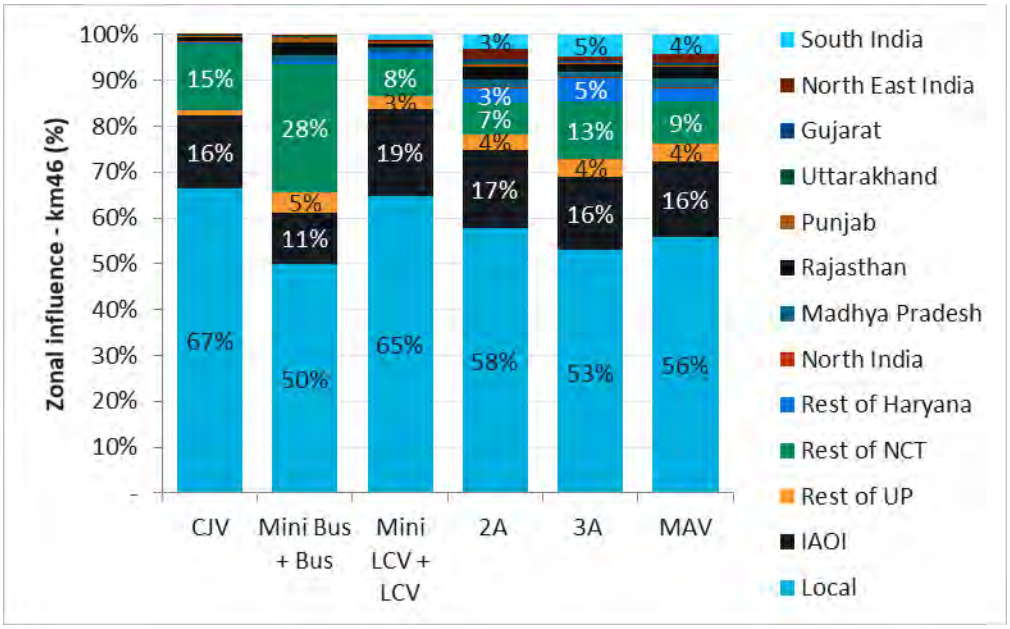
3.39 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[2] at each toll plaza of each Asset, aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed on trip ends and not trips.

3.40 The figures below present the zonal influence on various vehicle types at the toll plazas. We can see that 'local' trips make up the largest share for all vehicle types, decreasing from CJV and heavy trucks. Except at km164 where IAOI has a 48% influence on CJV trips, local has the largest zone influence (67% at km46, 61% at km74, 55% at km94).

3.41 For inter-urban corridors, only smaller vehicles see a higher share of local trips compared to trucks. However, since we see industrial zones located on the Asset itself, the influence of local zones is high for even heavy trucks like MAV, ranging from 14% at km164 to 56% at km46.

3.42 After local and IAOI zones (including the rest of Central NCR/NCT), we see that South India has the largest zonal influence at all toll plazas, except km46, for trucks. Since km46 is situated north of the Asset's junction with the peripheral expressways around Central NCR, this indicates that the Asset's strategic nature of carrying very long-distance traffic between the northernmost and southernmost parts of the country.

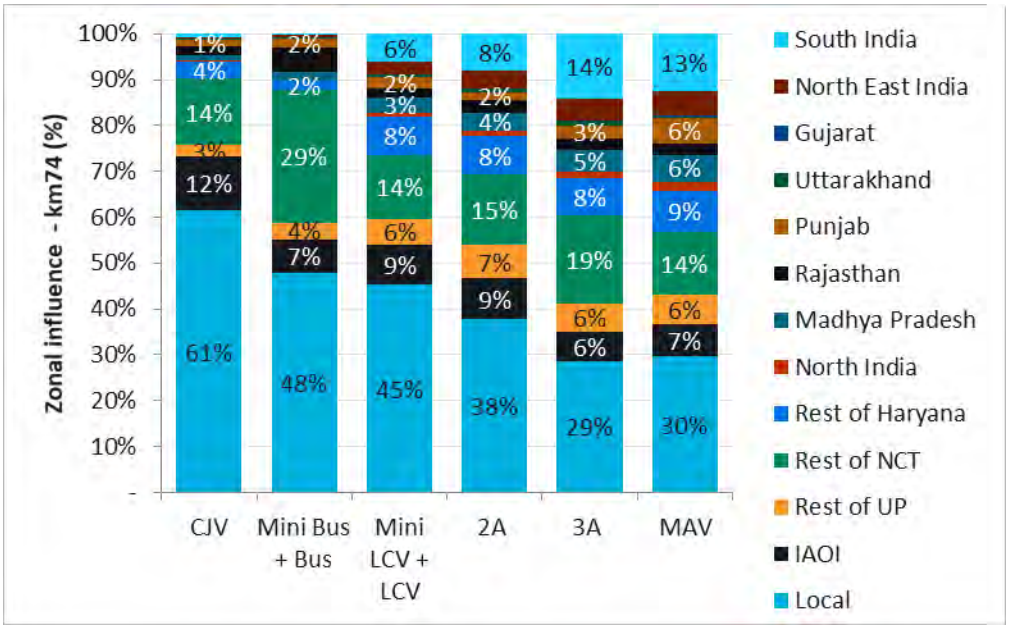
Figure 3.13: Zonal influence, km46 Prithila



Source: Steer analysis of OD data

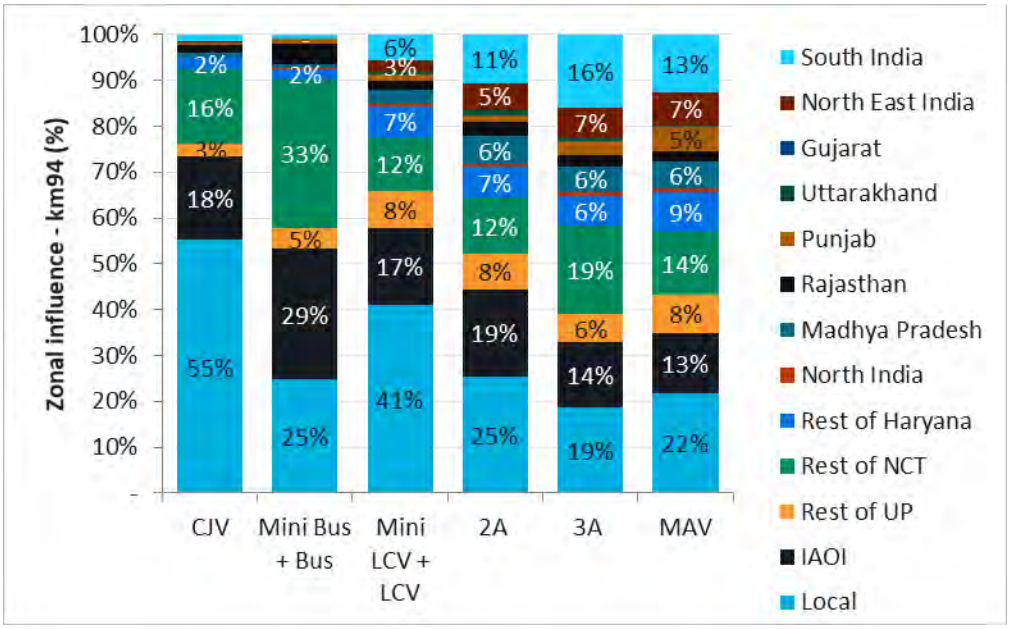
[2] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad is 50% since one trip end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.14: Zonal influence, km74 Srinagar



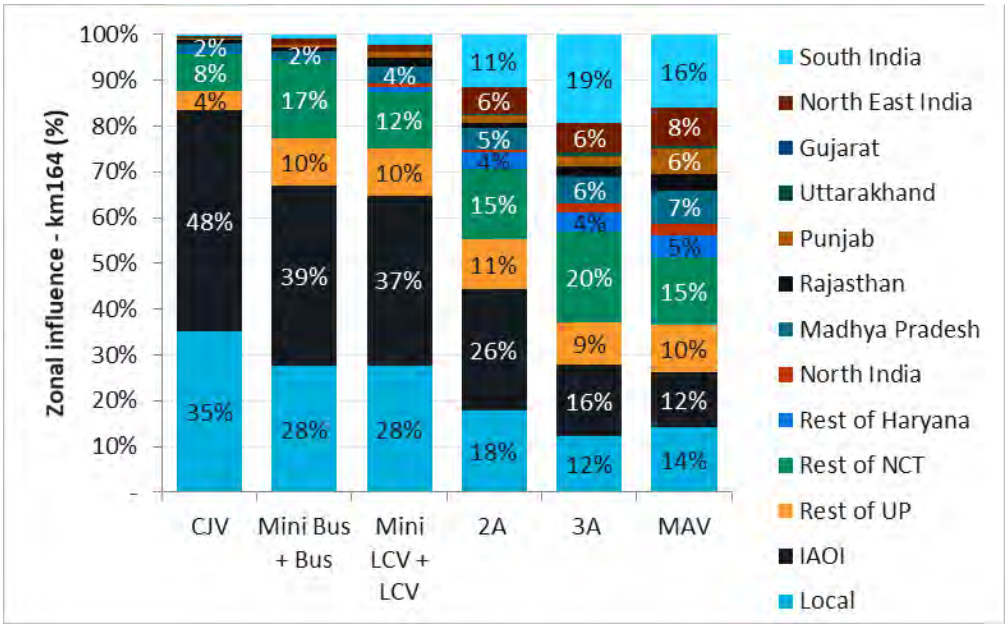
Source: Steer analysis of OD data

Figure 3.15: Zonal influence, km94 Kotwan



Source: Steer analysis of OD data

Figure 3.16: Zonal influence, km164 Mahuvan

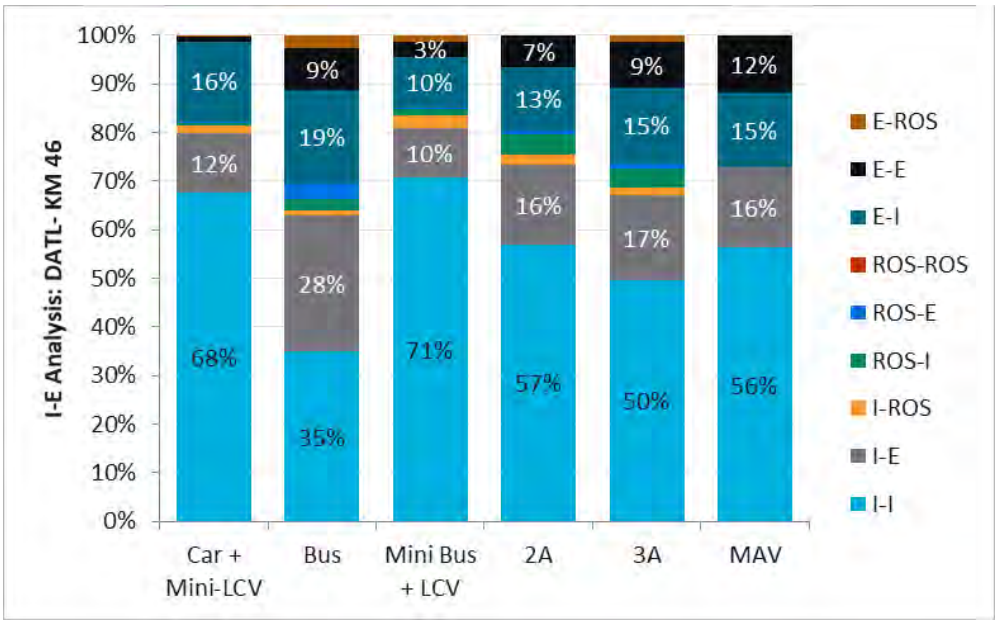


Source: Steer analysis of OD data

Internal External analysis

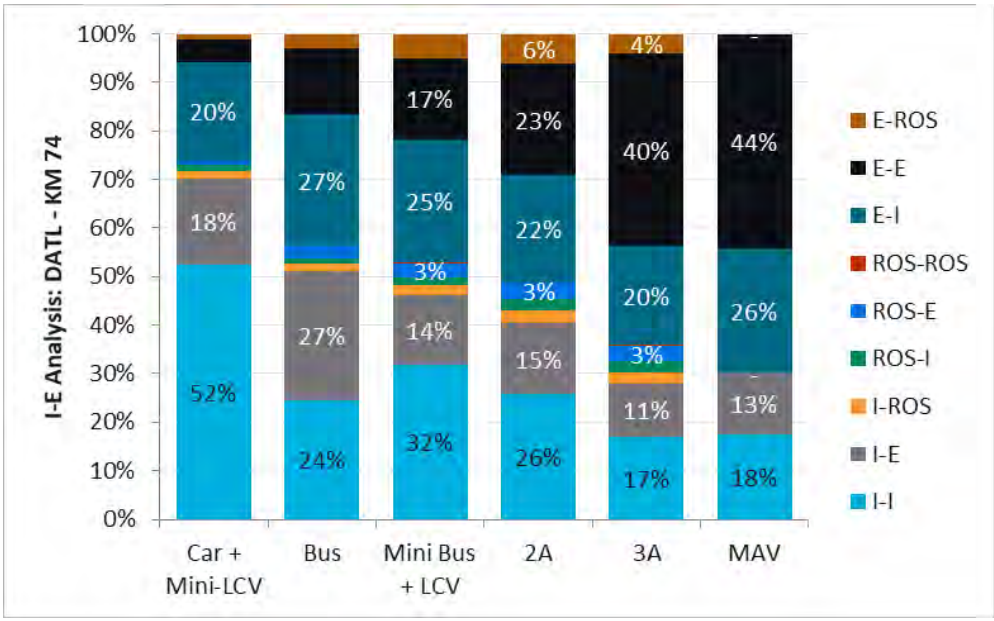
3.43 Internal-External analysis helps in identifying the trips which either have both the Origin and destination within the regions close to the Asset, any one end in the region or if it is through traffic, travelling over medium to long range trips. The graphs depicting the nature of trips are presented below.

Figure 3.17: Internal-external distribution, km46 Prithila



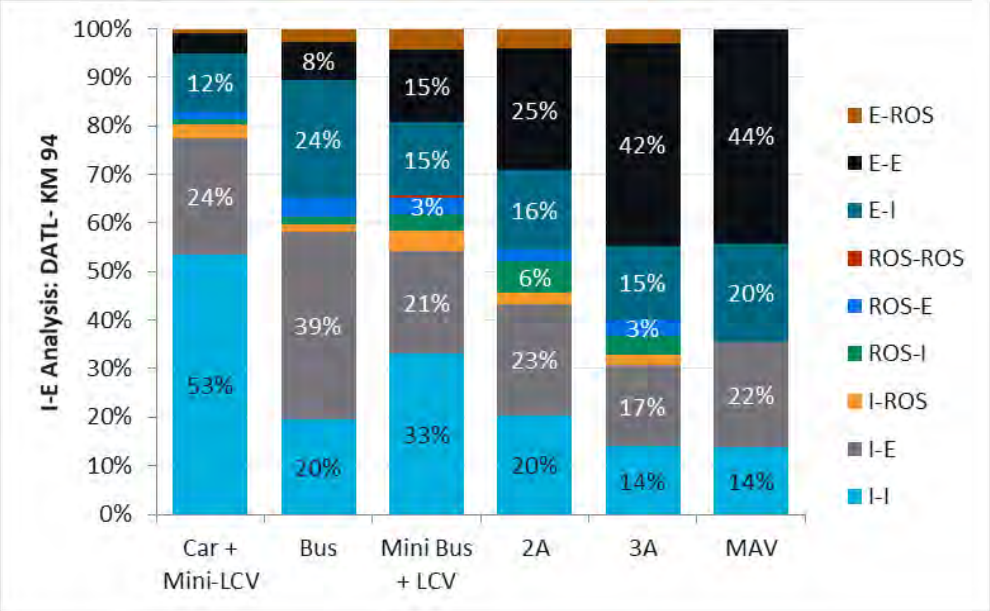
Source: Steer analysis of OD data

Figure 3.18: Internal-external distribution, km74 Srinagar



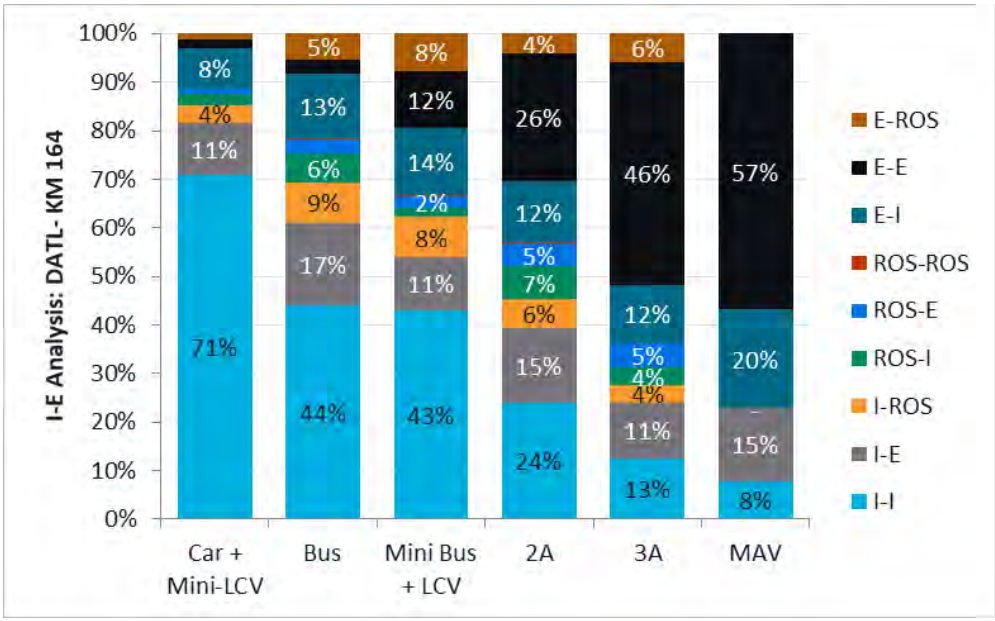
Source: Steer analysis of Client OD data

Figure 3.19: Internal-external distribution, km94 Kotwan



Source: Steer analysis of OD data

Figure 3.20: Internal-external distribution, km164 Mahuvan



Source: Steer analysis of OD data

3.44 The majority of trips along this Asset are E-E, reflecting again the significantly long-distance nature of trips on the Asset. As also seen in the zonal influence discussed earlier with share of South India influence increasing towards the southern toll plaza locations, we see that shares of E-E trips increase as we go southwards. The E-E influence is the least at km46 which has the highest (33% even for MAV) share of I-I trips.

Commodity distribution

3.45 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3-7: Aggregate commodity categories

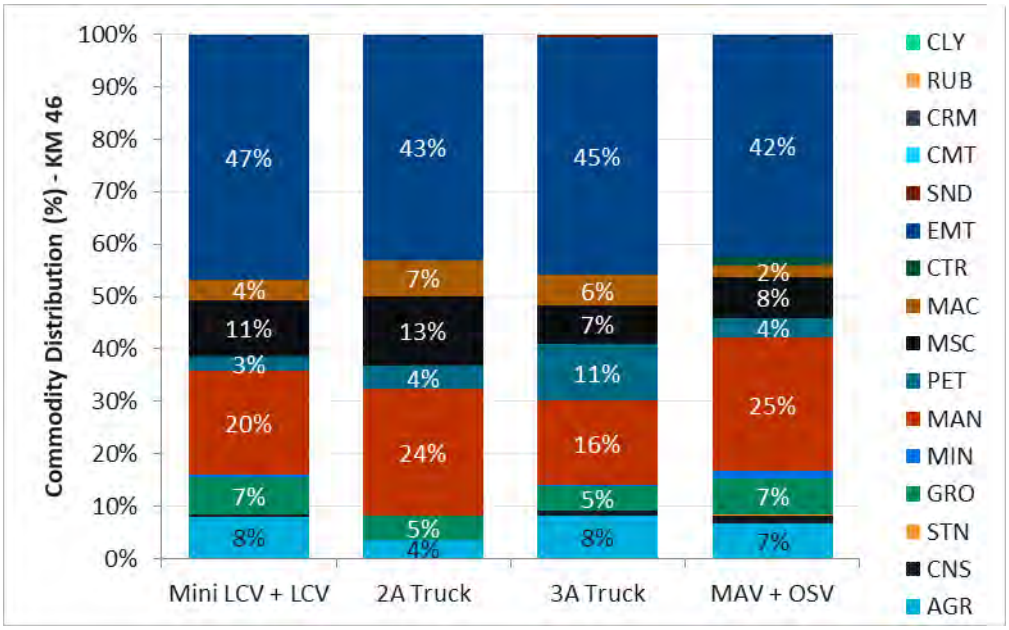
Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	

Commodity Description	Code	Combined codes used for charts
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

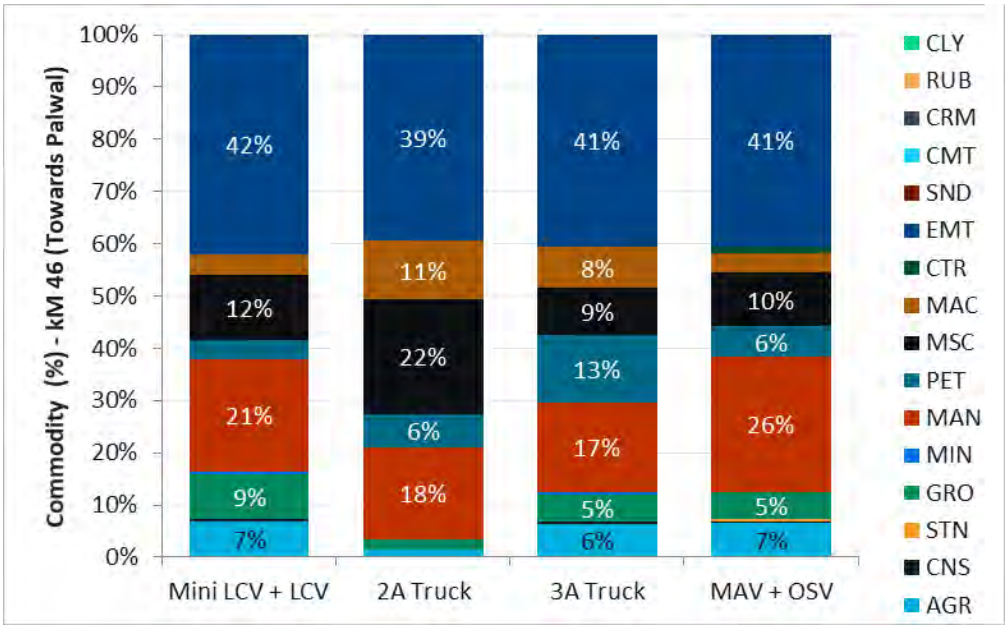
3.46 The figures below present the commodity distribution for goods vehicles at the four toll plaza locations. As observed during the site visit, we see that agricultural products and groceries, manufactured products, miscellaneous commodities and empty are the most influential commodity categories at km74, km94 and km164 locations. Commodity distribution is presented at the total level and by each direction, for each of the four toll plaza locations.

Figure 3.21: Commodity distribution, km46 Prithila (Total)



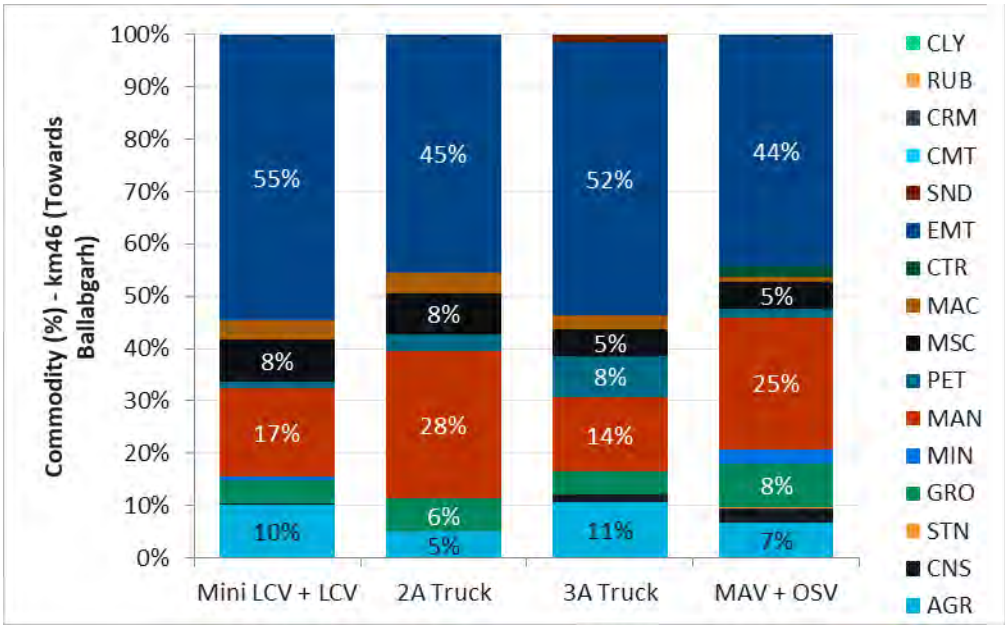
Source: Steer analysis of OD data

Figure 3.22: Commodity distribution, km46 Prithila (towards Palwal)



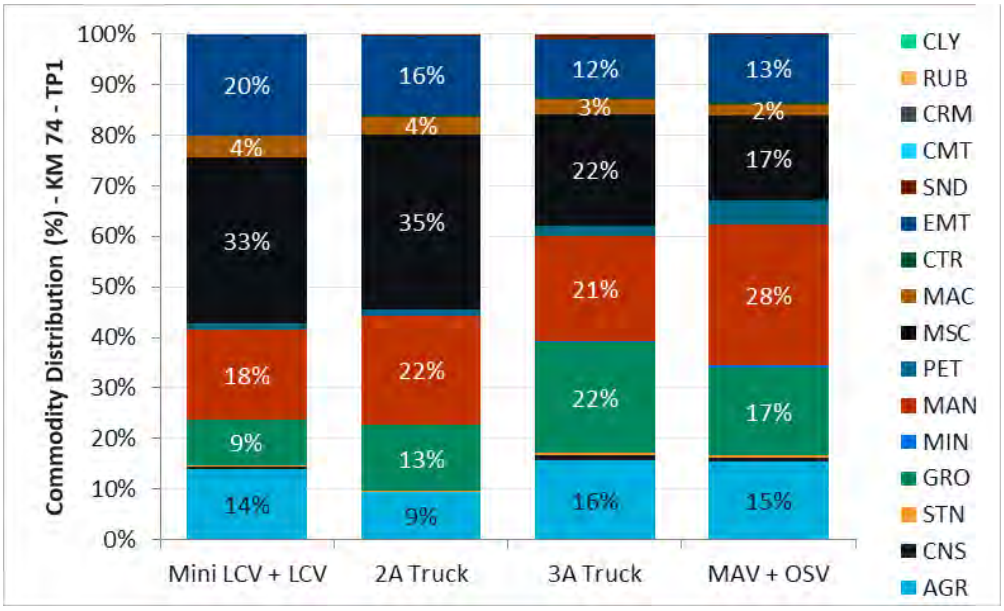
Source: Steer analysis of OD data

Figure 3.23: Commodity distribution, km46 Prithila (towards Ballabhgah)



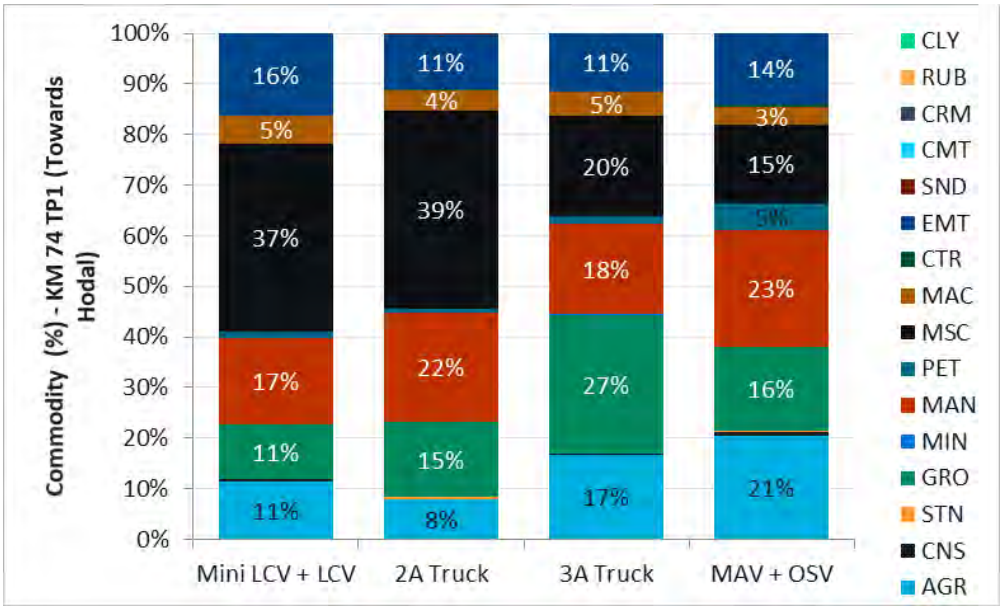
Source: Steer analysis of OD data

Figure 3.24: Commodity distribution, km74 Srinagar (Total)



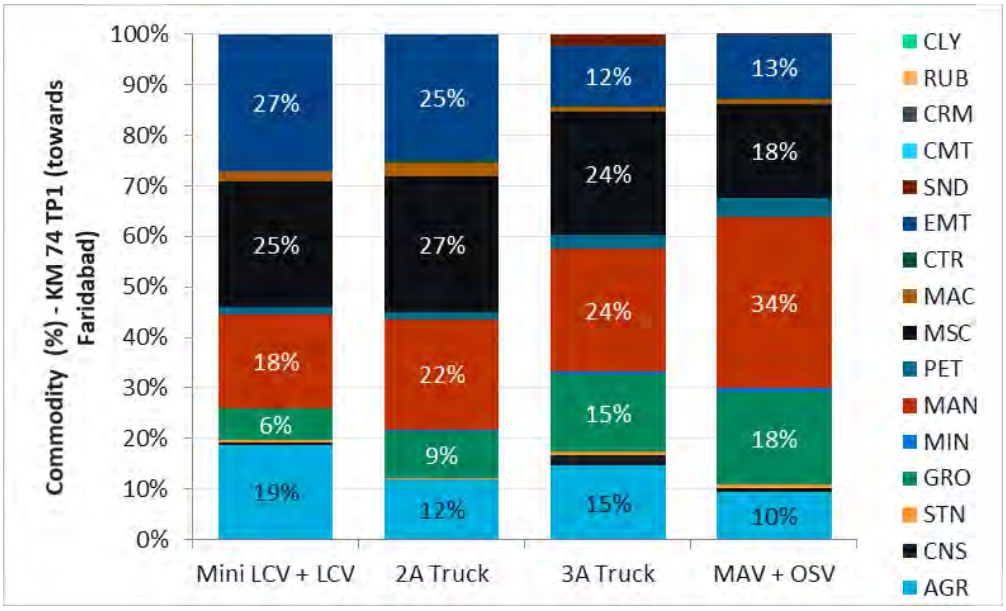
Source: Steer analysis of OD data

Figure 3.25: Commodity distribution, km74 Srinagar (towards Hodal)



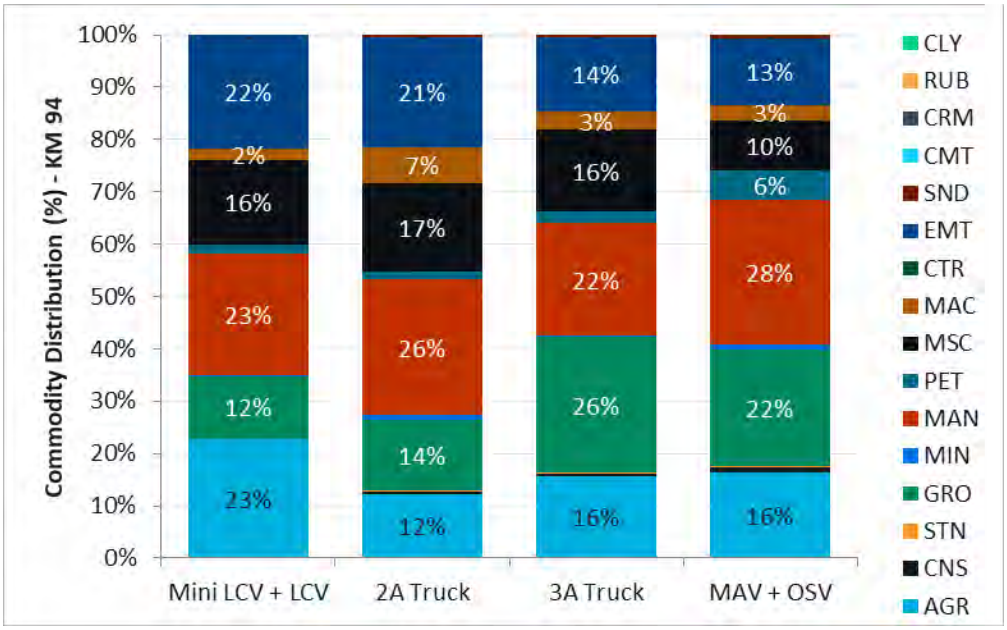
Source: Steer analysis of OD data

Figure 3.26: Commodity distribution, km74 Srinagar (towards Faridabad)



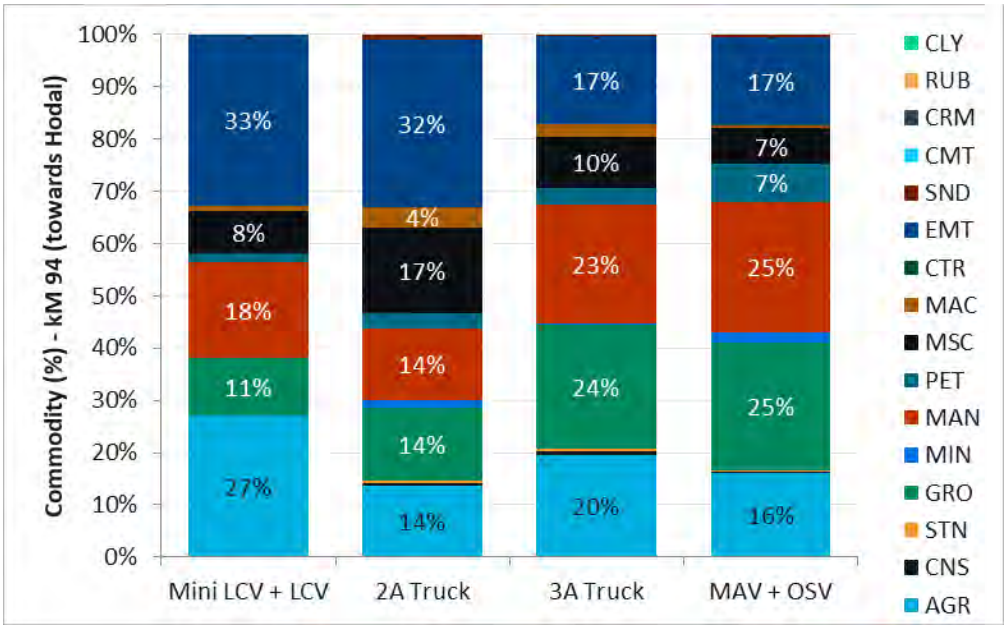
Source: Steer analysis of OD data

Figure 3.27: Commodity distribution, km94 Kotwan (Total)



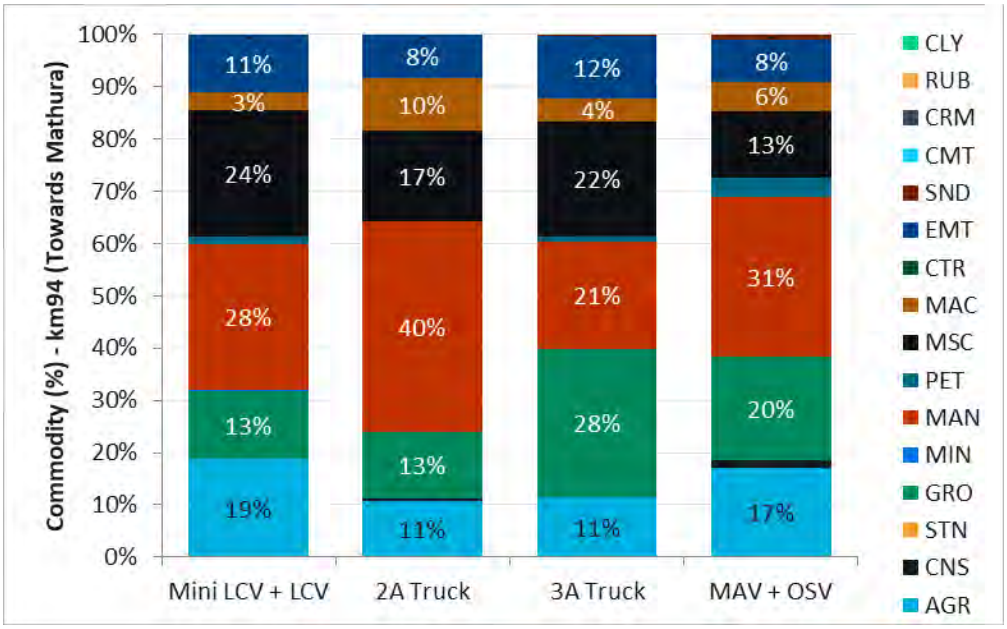
Source: Steer analysis of OD data

Figure 3.28: Commodity distribution, km94 Kotwan (towards Hodal)



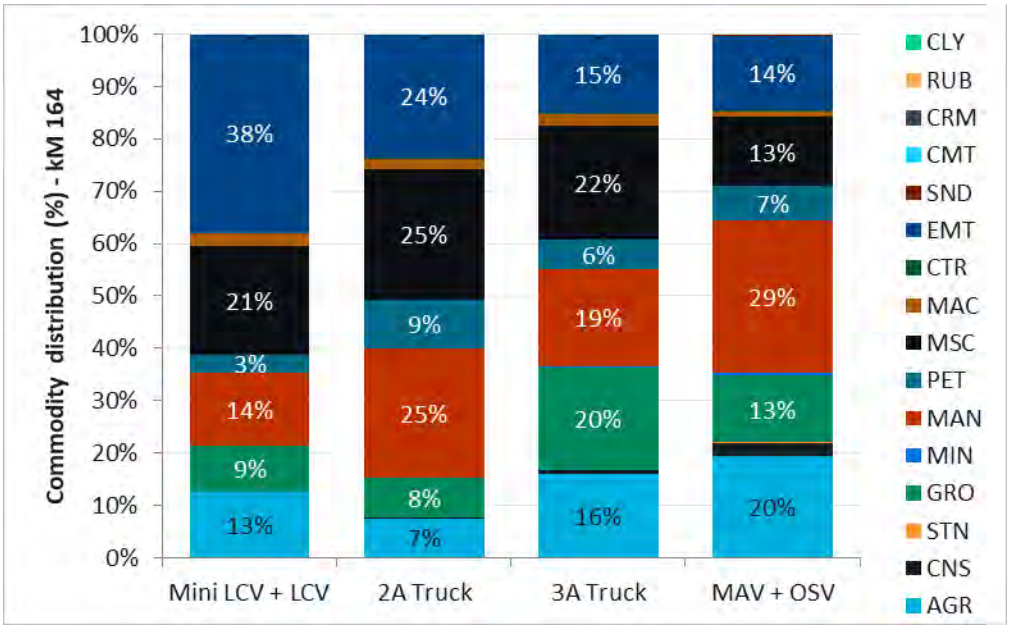
Source: Steer analysis of OD data

Figure 3.29: Commodity distribution, km94 Kotwan (towards Mathura)



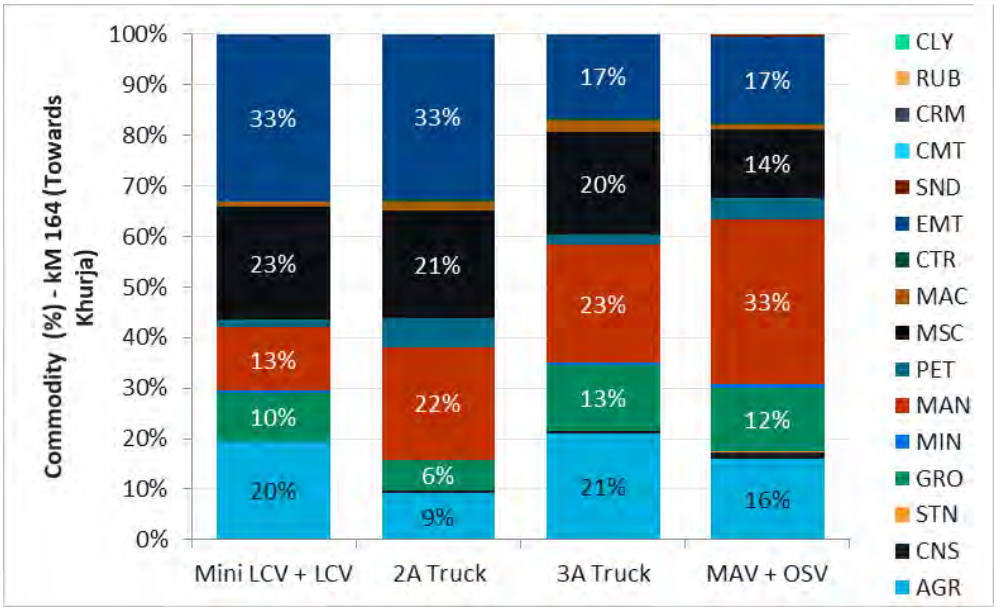
Source: Steer analysis of OD data

Figure 3.30: Commodity distribution, km164 Mahuvan (Total)



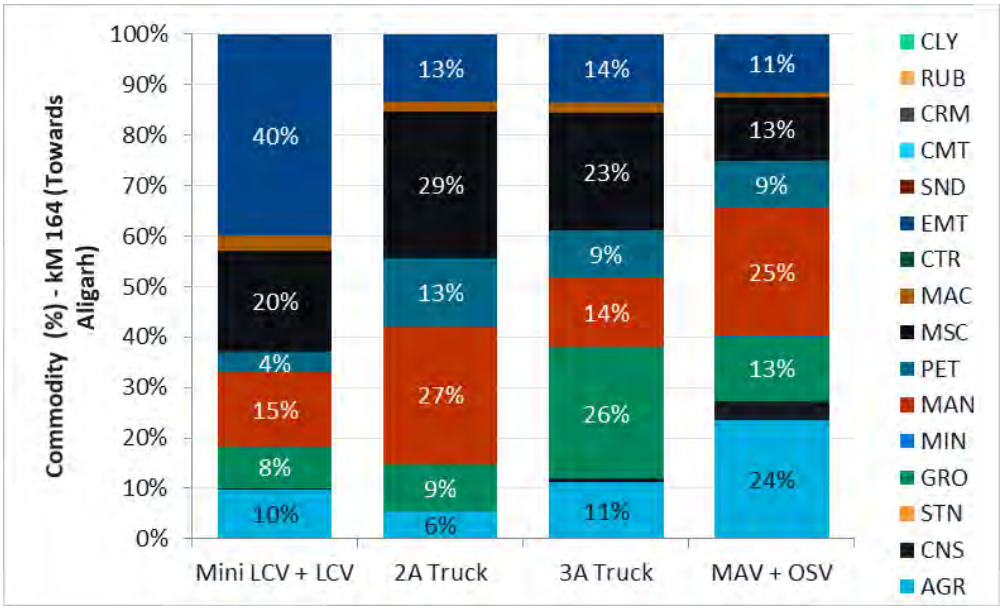
Source: Steer analysis of OD data

Figure 3.31: Commodity distribution, km164 Mahuvan (towards Khurja)



Source: Steer analysis of OD data

Figure 3.32: Commodity distribution, km164 Mahuvan (towards Aligarh)



Source: Steer analysis of OD data

3.47 'Empty' and 'Industrial/Manufacturing' are the two largest commodity proportions which vary across goods vehicle categories, together making up at least 40-65% of the distribution. Agricultural commodities and grocery items come a distant third and fourth respectively, in the range of 20% to 40% together.

3.48 The proportion of empty vehicles decreases with increasing vehicle size, seen more pronouncedly at locations away from Delhi. While Km46 shows about 40-45% empty trips across all vehicle types, the other three locations show a lower share, decreasingly for heavy trucks like 3A and MAV. This is expected as more local truck movements at km46 can manage to empty return trips.

3.49 The proportion of goods traffic carrying industrial/manufacturing goods is significant across all vehicle categories (including LCV and 2A) at all toll plaza locations. This indicates that there is a viable captive demand for LCV and 2A trucks on the Asset due to the nature of the industry in the corridor.

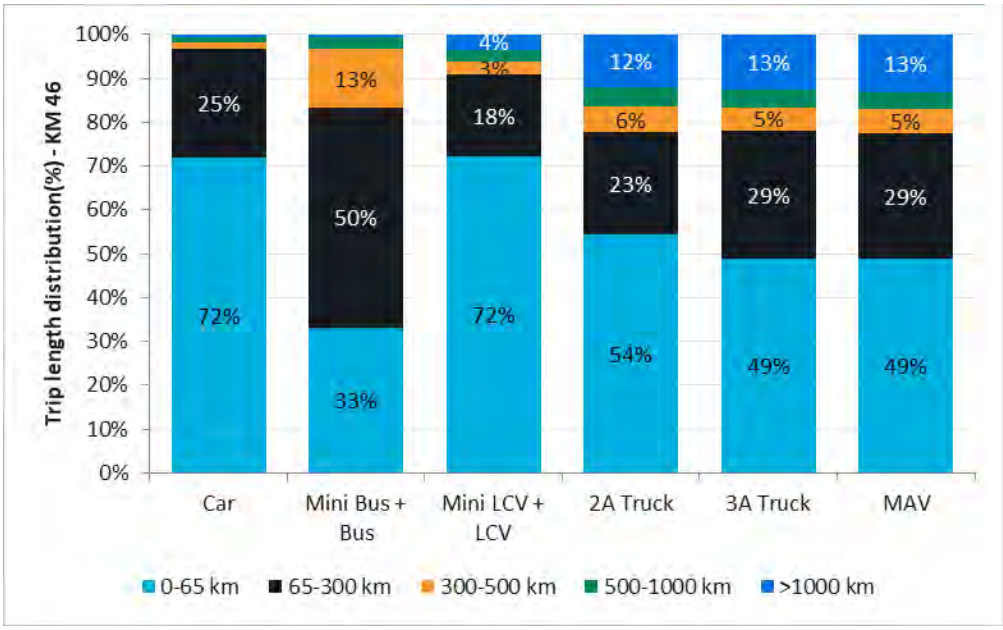
3.50 Miscellaneous commodities can be seen at km74 (for example, 17% MAV and 22% 3A), km94 and km164. Understandably, this is much lower at km46 (7-8% for 3A/MAV) as the category primarily includes long-distance movement of parcels and couriers with a significant share of trip ends north of Delhi.

Trip length analysis

3.51 Trip-length distribution provides the distance-based profile of various vehicle types. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

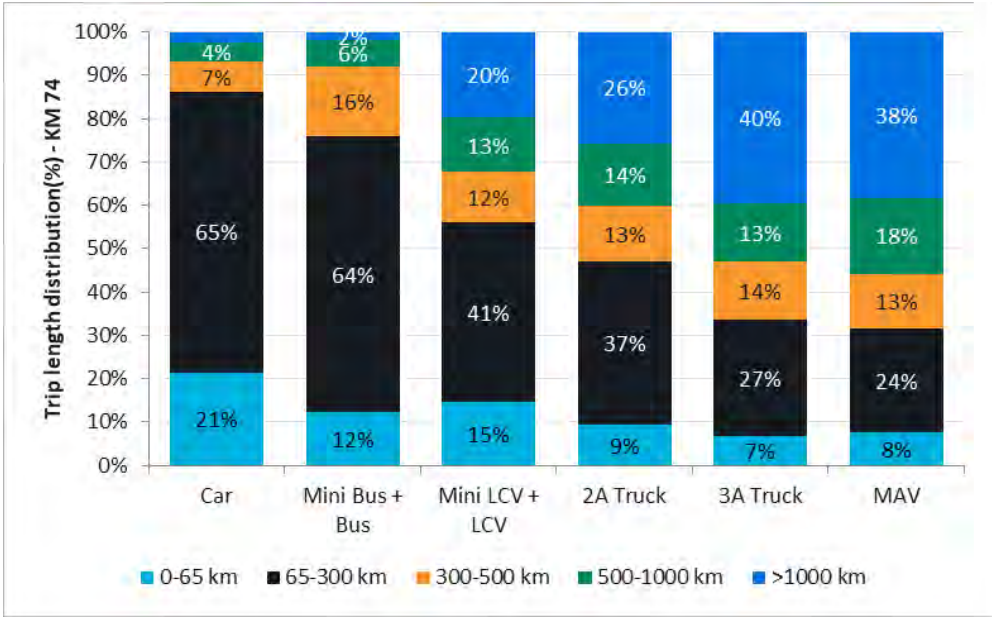
distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[3]

Figure 3.33: Trip length distribution, km46 Prithila



Source: Steer analysis of OD data

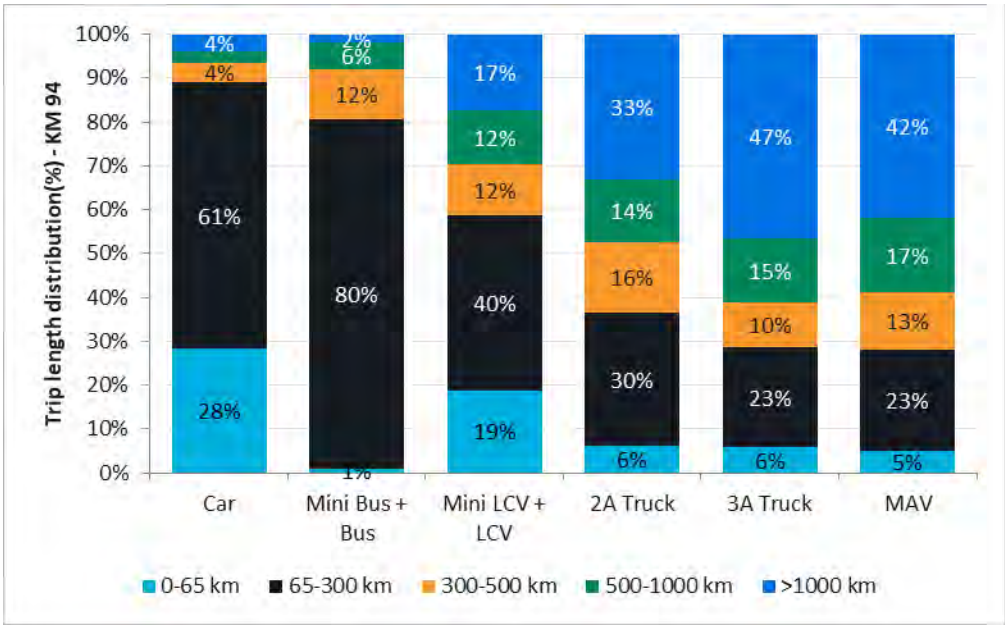
Figure 3.34: Trip length distribution, km74 Srinagar



Source: Steer analysis of OD data

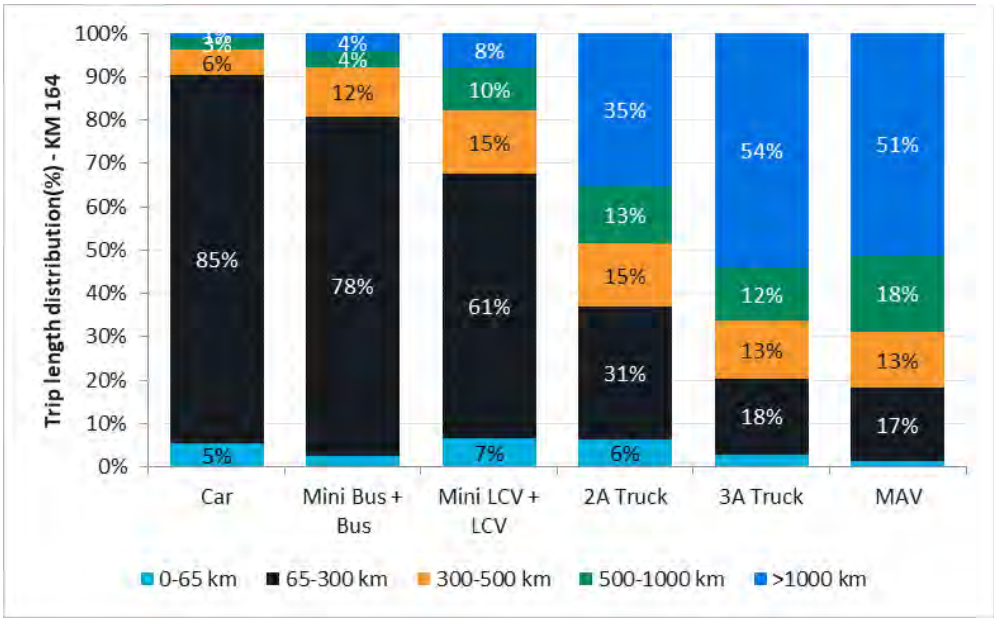
[3] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.35: Trip length distribution, km94 Kotwan



Source: Steer analysis of OD data

Figure 3.36: Trip length distribution, km164 Mahuvan



Source: Steer analysis of OD data

3.52 As discussed in other previous sub-sections, km46 has a distinct distribution of trip lengths compared to the other three toll plazas, particularly showing very high shares of 0-65 km trip distances, ranging from about 50% for MAVs to 72% for CJVs. This share decreases as we move southwards to less than 7% at km164.

3.53 Especially for 3A and MAV, we see that 40-50% of trips are very long-distance, as also seen in the zonal influence presented earlier. Trips with one end at South India form a major part of this share.

Conclusions

3.54 In summary, TP1 km74 Srinagar has a higher share of CJVs compared to TP2 (66% compared to 52%). The opposite is true for MAVs, which represent 18% of vehicles at TP1 km74 Srinagar, but 26% at TP2 km164 Mahuvan.

3.55 Historically across the period FY13 to FY22, both plazas have exhibited strong CAGRs. In terms of year on year growth, on average both plazas experienced slower growth over FY14 to FY17, with growth being much greater in recent years (FY18-FY20). When considering ticket segmentation, for CJVs both plazas have experienced a trend of an increasing share of Single tickets and a reduction in the share of Return tickets (FY12-FY20). For MAVs Single tickets have remained dominant, holding a share of over 90% since FY17 at both plazas.

3.56 The TVC does show slight variation on the TMS, at the total level TMS is 0.8% lower than TVC at TP1, and 0.5% higher than TVC at TP2. But overall, due to these differences being minimal, we believe the TVC data validates the TMS data.

3.57 The OD analysis found that in terms of zonal influence, TP1 km74 Srinagar had a higher share of local trips compared to TP2 km164 Mahuvan. TP2 km164 Mahuvan did however, have a significant share of IAOI trips. The high share of local and IOAI trips is common to both light and heavy vehicles, due to the industrial zones located on the Asset itself. The key commodities transported on the Asset include agricultural products and manufactured products, which combined make up around 45-50% of the commodity share at both plazas. At both plazas (more so at TP1 km74 Srinagar) Groceries and Miscellaneous also hold a significant share,

3.58 When considering the internal and external distribution, for MAVs TP2 km164 Mahuvan has a greater share of E-E trips compared to TP1 km74 Srinagar. Furthermore, as expected for CJVs, both toll plazas show a much lower share of E-E trips, with a dominance of I-I trips, particularly at TP1 km74 Srinagar which reaches 68%, TP2 km164 Mahuvan still has a majority share of I-I at 52%. The trip length analysis supports these findings, with MAVs at both plazas having a large share of trips in excess of 500km, but the share is larger at TP2 than at TP1. Trips with one end at South India form a major part of this share. Very short distance trips (of less than 65km), hold a greater share at TP1, than at TP2. Generally, the share of short distance trips falls as one moves south down the Asset.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the regions where the Asset is located and the country as a whole. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4-1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Uttar Pradesh and Delhi (containing the Asset), compared to that of the country. Overall, urbanisation is seen at both

the state and national levels, as shown by the fact that the rural population is growing slower than the urban population. Overall, Uttar Pradesh and Delhi have grown at a rate which is similar to the country average, in the decade between 2001 and 2011.

Table 4-2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Uttar Pradesh	166	132	35	200	155	44	1.8%	1.7%	2.6%
Delhi	13.8	0.9	12.9	16.8	0.4	16.4	1.9%	(7.8%)	2.4%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of patterns of urbanisation, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

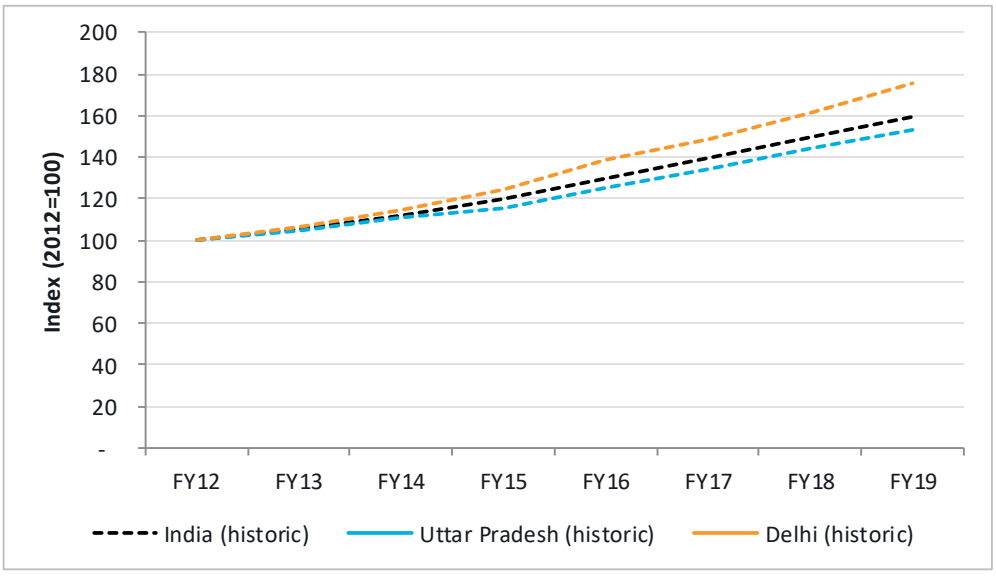
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Uttar Pradesh has been weaker than the country as a whole, whereas Delhi being the capital city has grown at a much faster pace than the national average. Delhi and Uttar Pradesh contribute approximately 4% and 8% respectively to India's GDP. The following figure illustrates the evolution of Delhi and Uttar Pradesh's GSDP.

Figure 4.1: Evolution of Delhi's and Uttar Pradesh's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

Uttar Pradesh

4.9 Uttar Pradesh is the most populous state in India with a population of ~200 million people. The state has a large pool of skilled, semi-skilled and unskilled labour. Uttar Pradesh is also considered the largest consumer base in the country.

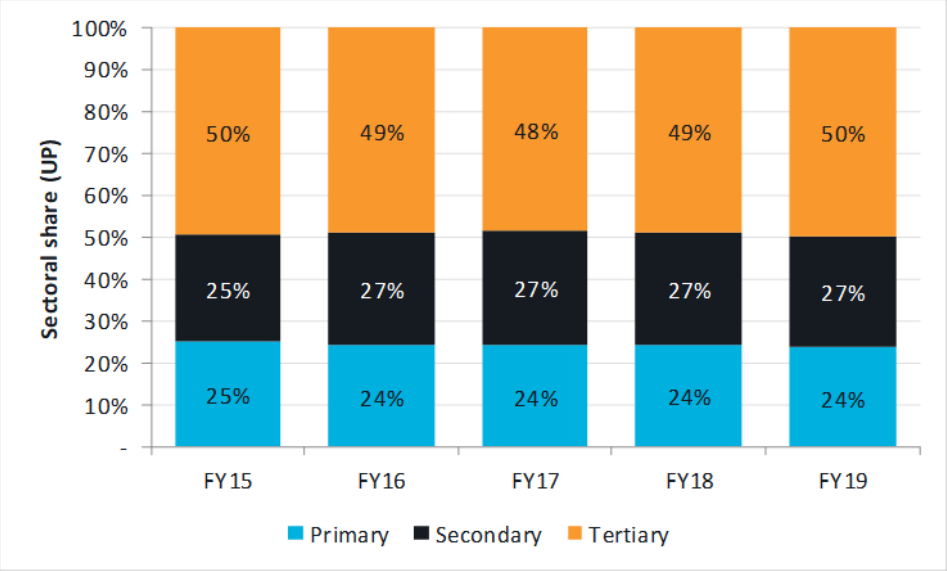
4.10 The tertiary sector has the highest sectoral contribution to the state GDP followed by the secondary and primary sectors, with shares remaining stable during the past five years.

4.11 The tourism and transport sector constitute a majority of the state's tertiary sector. Uttar Pradesh is considered a favoured tourist destination in India, with key tourist attractions being Agra, Varanasi, Mathura and Prayagraj. In 2018, the state attracted the second highest domestic tourist arrivals in the country with 285 million visits. The state holds third position in the country in foreign tourist arrivals with over 3.78 million[4] people arriving.

4.12 In terms of secondary sector, the state has key industrial areas in Khurja (Ceramic); Moradabad (Metals); Meerut, Bareilly, Mirzapur and Lucknow (Handloom & Handicrafts); and Kanpur and Noida (Leather and tannery). The state also has an oil refinery in Mathura, operated by Indian Oil Corporation.

4.13 Uttar Pradesh has very fertile Gangetic land with a large share of population dependent upon agriculture sector for the livelihood. The key primary industries in the state include food processing, crop production and horticulture. The state is mainly known for production of wheat, sugarcane, potato and mango.

Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP



Source: Central Statistics Organisation

Delhi

4.14 Delhi, the capital city of India, is one of the largest metropolises in the country.

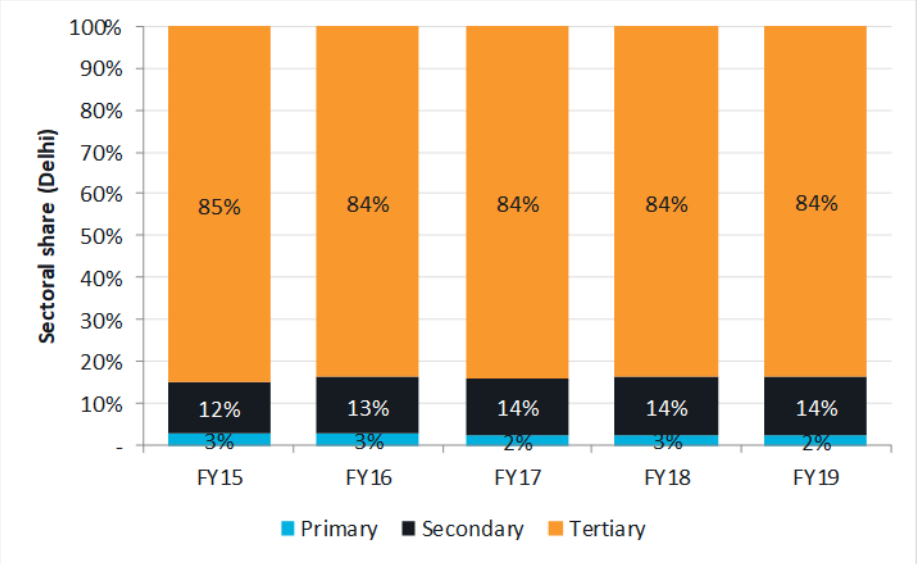
[4] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

4.15 In terms of sectoral contribution, the tertiary sector has the highest share followed by the secondary and primary sectors, with shares remaining stable during the past five years.

4.16 The biggest contributors to the tertiary sector in Delhi are tourism, trade, financial services and real estate. Owing to its location, connectivity and rich cultural history, Delhi has always been a prime tourist attraction of the country with key tourist places being India Gate, Lotus Temple, Humayun's Tomb and Akshardham. In 2018, the state attracted the fourth highest foreign tourist arrivals, around 2.7 million. The Indira Gandhi International Airport of Delhi serves both domestic and international passengers. It was the 12th busiest airport in the world in 2018 in terms of traffic volumes. The airport handled around 69.23 million passengers in 2018-19.

4.17 In terms of secondary sector, the state has key industrial clusters at Narela, Naraina, Okhla and Mayapuri. The share of primary/agriculture sector is very miniscule in the state.

Figure 4.3: Sectoral contribution to Delhi's GSDP



Source: Central Statistics Organisation

Haryana

4.18 Apart from Delhi's core economy, the asset also has an influence of the larger National Capital Region (NCR) which includes cities from the state of Haryana like Gurugram, Faridabad, Manesar and Palwal.

4.19 The state of Haryana contributes nearly 3.5% to India's GDP. The state's GSDP has grown at a CAGR of 9% during between FY15 and FY20. In terms of sectoral contribution, the tertiary sector has the highest share (50%) followed by the secondary (32%) and primary (18%) sectors.

4.20 Haryana is one of the leading states in terms of industrial production, especially automobiles and auto components. The Gurgaon-Manesar-Faridabad belt houses large automotive players such as Maruti Suzuki, Hero Motor and Yamaha. Under the 'Make in India' project, the Manesar-Bawal Investment Region has been identified by the Government to be one of the key manufacturing hubs in the state.

4.21 The state has also emerged as a base for the knowledge industry including IT and biotechnology. Many large Indian and multinational companies have set up their offices in the state (Gurugram) due to its high-quality infrastructure and proximity to Delhi.

4.22 Haryana also houses large number of agriculture and allied industries manufacturing plants in the state such as Nestle, Haldiram, and GlaxoSmithKline Consumer Healthcare.

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions, and results for baseline (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'. To understand the historical traffic trends in relation to these growth drivers, we carry out regression analyses to determine the historical relationship between each traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.3 Typically, passenger and light commercial vehicle traffic like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state in which the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because the majority of light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.4 Elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in growth drivers of traffic. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.5 Following the brief note on historical trends shown in Chapter 3, we now delve deeper into results of the historical growth analysis for each major vehicle type. The table below shows the historical CAGRs on the Asset by vehicle type.

Table 5-1: Vehicle-wise growth and CAGR (%), km74 Srinagar

Vehicle type	Growth (%)							CAGR (%)		
	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY13-FY20	FY16-FY20	FY20-FY22
CJV	5.5%	4.0%	14.1%	19.4%	2.2%	2.4%	56.4%	5.5%	9.7%	26.5%
LCV	(0.3%)	6.4%	(10.9%)	12.5%	(1.4%)	(16.7%)	28.1%	0.1%	1.3%	3.3%
2A/Bus	(8.4%)	9.4%	27.7%	17.7%	10.7%	(1.8%)	32.9%	6.8%	16.2%	14.2%
3A/MAV/OSV	7.2%	18.4%	18.2%	19.8%	15.5%	(3.0%)	34.1%	13.4%	18.0%	14.1%

Vehicle type	Growth (%)							CAGR (%)		
	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY13-FY20	FY16-FY20	FY20-FY22
Total AADT	**3.5%**	**7.2%**	**13.8%**	**18.7%**	**5.5%**	**(0.6%)**	**47.3%**	**6.5%**	**11.2%**	**21.0%**
PCU	**2.5%**	**10.1%**	**15.9%**	**18.7%**	**8.7%**	**(1.7%)**	**41.3%**	**8.0%**	**13.3%**	**17.8%**

Source: Steer analysis of Client TMS data

Table 5-2: Vehicle-wise growth and CAGR (%), km164 Mahuvan

Vehicle type	Growth (%)							CAGR (%)		
	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY13-FY20	FY16-FY20	FY20-FY22
CJV	8.1%	(1.5%)	12.3%	7.3%	3.8%	26.8%	13.7%	3.9%	5.4%	20.1%
LCV	1.1%	(1.7%)	(2.5%)	(1.4%)	(10.4%)	(19.9%)	19.7%	(2.3%)	(4.1%)	(2.0%)
2A/Bus	(6.3%)	(0.2%)	28.8%	16.0%	12.2%	(5.8%)	29.4%	5.9%	13.7%	10.4%
3A/MAV/OSV	5.1%	0.0%	17.4%	15.4%	10.4%	(5.7%)	27.5%	9.3%	10.6%	9.6%
Total AADT	**4.3%**	**(0.9%)**	**14.0%**	**9.9%**	**5.7%**	**8.0%**	**19.9%**	**4.9%**	**7.0%**	**13.8%**
PCU	**2.8%**	**(0.6%)**	**16.6%**	**12.3%**	**7.9%**	**0.7%**	**23.7%**	**6.2%**	**8.9%**	**11.6%**

Source: Steer analysis of Client TMS data

5.6 The table below presents the growth drivers identified to model the forecast background traffic growth rates. For km46 alone, cars (including mini-LCVs) have been modelled with respect to GSDP Delhi alone at 100%.

Table 5-3: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP Uttar Pradesh	GSDP Delhi
Car		50%	50%
LCV		50%	50%
Bus		50%	50%
2A	100%		
3A	100%		
MAV	100%		

Source: Steer analysis of Client data

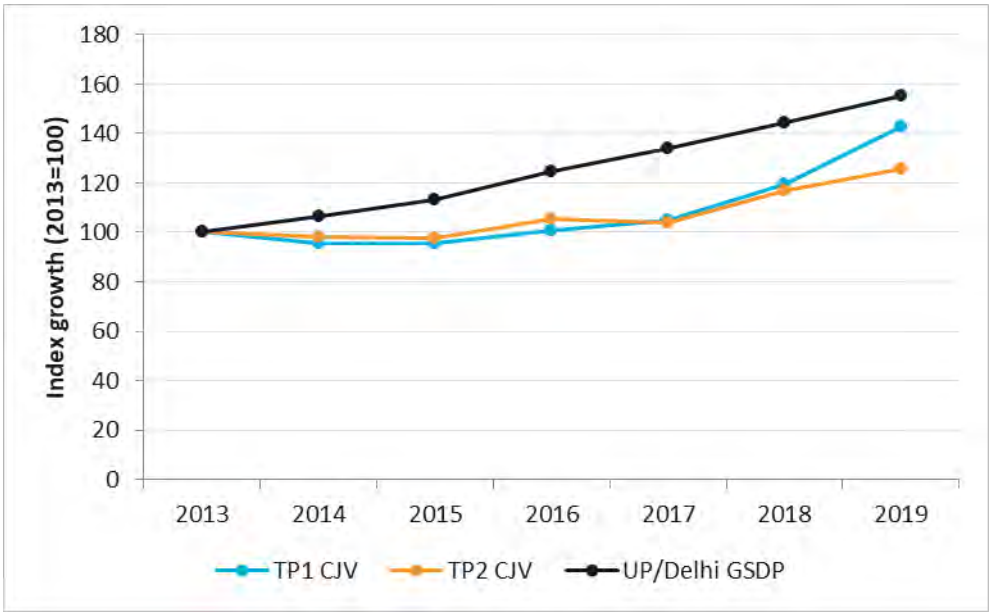
5.7 The recent historical period of tolling is chequered with variations in traffic growth between years for certain vehicle types. For 3A and MAV, we see strong positive growth in FY18 through FY20, due to the network shift observed from NH48 to NH192/NH52 after completion of construction of the Western and Eastern Peripheral Expressways. LCV and 2A show variations. This is one of the reasons for differences between the derived and assumed elasticities as we typically forecast elasticities to reflect the more recently observed relationship between traffic growth and macroeconomic growth either based on recent elasticities or benchmarks.

5.8 Please note that in our regression analysis, we have used the combined traffic for toll categories as data for historical years were available only in combined form.

CJV

5.9 We see from the OD data that the CJVs primarily cater to regional movements between NCR, Faridabad, Mathura/Vrindavan, Agra and other towns lying on the Asset. Apart from the local and IAOI influence seen from towns and cities in Uttar Pradesh, we also observed a considerable influence from Central NCR and Faridabad. We have therefore taken a 50:50 combined GSDP growth of UP and Delhi to be the growth driver to model the growth of CJV traffic. The following figure shows the relationship between indexed values of CJV traffic and UP/Delhi GSDP at km74 Srinagar and km164 Mahuvan.

Figure 5.1: Relationship between CJV traffic and Uttar Pradesh/Delhi GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.10 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. This assumption is very contextual and subject to change as there are changes in economic policies of government and overall economic stability nationally and globally.

5.11 Historically, the CJV traffic on the Asset has shown healthy growth in the FY16-FY19 period at about 6%, compared with the FY13-FY16 period showing slower positive growth rates. The regression analysis suggests that between FY12 and FY19 traffic has grown with a background traffic growth elasticity of 1.1 at both toll plazas with respect to UP/Delhi GSDP. Taking note of the positive outlook for passenger traffic on the tourism-driven Asset and the regression results, we have assumed a forecast background elasticity of 1.20 and 1.00 for CJV going forward at km74 Srinagar and km164 Mahuvan, respectively. Km46 Prithila is expected to follow the same elasticities as km74, while km94 Kotwan is assumed to have an elasticity of 1.10.

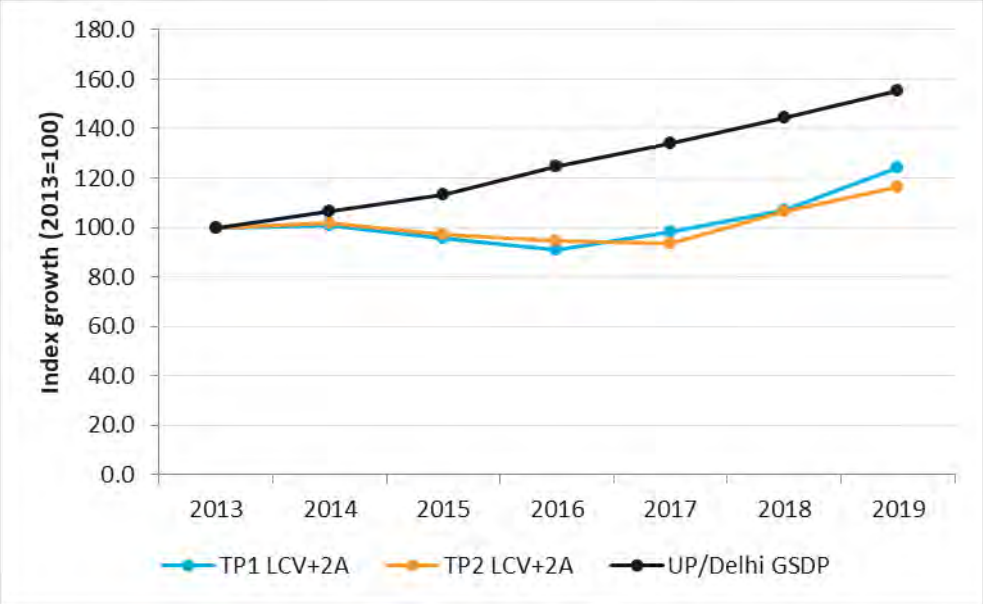
5.12 Given that relationships between traffic growth and macroeconomic growth reduce in elasticity as the economy becomes advanced and urbanisation increases, we have assumed that the elasticities at km46 and km74 will decrease to 1.0 by FY25.

LCV, 2A

5.13 Compared to heavy vehicles like 3A and MAV, LCV and 2A have more regional movements within the state – UP and Delhi in this case as seen in the OD data analysis. More than 45% of LCVs 2As at km46 have one trip end in either UP or Delhi. Similarly, more than 85% of LCVs and 55% of 2As at km46 have one trip end in either UP or Delhi. We have therefore taken GSDP growth of UP/Delhi to be the growth driver to model growth of LCV+2A traffic. The following figure shows the relationship between indexed values of LCV+2A combined traffic and UP/Delhi GSDP.

5.14 In the recent FY16-FY19 period, LCV+2A combined growth on the Asset has shown increasingly positive growth. However, looking at 2A/Bus traffic specifically, we can see that 2A has been growing faster than LCV from FY17 onwards. We believe this could be because of the shift in growth from LCV to 2A, and/or classification issues. However, given that we see 2A growing faster than LCVs at other roads across the country, we believe this is due to a preference for 2A over LCVs partly due to the axle load norms in July FY19.

Figure 5.2: Relationship between LCV+2A/Bus combined traffic and Uttar Pradesh/Delhi GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.15 Based on the above observations and our experience across other toll roads in the country, we conclude that LCV will continue to grow, however at a lower elasticity of 0.25 compared to 0.8/0.6 at km74/km164 for 2A, with respect to GSDP. We have forecast km46 and km96 to follow the same elasticities as km74.

Bus

5.16 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at intervals of time. Based on our experience across the country, buses on inter-urban corridors show moderate elasticities of 0.4 to 0.6 with respect to the GSDP.

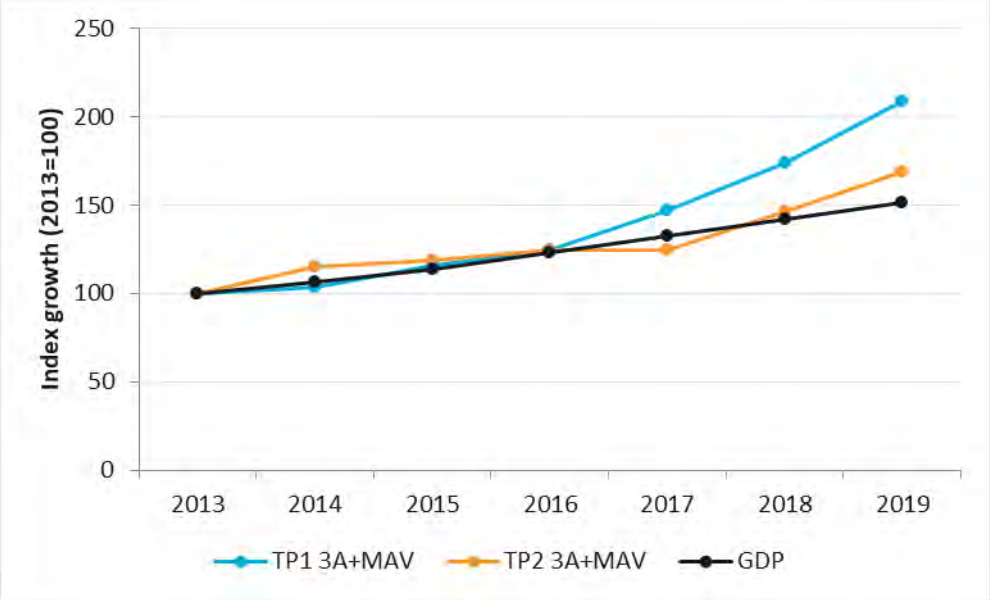
5.17 However, as seen in the table presented earlier, bus growth especially at km164 has been very minimal, negative for several years. Based on that and considering benchmarks, we have therefore assumed an elasticity of 0.5 with respect to UP/Delhi GSDP at all toll plazas. We forecast km46 and km94 to follow the same elasticities as km74.

3A/MAV Trucks

5.18 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in their commodity distribution which means that traffic growth in 3A and MAV is dependent on industry demand-supply ecosystems spread across the country, we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

5.19 Historically, 3A+MAV combined traffic posted very strong growth FY18 onwards. This is due to the network shift from NH 8 to NH 2, due to the phased completion of construction on the Eastern and Western Peripheral Expressways. The identification of this shift has been confirmed by negative growth seen on toll roads located on NH 8 corridor during this period.

Figure 5.3: Relationship between 3A+MAV combined traffic and India's GDP



Source: Steer analysis of Client TMS data and publicly available GDP

5.20 Based on the above points, considering the history of network shift from NH 2, and the regression results, we have assumed elasticities of 0.90 for 3A and 1.1 for MAV trucks across all plazas.

5.21 Given that relationships between traffic growth and macroeconomic growth reduce in elasticity as the economy becomes advanced and urbanisation increases, we have assumed that the elasticities at all the toll plaza locations will decrease to 1.0 by FY25.

Forecasts for background elasticities

5.22 The below table presents a summary of the results of the regression analysis carried out on the historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.23 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5-4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle Type	Growth Driver	History		Forecast	
		Derived elasticity	Years considered	Assumed forecast elasticity	Evolution of elasticity
Km74 Srinagar					
Car	GSDP Uttar Pradesh/Delhi	1.20	FY12-FY13, FY15, FY18-FY19	1.20	Decreasing to 1.1 by FY25
LCV*	GSDP Uttar Pradesh/Delhi	1.0	FY12-FY15, FY18	0.25	No change
Bus	GSDP Uttar Pradesh/Delhi	1.0	FY11, FY18-FY19	0.5	Decreasing to 0.25 by FY25
2A*	GSDP Uttar Pradesh/Delhi	1.8	FY12-FY15, FY18	0.80	No change
3A	GDP	1.8	FY12-FY15, FY17-FY18	0.90	No change
MAV	GDP			1.10	Decreasing to 0.9 by FY25
Km164 Mahuvan					
Car	GSDP Uttar Pradesh/Delhi	1.1	FY11-FY19	1.00	No change
LCV*	GSDP Uttar Pradesh/Delhi	0.2	FY12-FY14, FY16, FY18	0.25	No change
Bus	GSDP Uttar Pradesh/Delhi	0.2	FY11, FY14, FY18-FY19	0.50	Decreasing to 0.25 by FY25
2A*	GSDP Uttar Pradesh/Delhi	1.9	FY12-FY14, FY16, FY18	0.60	No change
3A	GDP	1.2	FY12-FY15, FY17	0.90	No change
MAV	GDP			1.10	Decreasing to 1.0 by FY25
Km46 Prithila					
Car	GSDP Uttar Pradesh/Delhi	-	-	1.20	Decreasing to 1.1 by FY25
LCV*	GSDP Uttar Pradesh/Delhi	-	-	0.25	No change

Vehicle Type	Growth Driver	History		Forecast	
		Derived elasticity	Years considered	Assumed forecast elasticity	Evolution of elasticity
Bus	GSDP Uttar Pradesh/Delhi	-	-	0.5	Decreasing to 0.25 by FY25
2A*	GSDP Uttar Pradesh/Delhi	-	-	0.80	No change
3A	GDP	-	-	0.90	No change
MAV	GDP	-	-	1.10	Decreasing to 0.9 by FY25
Km94 Kotwan					
Car	GSDP Uttar Pradesh/Delhi	-	-	1.10	No change
LCV*	GSDP Uttar Pradesh/Delhi	-	-	0.25	No change
Bus	GSDP Uttar Pradesh/Delhi	-	-	0.50	Decreasing to 0.25 by FY25
2A*	GSDP Uttar Pradesh/Delhi	-	-	0.80	No change
3A	GDP	-	-	0.90	No change
MAV	GDP	-	-	1.10	Decreasing to 0.9 by FY25

Source: Steer analysis of Client data *regression was run on LCV-2A and 3A-MAV after combining traffic numbers

Forecasts for growth drivers

5.24 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. In particular, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.25 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 being 4%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.26 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in Figure 5.4.

5.27 Based on that, GDP is forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.28 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

Uttar Pradesh and Delhi GSDP

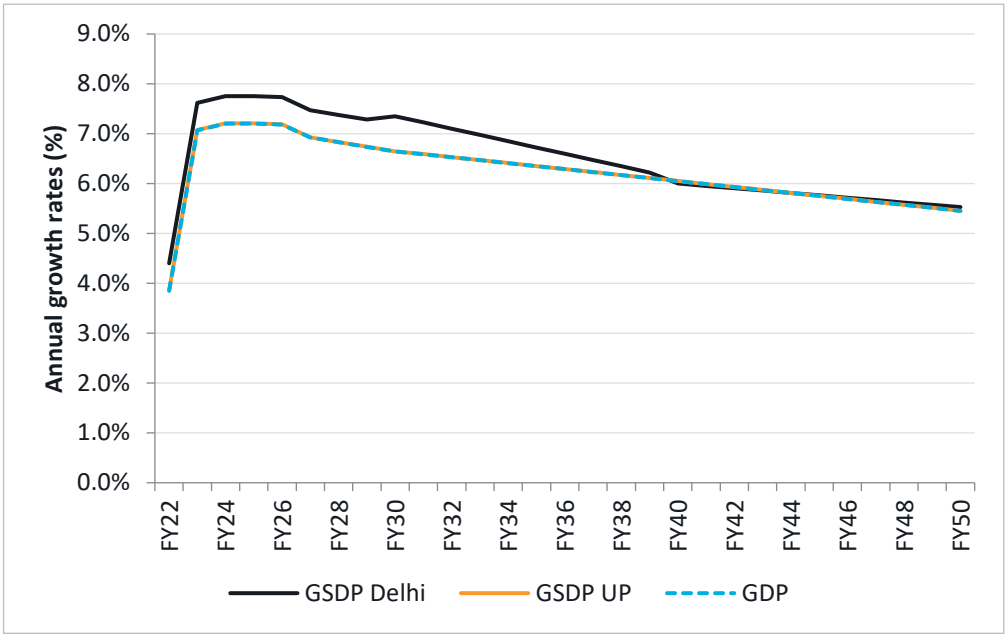
As per Client projections, Delhi's GSDP growth assumes to continue outpacing the national GDP throughout the concession period, while Uttar Pradesh GSDP is already in line with the national trend. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.29 There are significant investments expected to take place as part of the states' plans and Uttar Pradesh and Delhi are expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher-than-expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost the two states' economy.

5.30 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.31 The GDP-GSDP lines are expected to converge by FY40. The chart below shows the forecast growth lines for GDP and Uttar Pradesh and Delhi GSDPs.

Figure 5.4: GDP-GSDP forecast



Source: GDP and GSDP forecast provided by Client

6 Forecast: Base year AADT and Impacts

Introduction

6.1 Following the discussion on estimated and assumed forecast background growth rates in the previous chapter, this chapter first deals with the forecasting assumptions around base year AADT and potential impacts on traffic growth on the Asset. Later, it also presents the assumed toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to estimate the forecast revenue based on the forecast traffic. In the final section, the chapter summarises the traffic growth rates for the forecast years.

6.2 The following table lists key intermediate and final outputs that have presented in chapter 5 and 6.

Table 6-1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT FY21 and FY22	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Background historical elasticities with respect to growth drivers	Chapter 3, 5, Appendix A
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix A
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer

6.3 All traffic is presented as AADT by vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Though FY39 is the last year of concession, we have presented summary forecasts until FY44 in this chapter. Appendix B presents detailed forecasts until FY44.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied monthly traffic the seasonality – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. The averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 The seasonality factors assumed for individual vehicle types for each toll plaza are shown in the table below.

Table 6-2: Seasonality correction factors for TP1 Km74 Srinagar

Vehicle Class	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.99	1.03	0.95	1.07	1.05	1.21	1.04	0.92	0.96	1.00	0.89	0.93
LCV	0.98	1.00	1.02	1.09	1.10	0.99	0.96	0.94	0.97	1.04	0.93	1.00
Bus	1.05	1.01	1.02	1.08	1.08	1.00	0.96	0.99	1.02	0.99	0.93	0.90
2A	1.05	1.01	1.02	1.08	1.08	1.00	0.96	0.99	1.02	0.99	0.93	0.90
MAV	1.07	1.07	1.04	1.11	1.11	0.99	0.91	0.95	0.97	0.98	0.93	0.93

Source: Steer analysis of Client historical TMS data

Table 6-3: Seasonality correction factors for TP2 Km164 Mahuvan

Vehicle Class	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	1.01	1.03	0.93	1.01	1.04	1.20	1.07	0.91	0.95	1.02	0.91	0.98
LCV	0.95	1.00	1.04	1.11	1.11	1.01	0.94	1.00	0.96	1.00	0.94	0.96
Bus	1.01	0.98	1.02	1.07	1.08	0.98	0.95	0.97	1.02	1.05	0.94	0.95
2A	1.01	0.98	1.02	1.07	1.08	0.98	0.95	0.97	1.02	1.05	0.94	0.95
MAV	1.01	1.02	1.07	1.17	1.11	1.00	0.98	0.96	0.93	0.97	0.90	0.93

Source: Steer analysis of Client historical TMS data

Base year FY22 AADT estimates

6.8 As discussed earlier in chapter 1 and in 3, The second wave of COVID-19 infections peaked in the in the months of April and May 2021. The largest impact of the wave was visible on passenger vehicles mainly CJV and buses. However, goods vehicles continued to operate on near normal volumes. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.9 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6-4: Monthly MADT and Adopted AADT for FY22 – TP1 Srinagar

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted (FY22*)
CJV	16,417	19,810	18,665	15,513	20,133	19,981	**17,977**
LCV	1,523	1,415	1,412	1,241	1,442	1,470	**1,377**
Bus	631	698	663	600	546	788	**638**
2A	2,702	2,242	2,434	2,358	2,624	2,613	**2,405**
3A/MAV	5,503	5,129	5,135	4,756	5,338	5,381	**4,915**
Total	**26,777**	**29,294**	**28,309**	**24,468**	**30,082**	**30,233**	**27,313**
PCU	**47,037**	**47,841**	**47,181**	**42,093**	**49,587**	**50,317**	**45,548**

Source: Steer analysis of client data

Table 6-5: Monthly MADT and Adopted AADT for FY22 – TP2 Mahuvan

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted (FY22*)
CJV	10,996	13,592	13,003	10,690	13,176	13,155	**12,278**
LCV	1,532	1,423	1,444	1,258	1,445	1,483	**1,383**
Bus	727	802	761	680	619	767	**712**
2A	3,460	2,920	3,133	2,965	3,279	3,373	**3,123**
3A/MAV	6,661	6,432	6,520	5,982	6,538	6,542	**6,096**
Total	**23,376**	**25,169**	**24,860**	**21,576**	**25,057**	**25,318**	**23,593**
PCU	**48,047**	**48,321**	**48,571**	**43,443**	**48,819**	**49,591**	**46,168**

Source: Steer analysis of client data

New TPs at km46 (Prithila) and km94 (Kotwan)

6.10 The traffic volumes at the two upcoming toll plazas (Km46 and Km94) on the Asset have been estimated using a conversion factor which was derived using TVC data collected at TP1 (km74) and at locations of km46 and km94. TVC surveys were caried out by client in Aug 2021 at KM

74, 46 and 94. These factors represent the proportion of traffic observed on KM46 and 94 as a proportion of traffic observed on KM74.

6.11 The derived AADTs for Km46 and Km94 along with the factors are given in the table below.

Table 6-6: Estimation factors and FY22 AADT at Km46 and Km94

Vehicle Class	Km74	Km46		Km94	
	AADT	Factor	AADT	Factor	AADT
CJV	17,977	1.85	33,258	1.00	18,041
LCV	1,377	1.71	2,355	1.13	1,555
Bus	638	1.27	1,000	0.89	842
2A	2,405	0.60	1,254	1.34	2,944
3A	1,799	0.74	1,409	1.15	2,302
MAV	3,116	0.74	2,228	1.15	3,350
Total	**27,313**	-	**41,504**	-	**29,034**
PCU	**46,615**	-	**55,712**	-	**50,530**

Source: Steer analysis of Client TMS and TVC data

6.12 Based on factors derived from the TVC vs TMS data analysis carried out for km74, we were able to estimate payable traffic using the total traffic at the new toll plazas. Based on our understanding of exemptions and violations at various toll plazas across the country, we have modified the share of exemptions at km46 and km94 while keeping exemptions at km74 as the benchmark for our calculations. The reasoning behind the change in exemptions is based on the fact that, as we move closer to urban centres, the level of exemptions generally increase, and as we move further away, the share decreases. The exemption shares assumed for forecasts on all toll plazas are as shown in the table below. The same share has been assumed from FY23 onwards.

Table 6-7: Assumptions for share (%) of exemptions and violations on Asset TPs

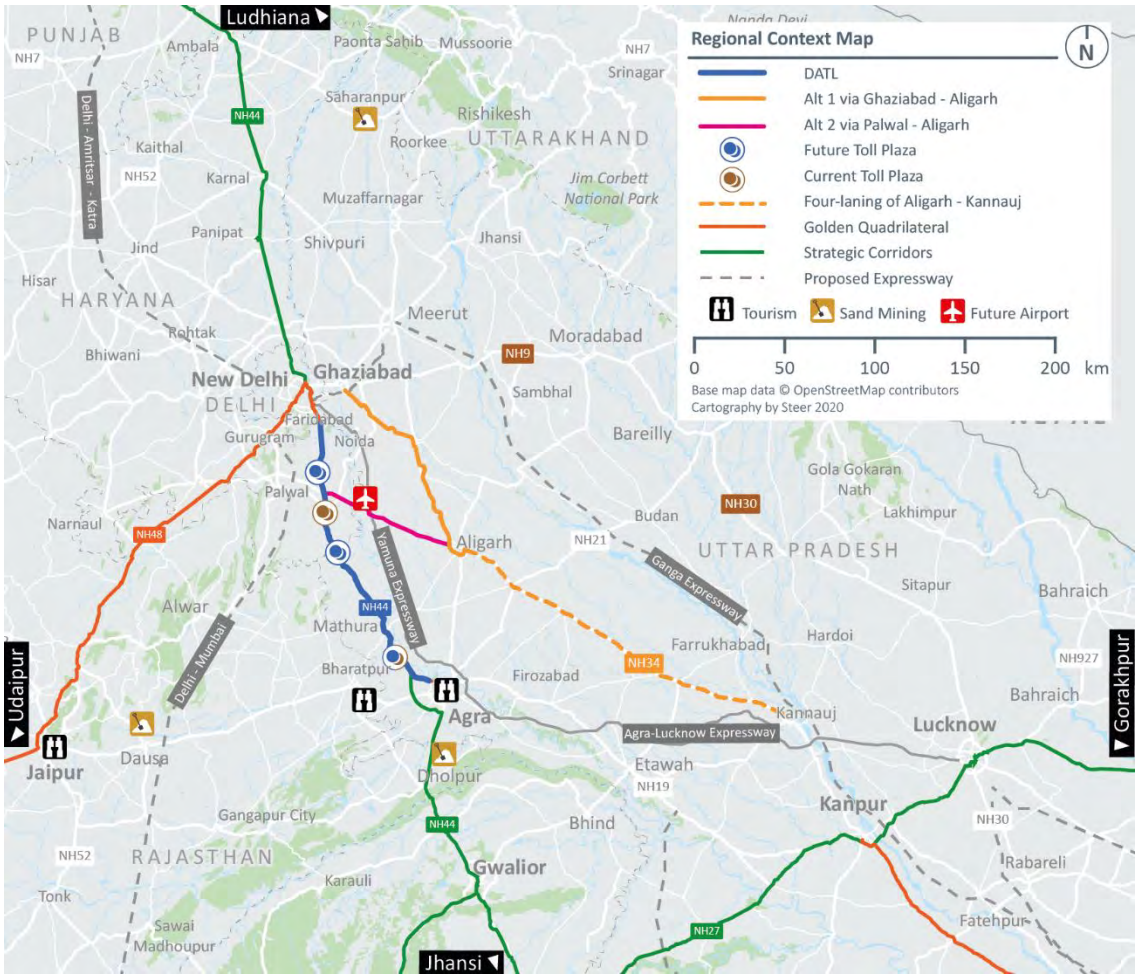
Vehicle Class	Km46	Km74	Km94	Km164
	FY22	FY22	FY22	FY22
CJV	20%	11%	11%	10%
LCV	10%	2%	3%	6%
Bus	3%	1%	3%	0%
2A	3%	1%	1%	1%
3A	3%	1%	1%	1%
MAV	3%	1%	1%	1%
OSV	3%	1%	1%	1%

Source: Steer analysis of Client TMS and TVC data

Analysis of potential impacts

6.13 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context



Source: Steer analysis and cartography

Alternate routes and improvements

6.14 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in Chapter 2, in order to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.15 Apart from the Delhi-Mumbai Expressway expected to be complete by FY23, other major network developments that could potentially have an impact on traffic plying on the Asset include four-laning of Aligarh-Kannauj and Palwal-Tappal-Aligarh Road sections, and six-laning of the Ghaziabad-Aligarh Road. Besides, commissioning of the proposed Ganga Expressway will directly compete with a considerably sized long-distance traffic market plying on the Asset.

6.16 The following table presents the upcoming network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6-8: List of network/other developments

S. No.	Development	Route affected	Year of completion	Impact (+/-)
1.	Continued positive diversion from NH48-SH31	*Asset route* North-south NH19-NH52 corridor through Gwalior further south *Alternate route* North-south NH48-SH31 corridor through Chittorgarh and Jaora	FY23	+ve
2.	Palwal-Tappal-Aligarh	*Asset route* East-west NH 2 corridor connecting Delhi and Lucknow via Agra *Alternate route* Palwal region connected to Aligarh-Lucknow via Palwal-Tappal-Aligarh Road section y	FY24	-ve
3.	Delhi-Mumbai Expressway	*Asset route* North-south NH19 – NH52 corridor *Alternate route* Market 1: Delhi-Ratlam-Indore Market 2: Delhi-Mumbai via Delhi-Mumbai Expressway	FY24	-ve
4.	Ganga Expressway	*Asset route* Delhi-Agra-Lucknow through NH2/NH19 *Alternate route* East-west expressway between Meerut and Prayagraj	FY26	-ve

Source: Steer analysis

Impact assessment for network/other developments

6.17 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated from each of these. Please note that all traffic volumes for impacts were estimated as impact rates applied on FY20 AADT.

Continuance of FY20 impact diversion from NH48-SH31 in FY22

6.18 Long-distance north-south traffic between Delhi/north and Indore/Mumbai/south have two major routes. One is through NH19 (old NH2), NH44 and NH52 (old NH3) that connects Delhi with Indore through Agra (Asset Road) and Gwalior. The second is through NH48 (old NH8) and SH31 that connects Delhi and Indore through Jaipur, Chittorgarh and Jaora. For the past three years, six-laning of the NH48 sections between Kishangarh and Chittorgarh and four-laning of sections on NH52 have meant that traffic diverted between the two corridors. Since FY20, due to completion of sections on NH52 providing a more streamlined trip through the Asset route, heavy truck traffic has been observed to be shifting to the Asset corridor through NH19 and NH52.

6.19 Based on our studies on the NH48, and feeder toll road assets on the competing corridor, we understand that about 225 (75 3A and 150 MAV) trucks were lost from the parallel NH48-SH31 corridor through Chittorgarh and Indore connection in FY21. Further, we expect another 150 (50 3A and 100 MAV) trucks making up about 3-5% of AADT to divert in FY23 from the NH48-SH31 corridor to the Asset corridor. The table below presents these impacts.

Table 6-9: Impacts due to continued diversion from NH48-SH31

Vehicle type	FY23-FY25
Km74 Srinagar	
3A	4%
MAV	4%
Km94 Kotwan	
3A	3%
MAV	3%
Km164 Mahuvan	
3A	3%
MAV	3%

Source: Steer analysis

Construction-related vehicles for Jewar Airport and Jewar Metro

6.20 Apart from the diversion-related impacts, we have also separately identified potential for construction-related traffic for large infrastructure projects in the near term to have a traffic impact the Asset. Particularly, we have mapped regions with construction-related material being mined and produced like Dholpur, Dausa, Dadri, Saharanpur, Yamuna Nagar and Haldwani for projects like the Jewar Airport, Jewar Metro and the Delhi-Mumbai Expressway.

6.21 The table below presents these impacts by each infrastructure development foreseen in the short term, estimated using benchmarks. Understandably, impacts in the long term are already part of our background growth forecasted and cannot be separated out.

Table 6-10: Impacts due to construction-related movement for Jewar Airport and Metro

Vehicle type	FY23-FY25
Km164 Mahuvan	
2A	1.0%
3A	1.0%
MAV	1.0%

Source: Steer analysis

Delhi-Mumbai Expressway

6.22 The Delhi-Mumbai Expressway is a 1290-km long greenfield expressway being developed to provide an improved level of service to long-distance traffic between North and Western India, compared to the existing national highways that are already operating at high-capacity utilisation. Competing with the traditional north-south NH corridors - NH 2 corridor containing the Asset and the NH 8 corridor part of the Golden Quadrilateral, the upcoming Delhi-Mumbai Expressway could provide faster and unhindered connectivity, as illustrated in the map above.

6.23 As discussed earlier, we have considered two types of north-south movements for this impact, as these have distinct cost comparisons between the Asset corridor and the upcoming expressway:

- **Indore region**: The route through the expressway via Ratlam provides an alternate route for long-distance traffic to reach Indore. However, due to the last-mile connectivity through a road – Ratlam-Multhan-Dr Ambedkar Nagar with a lower level of service, there can be bias against the expressway for this trip segment.
- **Mumbai region and South India**: These movements currently use either NH 8 or NH 2 to play between Mumbai region, Kerala and Karnataka in the south, and Delhi and regions north. While Andhra Pradesh traffic already is part of the NH 44 route and therefore out of scope, we have not included Tamil Nadu in the in-scope traffic as we have observed recent shifts from other corridors to the NH 44 route. Overall, the route through expressway provides cost savings through unhindered, seamless and quicker travel with potentially competitive toll costs.

6.24 Assuming successful implementation of all the sections of both the expressway, we have estimated impacts as shown in the table below, using a GJC-based logit model. We have staged the impact over three years to account for a phased completion (40%, 80%, 100%) of various sections and gradual unfolding of the impacts. The staging is to account for the gradual network shift as the network stabilises with the expected completion of all sections of the Delhi-Mumbai Expressway in FY26.

Table 6-11: Combined impact due to completion of Delhi-Mumbai Expressway for Indore and Mumbai/South India region markets

Vehicle type	FY24	FY25	FY26
Km74 Srinagar			
CJV	(0.2%)	(0.4%)	(0.5%)
LCV	(1.2%)	(2.3%)	(2.9%)
2A	(1.8%)	(3.7%)	(4.6%)
3A	(6.9%)	(13.8%)	(13.5%)
MAV	(6.4%)	(12.7%)	(11.8%)
Km94 Kotwan			
CJV	(0.1%)	(0.3%)	(0.3%)
LCV	(0.9%)	(1.9%)	(2.3%)
2A	(2.2%)	(4.4%)	(5.5%)
3A	(5.9%)	(11.7%)	(12.2%)
MAV	(5.7%)	(11.5%)	(11.2%)
Km164 Mahuvan			
CJV	(0.1%)	(0.2%)	(0.2%)
LCV	(0.6%)	(1.1%)	(1.4%)
2A	(2.4%)	(4.7%)	(5.9%)
3A	(6.1%)	(12.2%)	(12.7%)
MAV	(5.8%)	(11.7%)	(11.7%)

Source: Steer analysis of Client OD data, TMS data and publicly available information

Palwal-Tappal-Aligarh

6.25 The Palwal-Tappal-Aligarh Road is a two-laned section that is a key connection between the region south of Central NCR and Aligarh-Lucknow corridor. The road is currently under expansion to 4 lane tolled road. For long-distance traffic between Central NCR, west and northwest, and Lucknow and east, this upgrade would improve the level of service of the alternate corridor connecting the regions west and northwest of Central NCR with the region east of Lucknow.

6.26 The table below presents the estimated impact due to the upgrade at the Asset's toll plazas, derived using a GJC-based logit model.

Table 6-12: Impact due to upgrade of Palwal-Tappal-Aligarh

Vehicle type	Km74 Srinagar		Km94 Kotwan		km164 Mahuvan	
	FY24	**FY25**	**FY24**	**FY25**	**FY24**	**FY25**
Staging	*50%*	*100%*	*50%*	*100%*	*50%*	*100%*
CJV	(0.3%)	(0.7%)	(0.4%)	(0.7%)	(0.1%)	(0.1%)
LCV	(1%)	(2%)	(1%)	(2%)	(1%)	(1%)
2A	(2%)	(3%)	(1%)	(2%)	(2%)	(3%)
3A	(2%)	(4%)	(2%)	(4%)	(3%)	(5%)
MAV	(2%)	(4%)	(2%)	(4%)	(3%)	(5%)

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Ganga Expressway

6.27 The Ganga Expressway is a 596-km long greenfield expressway being developed to provide an improved level of service to long-distance traffic between western and eastern India. Competing with the traditional east-west NH corridors - NH 2 corridor containing the Asset and the Delhi-Agra-Lucknow and Purvanchal Expressways, the upcoming Ganga Expressway could provide faster and unhindered connectivity, as illustrated in the map above.

6.28 We have considered two types of east-west movements for this impact, as these have distinct cost comparisons between the Asset corridor and the upcoming expressway:

- **Delhi region**: The route through the expressway provides a competitive route for long-distance traffic from Delhi and west to reach Lucknow and east. While toll costs are favourable for the Asset route, distance and time costs are lower on the expressway.
- **Northwest of Delhi**: These movements currently use either NH 8 or NH 2 to play between Mumbai region and South India in the south, and Delhi and regions north. The route through expressway provides both toll and distance cost savings and therefore a significant proportion of traffic will shift to the expressway.

6.29 Assuming successful implementation of all the sections of both the expressway, we have estimated impacts as shown in the table below, using a GJC-based logit model. We have staged the impact over two years to account for a phased completion of various sections and gradual unfolding of the impacts. The staging is to account for the gradual network shift as the network stabilises with completion of all sections of the Ganga Expressway in FY27.

Table 6-13: Combined impact due to completion of Ganga Expressway for Delhi/west and Northwest of Delhi region markets

Vehicle Class	FY26	FY28
Km74 Srinagar		
CJV	(0.0%)	(0.1%)
LCV	(1%)	(2%)
2A	(2%)	(3%)
3A	(2%)	(4%)
MAV	(3%)	(5%)
Km94 Kotwan		
CJV	(0.0%)	(0.1%)
LCV	(1%)	(2%)
2A	(2%)	(3%)
3A	(1%)	(3%)
MAV	(2%)	(4%)
Km164 Mahuvan		
CJV	(0.0%)	(0.1%)
LCV	(1%)	(2%)
2A	(1%)	(3%)
3A	(2%)	(3%)
MAV	(2%)	(4%)

Source: Steer analysis of Client OD data, TMS data and publicly available information

6.30 As discussed earlier, the impacts are larger at the toll plazas other than km46 given that long-distance traffic connecting north of Delhi can bypass the same using the peripheral expressways. Even though TP2 has additional long-distance traffic (avoiding the KMP Expressway and km74 Srinagar and) joining the Asset Road at Hodal through MDR132, we believe this is out of scope for this impact as the route alignments are very different and this additional traffic already exhibits sensitivity to tolling which is higher on the expressway for the Delhi markets.

Yamuna Expressway (no impact has been assumed)

6.31 The Yamuna Expressway (YE) is a 165-km-long access-controlled six-lane expressway connecting Greater Noida and Agra. In terms of the end points of the road, it is similar to the asset with the asset ending in Faridabad. However, it primarily serves leisure and tourist trips by cars and tourist buses, with a small share of goods traffic as well.

6.32 To understand whether the expressway poses any diversion threat to the Asset, we have considered two traffic markets:

- Trips with one end in Delhi and travelling to Agra and beyond
- Trips with one end north of Delhi and travelling to Agra and beyond

6.33 For these two markets, we have compared the year-wise toll profile in the forecast years for CJV and MAV. For the asset, we have used the toll evolution as explained in the next section (Revenue Forecasting Assumptions). For the expressway, we have made assumptions based on

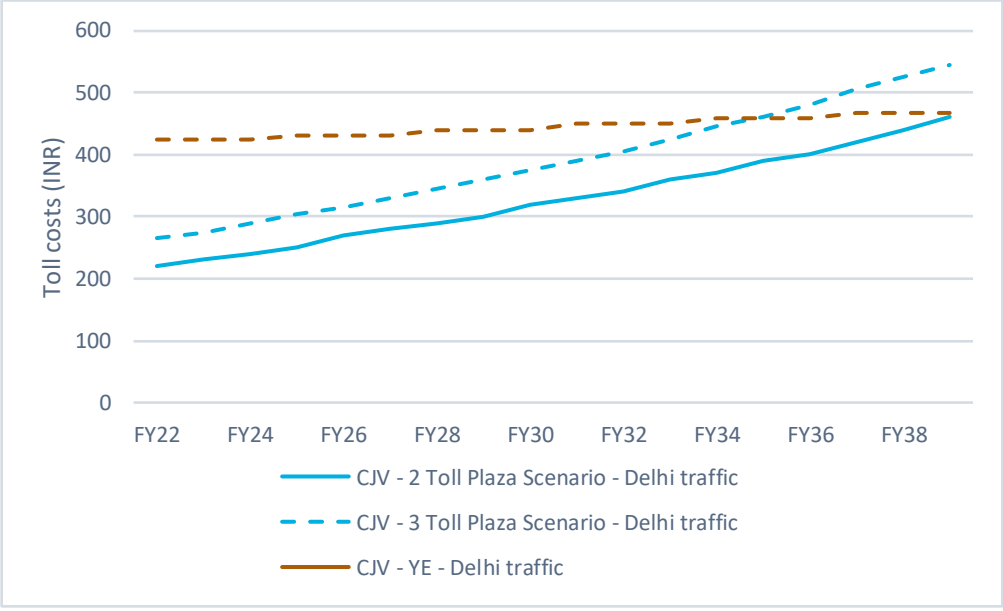
limited information available publicly and based on information from industry contacts and the Client. The expressway was commissioned in FY13 and continued with the same toll rate until FY17/FY18 when there was the first toll fee revision. The next fee revision of a 2-3% increase was expected in FY20 but did not happen. We have assumed this to happen in FY22 with subsequent revisions of the same increase rate to happen every three years.

6.34 As already discussed earlier about the sticky nature of both Delhi and North-of-Delhi long-distance traffic on the Asset due to different trip purposes (leisure and tourism) dominating on the expressway, the toll cost comparison further illustrates the lower toll cost for both cars (those currently preferring the Asset) and trucks until FY34 for the Delhi market and FY38 for the North-of-Delhi market.

6.35 For the Delhi market, traffic will cross three new toll plazas (km46, km94, km164) in the '3Toll Plaza' scenario with fresh tolling on KM46 on which an additional structure cost is being added, leading to a higher toll cost compared to '2 Toll Plaza' scenario. However, for the North-of-Delhi traffic market that reaches the Asset through the peripheral expressways (EPE and KMP), vehicles in the '3 Toll Plaza' scenario will cross only two new toll plazas (km94, km164) with lower total payable toll length, paying for only 120kms instead of 180kms of tollable length.

6.36 The charts below show a comparison of the toll costs for CJV for the two markets considered. For the future '3 Toll Plaza' Scenario, we see that costs are higher than in the '2 Toll Plaza' Scenario for Delhi market due to the additional structural costs at km46 though the distance covered is the same.

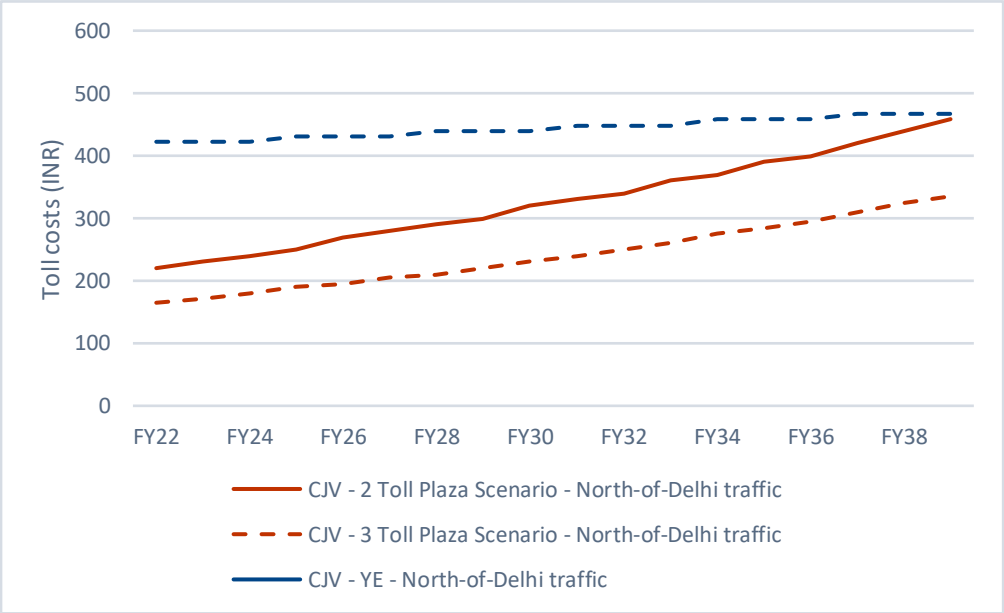
Figure 6.2: Toll costs (INR) of Delhi long-distance CJV traffic for Asset vs expressway route



Source: Steer analysis

6.37 In contrast, for the North-of-Delhi market, we see that costs in the '3 Toll Plaza' Scenario are lower than in the '2 Toll Plaza' Scenario due to the lower tollable distance covered (km46 is not passed). However, toll costs in both these scenarios on the Asset are much lower than on the Yamuna Expressway.

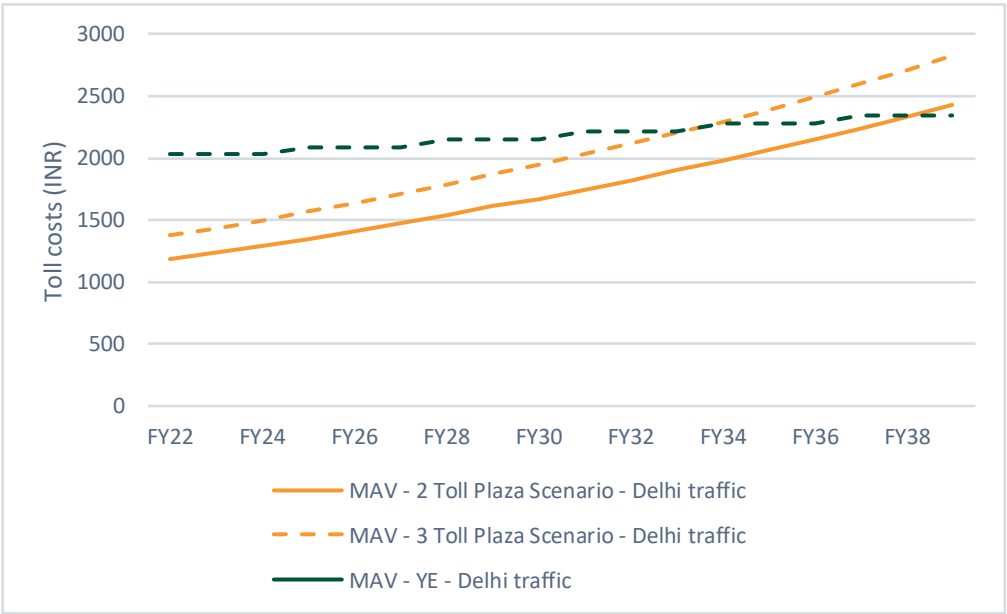
Figure 6.3: Toll costs (INR) of North-of-Delhi long-distance CJV traffic for Asset vs expressway route



Source: Steer analysis

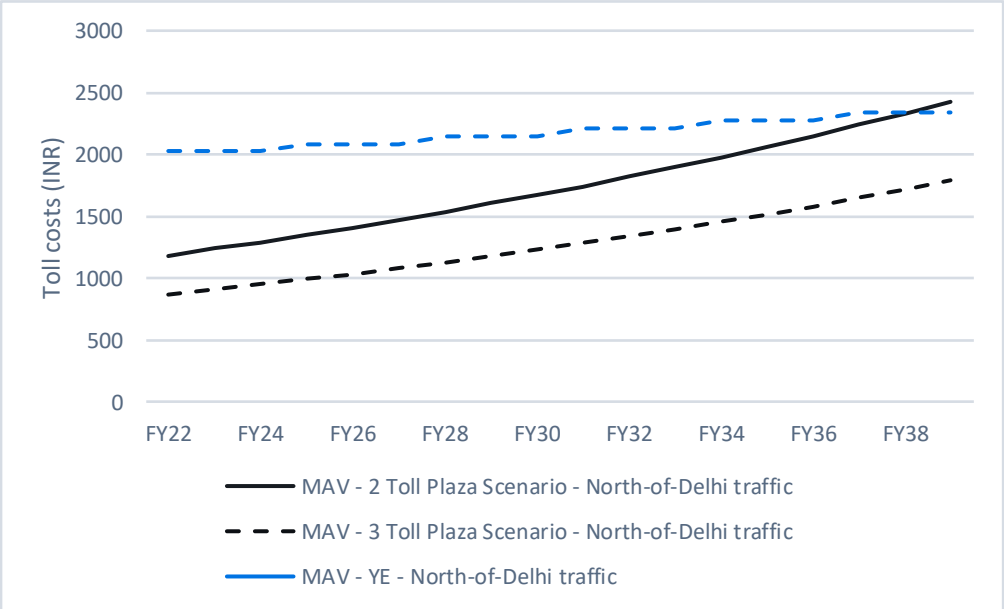
6.38 Likewise, the charts below show a comparison of the toll costs for MAV for the two markets considered. We see similar observations to CJV for MAV. The Delhi traffic market passes km46 in the '3 Toll Plaza' market and pays higher due to additional structure costs, whereas the North-of-Delhi traffic market pays lower. Again, toll costs in both these scenarios on the Asset are lower than on the Yamuna Expressway.

Figure 6.4: Toll costs (INR) of Delhi long-distance MAV traffic for Asset vs expressway route



Source: Steer analysis

Figure 6.5: Toll costs (INR) of North-of-Delhi long-distance MAV traffic for Asset vs expressway route



Source: Steer analysis

6.39 Our assumption for the toll revision on the expressway considers a slow increase as per the rate and frequency of increase seen over the operational period so far. It is possible that the expressway will have a much faster or yearly and higher toll increase, depending on the change in toll revision policies. Therefore, we do not foresee any impact of diversion to the Yamuna Expressway during the concession period.

Summary of impact assessments

6.40 The table below summarises the potential impacts on the Asset due to the several ongoing and foreseen improvements on the alternate routes, the Asset route and other regulatory developments.

Table 6-14: Summary of impact assessments

Impact	Year of impact	Probability/ scale of impact	In-scope traffic	Direction of impact (+/-)
Construction of Jewar airport and metro Includes construction-related material moving from Dholpur	FY23-FY25	Medium	Construction-related material moving from Dholpur	**+ve**
Continued diversion from NH48-SH31 Another year of positive impact due to diversion from parallel corridor	FY23-FY25	High	Both north-south and east-west long-distance traffic using the Asset	**+ve**
Delhi-Mumbai Expressway Diversion impact from competing under-	FY24-FY26	High	Traffic plying between Indore region and Delhi/north	**-ve**

Impact	Year of impact	Probability/ scale of impact	In-scope traffic	Direction of impact (+/-)
construction north-south expressway connecting Delhi to Mumbai			Traffic plying between Mumbai region and South India at one end, and Delhi/north at the other	**-ve**
Palwal-Tappal-Aligarh Diversion impact due to improved feeder route to alternate corridor	FY24-FY25	High	Trips between Delhi/west/northwest at one end and Lucknow and east at the other	**-ve**
Ganga Expressway Diversion impact from upcoming and competing east-west expressway connecting Delhi to Mumbai	FY26	Medium	Trips between northwest of Delhi, and Lucknow and east	**-ve**
			Trips between Delhi and west, and Lucknow and east	**-ve**

Source: Steer analysis of OD data, Client TMS data and publicly available information

Revenue forecasting assumptions

6.41 To forecast the revenues for a forecast year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate. While toll segmentation provides the breakup of trips paying each ticket type, trip factors provide the conversion factor to convert from traffic (trips) to tickets sold. This section discusses assumptions related to toll segmentation, trip factors and toll rates for the forecast period.

Toll evolution

6.42 Based on the concession agreement and the gazetted toll notification, we see that base toll rates increase every year based on WPI-linked inflation to provide us unrounded toll rates. These are rounded up to the nearest five to estimate the rounded toll rates charged to the road user. We have used actual toll rates from FY19 to FY23 toll notifications to validate the modelling of the toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually taper. With a smaller WPI growth at 2.0% in FY22 due to COVID impacts, WPI growth is assumed to start at 4.7% in FY23, followed by an increase to 5.5% by FY26, before eventually tapering down to 4.0% in FY30.

Table 6-15: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23	14.3%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%

Financial year	WPI growth (%)
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33 onwards	4.0%

Source: Shared by Client

6.43 The table below gives an overview of toll estimation.

Table 6-16: Toll estimation overview

Toll fee escalation	Revision date	Nearest rounding
Linked to 100% WPI increase	July	5

Source: Concession agreement and toll notification

Toll segmentation and trip factors

6.44 We have analysed the historical TMS data split by toll categories, to understand trends, as shown in Chapter 3. In FY21, we observed a significant reduction in share of exemptions and violations due to FASTag implementation and penetration. From FY22 we have taken reported segmentation and have used the same going forward., as shown in the tables below.

Table 6-17: Toll segmentation for the base year of long-term forecasts FY22 TP1, Km74

Forecast	CJV	LCV	Bus	2A	3A/MAV
	FY22	FY22	FY22	FY22	FY22
Single	34%	56%	29%	84%	90%
Return	40%	42%	70%	15%	10%
Monthly	0%	0%	0%	0%	0%
Local personal	15%	0%	0%	0%	0%
Exemptions & violations	11%	2%	1%	1%	0%

Source: Steer analysis of Client TMS data

Table 6-18: Toll segmentation for the base year of long-term forecasts FY22 TP2, Km164

Forecast	CJV	LCV	Bus	2A	3A/MAV
	FY22	FY22	FY22	FY22	FY22
Single	33%	57%	26%	82%	89%
Return	47%	37%	74%	17%	10%
Monthly	0%	0%	0%	0%	0%
Local personal	10%	0%	0%	0%	0%
Exemptions & violations	10%	6%	0%	1%	1%

Source: Steer analysis of Client TMS data

6.45 The shares for the upcoming toll plazas at km46 and km94 follow the forecast assumptions for km74 closely. The exemptions and violations here were derived from the TVC-TMS comparison based on TVC counts conducted in Q4 2021.

6.46 As for trip factors, based on the implementation of FASTag rules followed by NHAI order restricting sale of discounted passes by cash and our experience across toll roads, we have assumed trip factors as 1, 2 and 50 for Single, Return and Monthly categories, respectively.

6.47 There is no major toll category being charged, apart from the official list of toll categories in the toll notification. This assumes that further changes in toll categories, unless specific discounts are offered, are unlikely.

Traffic and Revenue forecasts

6.48 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU forecast growth rates and CAGRs on this Asset for the upcoming toll plazas. Further, Appendix B presents the AADT and revenues for the forecast period.

Table 6-19: Final traffic forecast, km46 Prithila

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	30,016	32,676	48,827	71,211	1,00,794	1,47,064
Mini LCV	3,242	3,302	3,600	3,904	4,205	4,559
LCV	2,355	2,398	2,626	2,860	3,098	3,386
Bus	1,000	1,031	1,136	1,237	1,340	1,464
2A	1,254	1,324	1,743	2,254	2,881	3,810
3A	1,409	1,498	2,039	2,720	3,582	4,901
MAV	2,200	2,366	3,325	4,562	6,170	8,702
OSV	28	31	44	63	88	129
AADT	**41,504**	**44,625**	**63,342**	**88,812**	**1,22,159**	**1,74,015**
PCU's	**55,712**	**59,667**	**83,122**	**1,14,511**	**1,55,347**	**2,18,688**

Source: Steer analysis

Table 6-20: Background traffic growth rates (%), km46 Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	8.9%	8.4%	7.8%	7.20%	6.5%	7.4%
Mini LCV	1.8%	1.7%	1.6%	1.50%	1.4%	1.5%
LCV	1.8%	1.8%	1.7%	1.61%	1.5%	1.7%
Bus	3.1%	2.0%	1.7%	1.61%	1.5%	1.7%
2A	5.7%	5.7%	5.3%	5.03%	4.8%	5.2%
3A	6.4%	6.4%	5.9%	5.66%	5.4%	5.8%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
MAV	7.5%	7.0%	6.5%	6.23%	5.9%	6.4%
OSV	7.8%	7.8%	7.3%	6.92%	6.6%	7.1%
AADT	**7.5%**	**7.3%**	**7.0%**	**6.58%**	**6.1%**	**6.7%**
PCU's	**7.1%**	**6.9%**	**6.6%**	**6.29%**	**5.9%**	**6.4%**

Source: Steer analysis

Table 6-21: Final revenue forecast (INR crores), km46 Prithila

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	35.5	67.2	143.7	260.9	460.0	883.0
Mini LCV	5.3	9.8	15.3	20.6	27.7	39.5
LCV	6.2	11.3	17.3	23.5	31.8	45.8
Bus	5.6	9.8	15.3	20.8	28.1	40.3
2A	8.1	14.7	27.3	44.4	70.4	122.6
3A	14.6	25.9	50.1	83.6	137.3	246.1
MAV	22.8	40.9	81.8	140.2	236.5	437.0
OSV	0.3	0.6	1.2	2.1	3.6	7.0
Total	**98.4**	**180.0**	**351.9**	**596.1**	**995.5**	**1,821.3**

Source: Steer analysis

Table 6-22: Revenue growth rates (%), km46 Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	89.3%	16.4%	12.7%	12.0%	11.5%	13.0%
Mini LCV	84.9%	9.4%	6.2%	6.1%	6.1%	6.9%
LCV	81.1%	9.0%	6.3%	6.2%	6.3%	6.9%
Bus	75.3%	9.2%	6.4%	6.2%	6.2%	7.0%
2A	80.9%	13.2%	10.2%	9.7%	9.7%	10.6%
3A	77.4%	14.1%	10.8%	10.4%	10.2%	11.3%
MAV	79.3%	14.9%	11.4%	11.0%	10.8%	11.9%
OSV	87.6%	15.4%	12.2%	11.8%	11.5%	12.6%
Total	**83.0%**	**14.3%**	11.1%	**10.8%**	10.6%	11.6%

Source: Steer analysis

Table 6-23: Final traffic forecast, km94 Kotwan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,588	17,928	26,142	37,681	53,080	77,692
Mini LCV	1,453	1,467	1,540	1,616	1,692	1,781

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
LCV	1,555	1,583	1,624	1,769	1,916	2,093
Bus	842	868	957	1,042	1,129	1,233
2A	2,944	3,110	3,652	4,722	6,035	7,981
3A	2,302	2,511	2,691	3,590	4,728	6,468
MAV	3,345	3,701	4,086	5,604	7,580	10,692
OSV	6	6	9	12	17	25
AADT	**29,034**	**31,175**	**40,700**	**56,036**	**76,177**	**1,07,966**
PCU's	**50,530**	**54,398**	**66,553**	**89,954**	**1,20,295**	**1,67,713**

Source: Steer analysis

Table 6-24: Background traffic growth rates (%), km94 Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	8.1%	7.8%	7.6%	7.09%	6.6%	7.2%
Mini LCV	1.0%	1.0%	1.0%	0.92%	0.9%	0.9%
LCV	1.8%	0.5%	1.7%	1.61%	1.5%	1.3%
Bus	3.1%	2.0%	1.7%	1.61%	1.5%	1.7%
2A	5.7%	3.3%	5.3%	5.03%	4.8%	4.6%
3A	9.1%	1.4%	5.9%	5.66%	5.4%	4.6%
MAV	10.7%	2.0%	6.5%	6.23%	5.9%	5.2%
OSV	7.8%	7.8%	7.3%	6.92%	6.6%	7.1%
AADT	**7.4%**	**5.5%**	**6.6%**	**6.33%**	**6.0%**	**6.1%**
PCU's	**7.7%**	**4.1%**	**6.2%**	**5.99%**	**5.7%**	**5.5%**

Source: Steer analysis

Table 6-25: Final revenue forecast (INR crores), km94 Kotwan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	31.7	34.4	70.3	128.5	225.2	433.4
Mini LCV	3.6	3.7	5.4	7.2	9.4	13.0
LCV	6.2	6.5	9.3	12.7	17.1	24.6
Bus	6.5	6.7	10.5	14.4	19.4	27.7
2A	27.2	29.3	48.7	79.5	126.2	218.4
3A	33.8	38.2	58.0	96.7	159.2	285.8
MAV	49.2	56.3	88.0	151.0	255.3	472.3
OSV	0.1	0.1	0.2	0.3	0.6	1.1
Total	**158.2**	**175.2**	**290.3**	**490.3**	**812.5**	**1,476.3**

Source: Steer analysis

Table 6-26: Revenue growth rates (%), km94 Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY43
CJV	8.5%	15.4%	12.8%	11.9%	11.5%	12.8%
Mini LCV	0.6%	8.1%	5.9%	5.5%	5.6%	6.2%
LCV	4.2%	7.6%	6.4%	6.2%	6.2%	6.6%
Bus	3.9%	9.3%	6.5%	6.2%	6.1%	7.0%
2A	8.1%	10.7%	10.3%	9.7%	9.6%	10.0%
3A	12.9%	8.7%	10.8%	10.5%	10.2%	10.1%
MAV	14.5%	9.4%	11.4%	11.1%	10.8%	10.7%
OSV	9.1%	15.5%	12.2%	11.7%	11.5%	12.7%
Total	**10.7%**	**10.6%**	**11.0%**	**10.6%**	**10.5%**	**10.7%**

Source: Steer analysis

Table 6-27: Final traffic forecast, km164 Mahuvan (new)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,532	16,366	22,843	31,221	44,185
Mini LCV	1,535	1,550	1,627	1,707	1,787	1,882
LCV	1,383	1,408	1,473	1,604	1,737	1,899
Bus	868	894	985	1,073	1,163	1,271
2A	2,968	3,124	3,359	4,078	4,908	6,060
3A	2,453	2,701	2,812	3,751	4,939	6,758
MAV	3,637	4,063	4,373	5,998	8,112	11,443
OSV	6	7	10	14	19	28
AADT	**23,593**	**25,279**	**31,005**	**41,069**	**53,887**	**73,524**
PCU's	**46,151**	**49,798**	**57,231**	**75,010**	**97,518**	**1,31,910**

Source: Steer analysis

Table 6-28: Background traffic growth rates (%), km164 Mahuvan (new)

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	7.3%	7.3%	6.9%	6.45%	6.0%	6.6%
Mini LCV	1.0%	1.0%	1.0%	0.92%	0.9%	0.9%
LCV	1.8%	0.9%	1.7%	1.61%	1.5%	1.4%
Bus	3.1%	2.0%	1.7%	1.61%	1.5%	1.7%
2A	5.3%	1.5%	4.0%	3.77%	3.6%	3.2%
3A	10.1%	0.8%	5.9%	5.66%	5.4%	4.5%
MAV	11.7%	1.5%	6.5%	6.23%	5.9%	5.1%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
OSV	7.8%	7.8%	7.3%	6.92%	6.6%	7.1%
AADT	**7.1%**	**4.2%**	**5.8%**	**5.58%**	**5.3%**	**5.2%**
PCU's	**7.9%**	**2.8%**	**5.6%**	**5.39%**	**5.2%**	**4.7%**

Source: Steer analysis

Table 6-29: Final revenue forecast (INR crores), km164 Mahuvan (new)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	23.4	25.3	50.0	88.0	150.7	281.3
Mini LCV	4.1	4.2	6.1	8.0	10.5	14.6
LCV	5.9	6.0	8.9	12.2	16.6	23.6
Bus	7.4	7.7	12.0	16.4	22.2	31.8
2A	29.7	32.2	48.6	73.9	111.3	179.6
3A	39.5	45.1	66.2	110.5	181.5	325.4
MAV	58.6	67.8	102.9	176.7	298.1	551.0
OSV	0.1	0.1	0.3	0.5	0.9	1.6
Total	**168.8**	**188.5**	**294.9**	**486.2**	**791.6**	**1,408.8**

Source: Steer analysis

Table 6-30: Revenue growth rates (%), km164 Mahuvan (new)

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	8.1%	14.6%	12.0%	11.34%	11.0%	12.2%
Mini LCV	2.3%	7.8%	5.7%	5.65%	5.6%	6.2%
LCV	1.7%	8.1%	6.4%	6.38%	6.1%	6.7%
Bus	3.6%	9.2%	6.5%	6.21%	6.2%	7.0%
2A	8.3%	8.6%	8.8%	8.53%	8.3%	8.5%
3A	14.2%	8.0%	10.8%	10.43%	10.2%	9.9%
MAV	15.8%	8.7%	11.4%	11.02%	10.8%	10.5%
OSV	8.8%	15.6%	12.2%	11.77%	11.4%	12.7%
AADT	**11.7%**	**9.4%**	**10.5%**	**10.24%**	**10.1%**	**10.1%**
PCU's	**8.1%**	**14.6%**	**12.0%**	**11.34%**	**11.0%**	**12.2%**

Source: Steer analysis

6.49 In addition to the future toll plazas above, the table below present the forecast traffic growth rates estimated for the operational toll plazas. Please note we are expecting that TP1 Km74 to be decommissioned. Therefore, growth rates and revenue tables has not been shown below:

Table 6-31: Final traffic forecast, km74 Srinagar

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,981	18,432	26,837	38,570	54,185	79,066
Mini LCV	996	1,005	1,051	1,098	1,144	1,199
LCV	1,377	1,402	1,427	1,554	1,684	1,840
Bus	850	876	965	1,051	1,138	1,244
2A	2,194	2,318	2,712	3,507	4,483	5,928
3A	1,799	1,983	2,030	2,708	3,566	4,879
MAV	3,104	3,476	3,729	5,116	6,919	9,759
OSV	12	13	19	27	38	56
AADT	**27,313**	**29,506**	**38,771**	**53,632**	**73,157**	**1,03,971**
PCU's	**45,640**	**49,464**	**60,470**	**82,074**	**1,10,139**	**1,54,059**

Source: Steer analysis

Table 6-32: Background traffic growth rates (%), km74 Srinagar

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY44
CJV	8.5%	7.8%	7.5%	7.03%	6.5%	7.2%
Mini LCV	0.9%	0.9%	0.9%	0.83%	0.8%	0.8%
LCV	1.8%	0.4%	1.7%	1.61%	1.5%	1.3%
Bus	3.1%	2.0%	1.7%	1.61%	1.5%	1.7%
2A	5.7%	3.2%	5.3%	5.03%	4.8%	4.6%
3A	10.2%	0.5%	5.9%	5.66%	5.4%	4.4%
MAV	12.0%	1.4%	6.5%	6.23%	5.9%	5.0%
OSV	7.8%	7.8%	7.3%	6.92%	6.6%	7.1%
AADT	**8.0%**	**5.6%**	**6.7%**	**6.41%**	**6.0%**	**6.2%**
PCU's	**8.4%**	**4.1%**	**6.3%**	**6.06%**	**5.8%**	**5.6%**

Source: Steer analysis

Table 6-33: Final traffic forecast, km164 Mahuvan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,532	16,366	22,843	31,221	44,185
Mini LCV	1,535	1,550	1,627	1,707	1,787	1,882
LCV	1,383	1,408	1,473	1,604	1,737	1,899
Bus	868	894	985	1,073	1,163	1,271
2A	2,968	3,124	3,359	4,078	4,908	6,060
3A	2,453	2,701	2,812	3,751	4,939	6,758
MAV	3,637	4,063	4,373	5,998	8,112	11,443

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
OSV	6	7	10	14	19	28
AADT	**23,593**	**25,279**	**31,005**	**41,069**	**53,887**	**73,524**
PCU's	**46,151**	**49,798**	**57,231**	**75,010**	**97,518**	**1,31,910**

Source: Steer analysis

Table 6-34: Background traffic growth rates (%), km164 Mahuvan

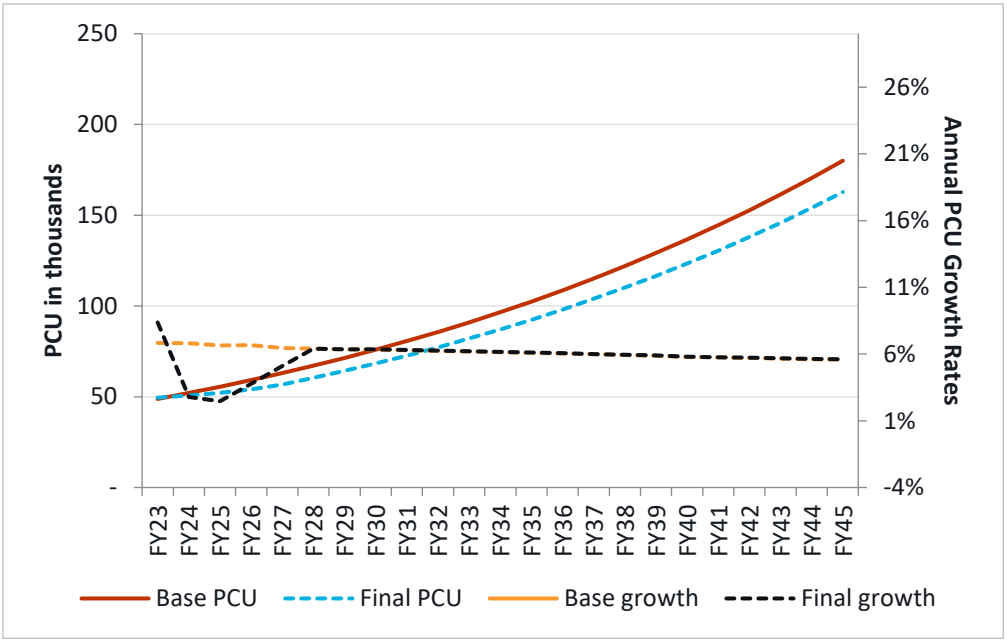
Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY43	FY23-FY43
CJV	7.3%	7.3%	6.9%	6.45%	6.0%	6.6%
Mini LCV	1.0%	1.0%	1.0%	0.92%	0.9%	0.9%
LCV	1.8%	0.9%	1.7%	1.61%	1.5%	1.4%
Bus	3.1%	2.0%	1.7%	1.61%	1.5%	1.7%
2A	5.3%	1.5%	4.0%	3.77%	3.6%	3.2%
3A	10.1%	0.8%	5.9%	5.66%	5.4%	4.5%
MAV	11.7%	1.5%	6.5%	6.23%	5.9%	5.1%
OSV	7.8%	7.8%	7.3%	6.92%	6.6%	7.1%
AADT	**7.1%**	**4.2%**	**5.8%**	**5.58%**	**5.3%**	**5.2%**
PCU's	**7.9%**	**2.8%**	**5.6%**	**5.39%**	**5.2%**	**4.7%**

Source: Steer analysis

6.50 As presented in the tables above, forecast CAGRs (FY23-FY44) in terms of PCUs (background plus impacts) for km74 and km164 are 5.6% and 4.7% respectively, While the background growth is primarily driven by car and heavy truck growth, the major difference between final and background growth rates (as also seen in the chart below) is driven by three impacts in the first seven-year period – negative diversions due to Delhi-Mumbai and Ganga Expressways, and four-laning of Palwal-Tappal-Aligarh-Kannauj sections. Final PCU growth rates in the same period for the upcoming toll plazas km46 and km94 are 6.4% and 5.5%, respectively.

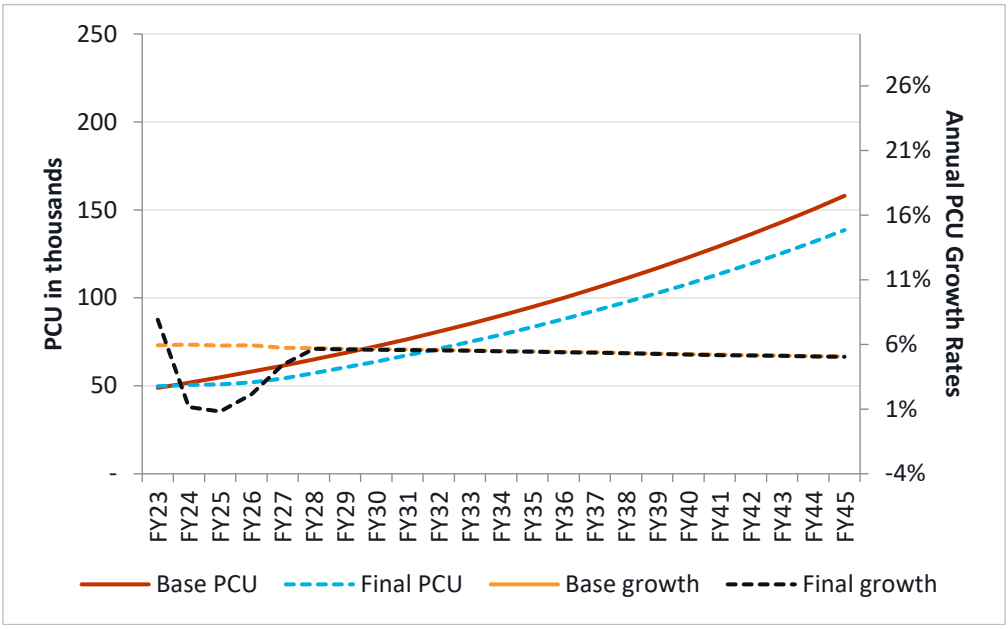
6.51 The figures below show the total traffic volumes and growth rates in terms of PCUs for operational and upcoming/planned toll plazas, for both background and final (background + impact) growth.

Figure 6.6: Traffic and growth rates for forecast PCUs - Background and final, km74 Srinagar



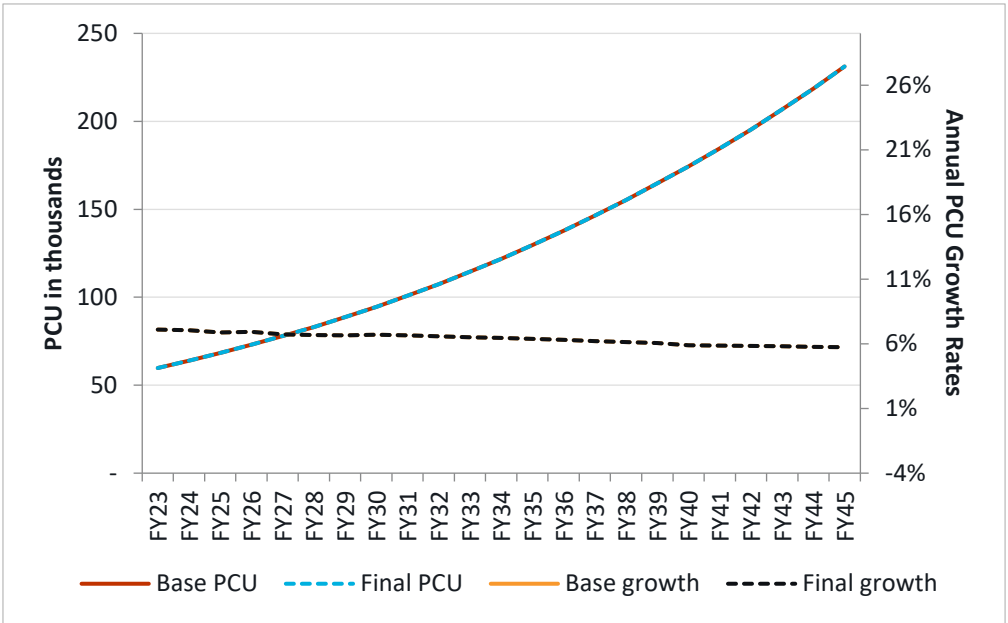
Source: Steer analysis

Figure 6.7: Traffic and growth rates for forecast PCUs - Background and final, km164 Mahuvan



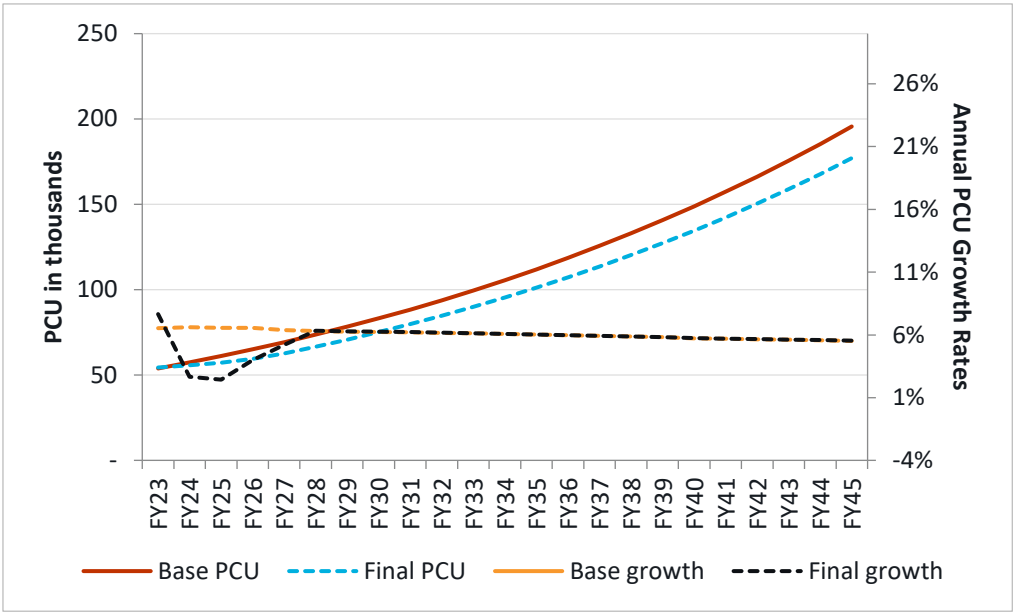
Source: Steer analysis

Figure 6.8: Traffic and growth rates for forecast PCUs - Background and final, km46 Prithila



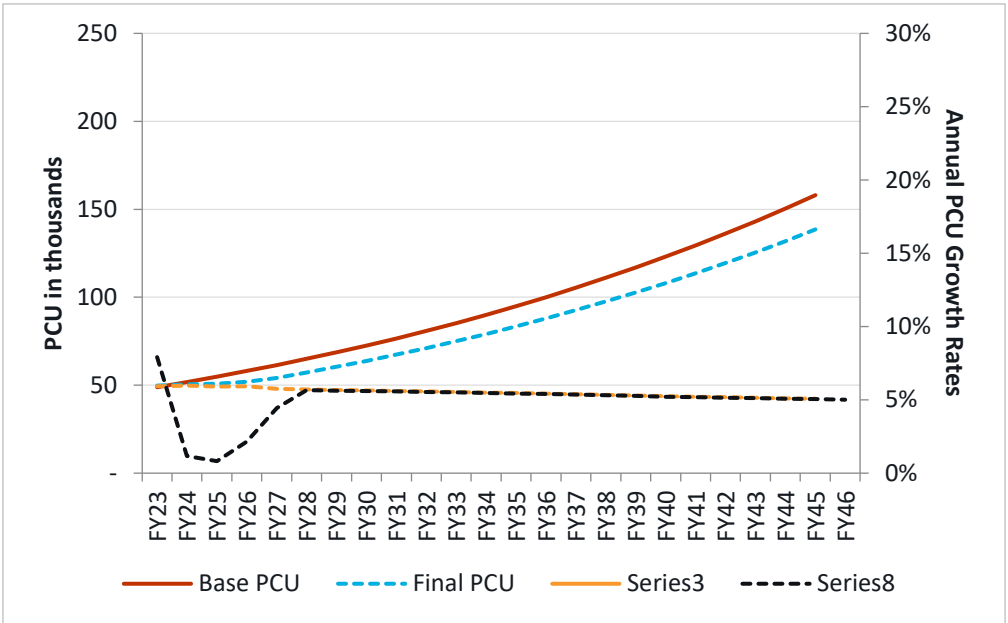
Source: Steer analysis

Figure 6.9: Traffic and growth rates for forecast PCUs - Background and final, km94 Kotwan



Source: Steer analysis

Figure 6.10: Traffic and growth rates for forecast PCUs - Background and final, km164 (new)



Source: Steer analysis

Upside and Downside Cases

6.52 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.53 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.54 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.35: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
DATL	GDP/GSDP	+1% every year	-1% every year
DATL	WPI	+1% every year	-1% every year
DATL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.55 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside

(optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.56 The upside case impacts included in forecasts are summarised in below:

Table 6.36: Summary of impacts on the Assets

Impact	Construction of Jewar airport and metro and NH3 diversion.	Delhi-Mumbai Expressway	Palwal-Tappal-Aligarh	Ganga Expressway
Year of Impact	**FY23-FY25**	**FY24 onwards**	**FY24 onwards**	**FY26 onwards**
KM-74 Srinagar	3A: 3.7% MAV: 4.1%	CJV: -0.3% LCV: -2.2% 2A: -3.5% 3A: -10.2% MAV: -8.8%	CJV: -0.5% LCV: -1.6% 2A: -2.3% 3A: -3.1% MAV: -2.7%	CJV: -0.1% LCV: -1.5% 2A: -2.6% 3A: -3.2% MAV: -3.8%
KM-164 Mahuvan	2A: 1.0% 3A: 3.5% MAV: 3.9%	CJV: -0.1% LCV: -1.1% 2A: -4.4% 3A: -9.5% MAV: -8.7%	CJV: -0.1% LCV: -0.9% 2A: -2.4% 3A: -3.8% MAV: -3.9%	CJV: -0.1% LCV: -1.4% 2A: -2.0% 3A: -2.3% MAV: -2.7%
KM-46 Prithila	--	--	--	--
KM-94 Kotwan	3A: 2.6% MAV: 2.9%	CJV: -0.2% LCV: -1.8% 2A: -4.1% 3A: -9.1% MAV: -8.4%	CJV: -0.5% LCV: -1.3% 2A: -1.6% 3A: -3.1% MAV: -3.1%	CJV: -0.1% LCV: -2.3% 2A: -3.2% 3A: -2.9% MAV: -3.9%
KM-164	2A: 1.0% 3A: 3.5% MAV: 3.9%	CJV: -0.1% LCV: -1.1% 2A: -4.4% 3A: -9.5% MAV: -8.7%	CJV: -0.1% LCV: -0.9% 2A: -2.4% 3A: -3.8% MAV: -3.9%	CJV: -0.1% LCV: -1.4% 2A: -2.0% 3A: -2.3% MAV: -2.7%

Source: Steer analysis of OD data, and publicly available information

Impacts-Downside Case

6.57 The downside case impacts included in forecasts are summarised in below:

Table 6.37: Summary of impacts on the Assets

Impact	Construction of Jewar airport and metro and NH3 diversion.	Delhi-Mumbai Expressway	Palwal-Tappal-Aligarh	Ganga Expressway
Year of Impact	**FY23-FY25**	**FY24 onwards**	**FY24 onwards**	**FY26 onwards**
KM-74 Srinagar	3A: 3.7% MAV: 4.1%	CJV: -0.6% LCV: -3.7% 2A: -5.8% 3A: -16.9% MAV: -14.7%	CJV: -0.9% LCV: -2.6% 2A: -3.8% 3A: -5.2% MAV: -4.6%	CJV: -0.1% LCV: -2.5% 2A: -4.4% 3A: -5.4% MAV: -6.4%
KM-164 Mahuvan	2A: 1.0% 3A: 3.5% MAV: 3.9%	CJV: -0.2% LCV: -1.8% 2A: -7.4% 3A: -15.8% MAV: -14.6%	CJV: -0.2% LCV: -1.5% 2A: -4.0% 3A: -6.4% MAV: -6.5%	CJV: -0.1% LCV: -2.4% 2A: -3.4% 3A: -3.8% MAV: -4.5%
KM-46 Prithila	--	--	--	--
KM-94 Kotwan	3A: 2.6% MAV: 2.9%	CJV: -0.4% LCV: -2.9% 2A: -6.9% 3A: -15.2% MAV: -14.0%	CJV: -0.9% LCV: -2.2% 2A: -2.6% 3A: -5.1% MAV: -5.1%	CJV: -0.1% LCV: -2.3% 2A: -3.2% 3A: -2.9% MAV: -3.9%
KM-164	2A: 1.0% 3A: 3.5% MAV: 3.9%	CJV: -0.2% LCV: -1.8% 2A: -7.4% 3A: -15.8% MAV: -14.6%	CJV: -0.2% LCV: -1.5% 2A: -4.0% 3A: -6.4% MAV: -6.5%	CJV: -0.1% LCV: -2.4% 2A: -3.4% 3A: -3.8% MAV: -4.5%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.58 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case. Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.38: Traffic forecast (With Upside Impacts) for KM 74: Srinagar

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,981	18,795	30,105	47,343	72,638	117,531
Mini LCV	996	1,008	1,065	1,126	1,188	1,263
Bus	1,377	1,409	1,494	1,663	1,841	2,062
LCV	850	882	995	1,108	1,227	1,374
2A	2,194	2,349	3,035	4,193	5,722	8,174

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
3A	1,799	2,013	2,381	3,420	4,846	7,227
MAV	3,104	3,538	4,392	6,534	9,573	14,839
OSV	12	13	21	33	51	83
AADT	**27,313**	**30,007**	**43,489**	**65,421**	**97,084**	**152,554**
PCU's	**45,640**	**50,265**	**68,327**	**100,466**	**146,167**	**225,242**

Source: Steer analysis

Table 6.39: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 74: Srinagar

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	10.7%	9.9%	9.5%	8.94%	8.4%	9.1%
Mini LCV	1.1%	1.1%	1.1%	1.08%	1.0%	1.1%
Bus	2.3%	1.2%	2.2%	2.05%	1.9%	1.8%
LCV	3.8%	2.4%	2.2%	2.05%	1.9%	2.1%
2A	7.1%	5.3%	6.7%	6.41%	6.1%	6.1%
3A	11.9%	3.4%	7.5%	7.22%	6.9%	6.3%
MAV	14.0%	4.4%	8.3%	7.94%	7.6%	7.1%
OSV	9.8%	9.8%	9.2%	8.82%	8.4%	9.0%
AADT	**9.9%**	**7.7%**	**8.5%**	**8.21%**	**7.8%**	**8.1%**
PCU's	**10.1%**	**6.3%**	**8.0%**	**7.79%**	**7.5%**	**7.4%**

Source: Steer analysis

Table 6.40: Revenue forecast (With Upside Impacts) for KM 74: Srinagar (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	45.2	4.5	119.9	242.2	484.4	1,082.9
Mini LCV	3.5	0.3	5.6	7.6	10.4	15.3
Bus	7.9	0.7	12.6	18.0	26.0	40.2
LCV	9.5	0.9	16.5	23.8	34.1	52.8
2A	28.7	2.8	58.3	105.1	185.4	366.8
3A	37.6	3.8	73.2	136.3	250.7	516.1
MAV	64.9	6.7	135.0	260.5	495.2	1,059.7
OSV	0.3	0.0	0.7	1.4	2.7	6.1
Total Revenue	**197.5**	**19.8**	**421.7**	**794.8**	**1,489.0**	**3,139.9**

Source: Steer analysis

Table 6.41: Revenue growth (With Upside Impacts) CAGR (%) for KM 74: Srinagar

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	(89.9%)	92.4%	15.1%	14.87%	14.3%	29.8%
Mini LCV	(90.8%)	77.3%	6.2%	6.60%	6.6%	20.2%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
Bus	(90.9%)	77.2%	7.5%	7.59%	7.5%	21.1%
LCV	(90.6%)	79.0%	7.6%	7.52%	7.5%	21.4%
2A	(90.3%)	83.7%	12.5%	12.02%	12.0%	26.2%
3A	(89.9%)	80.6%	13.3%	12.95%	12.8%	26.3%
MAV	(89.7%)	82.3%	14.0%	13.71%	13.5%	27.3%
OSV	(90.0%)	91.8%	15.0%	14.67%	14.4%	29.6%
Total	**(90.0%)**	**84.4%**	**13.5%**	**13.38%**	**13.2%**	**27.3%**

Source: Steer analysis

Table 6.42: Traffic forecast (With Upside Impacts) for KM 164: Mahuvan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,730	18,138	27,508	40,781	63,484
Mini LCV	1,535	1,553	1,651	1,755	1,862	1,994
Bus	1,383	1,414	1,531	1,704	1,886	2,113
LCV	868	901	1,017	1,132	1,253	1,404
2A	2,968	3,157	3,694	4,716	5,965	7,810
3A	2,453	2,742	3,282	4,715	6,680	9,963
MAV	3,637	4,135	5,149	7,660	11,222	17,395
OSV	6	7	11	17	26	42
AADT	**23,593**	**25,639**	**34,471**	**49,207**	**69,675**	**104,205**
PCU's	**46,151**	**50,508**	**64,382**	**90,767**	**127,104**	**188,094**

Source: Steer analysis

Table 6.43: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 164: Mahuvan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	9.2%	9.1%	8.7%	8.19%	7.7%	8.4%
Mini LCV	1.2%	1.2%	1.2%	1.20%	1.1%	1.2%
Bus	2.3%	1.6%	2.2%	2.05%	1.9%	1.9%
LCV	3.8%	2.4%	2.2%	2.05%	1.9%	2.1%
2A	6.4%	3.2%	5.0%	4.81%	4.6%	4.4%
3A	11.8%	3.7%	7.5%	7.22%	6.9%	6.3%
MAV	13.7%	4.5%	8.3%	7.94%	7.6%	7.1%
OSV	9.8%	9.8%	9.2%	8.82%	8.4%	9.0%
AADT	**8.7%**	**6.1%**	**7.4%**	**7.20%**	**6.9%**	**6.9%**
PCU's	**9.4%**	**5.0%**	**7.1%**	**6.97%**	**6.8%**	**6.5%**

Source: Steer analysis

Table 6.44: Revenue forecast (With Upside Impacts) for KM 164: Mahuvan (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	30.0	3.0	75.6	147.6	285.1	613.0
Mini LCV	5.2	0.5	8.4	11.5	15.9	23.5
Bus	7.7	0.7	12.6	18.0	25.9	40.0
LCV	9.7	0.9	16.7	24.0	34.6	53.5
2A	38.5	3.8	71.7	119.3	195.2	353.8
3A	51.2	5.3	103.6	193.0	354.9	730.6
MAV	76.0	8.0	162.5	313.5	596.1	1,275.6
OSV	0.2	0.0	0.4	0.8	1.6	3.7
Total Revenue	**218.4**	**22.2**	**451.4**	**827.7**	**1,509.2**	**3,093.7**

Source: Steer analysis

Table 6.45: Revenue growth (With Upside Impacts) CAGR (%) for KM 164: Mahuvan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	(90.1%)	91.0%	14.3%	14.07%	13.6%	28.9%
Mini LCV	(90.8%)	77.5%	6.4%	6.74%	6.8%	20.4%
Bus	(90.9%)	78.0%	7.4%	7.59%	7.5%	21.2%
LCV	(90.6%)	79.0%	7.6%	7.53%	7.5%	21.4%
2A	(90.2%)	80.1%	10.7%	10.34%	10.4%	24.1%
3A	(89.6%)	81.0%	13.3%	12.95%	12.8%	26.4%
MAV	(89.4%)	82.5%	14.0%	13.71%	13.5%	27.3%
OSV	(90.0%)	91.8%	15.0%	14.67%	14.4%	29.6%
Total	**(89.8%)**	**82.6%**	**12.9%**	**12.76%**	**12.7%**	**26.5%**

Source: Steer analysis

Table 6.46: Traffic forecast (With Upside Impacts) for KM 46: Prithila

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	30,016	33,326	54,677	87,353	135,115	218,599
Mini LCV	3,242	3,317	3,692	4,086	4,489	4,978
Bus	2,355	2,409	2,698	3,004	3,324	3,724
LCV	1,000	1,038	1,172	1,305	1,444	1,618
2A	1,254	1,342	1,892	2,614	3,566	5,095
3A	1,409	1,521	2,233	3,209	4,546	6,780
MAV	2,200	2,408	3,679	5,474	8,019	12,430
OSV	28	31	50	77	117	191
AADT	**41,504**	**45,392**	**70,093**	**107,120**	**160,621**	**253,416**
PCU's	**55,712**	**60,646**	**91,586**	**137,095**	**202,243**	**314,610**

Source: Steer analysis

Table 6.47: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 46: Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	11.0%	10.4%	9.8%	9.12%	8.3%	9.4%
Mini LCV	2.3%	2.2%	2.0%	1.90%	1.7%	2.0%
Bus	2.3%	2.3%	2.2%	2.05%	1.9%	2.1%
LCV	3.8%	2.4%	2.2%	2.05%	1.9%	2.1%
2A	7.1%	7.1%	6.7%	6.41%	6.1%	6.6%
3A	8.0%	8.0%	7.5%	7.22%	6.9%	7.4%
MAV	9.4%	8.8%	8.3%	7.94%	7.6%	8.1%
OSV	9.8%	9.8%	9.2%	8.82%	8.4%	9.0%
AADT	**9.4%**	**9.1%**	**8.9%**	**8.44%**	**7.9%**	**8.5%**
PCU's	**8.9%**	**8.6%**	**8.4%**	**8.09%**	**7.6%**	**8.2%**

Source: Steer analysis

Table 6.48: Revenue forecast (With Upside Impacts) for KM 46: Prithila (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	35.5	68.5	165.7	340.7	687.7	1,535.9
Mini LCV	5.3	9.8	16.2	22.9	32.9	50.4
Bus	6.2	11.3	18.3	26.4	38.0	59.0
LCV	5.6	9.9	16.3	23.5	33.8	52.1
2A	8.1	14.9	30.6	55.0	97.5	191.6
3A	14.6	26.3	56.5	105.3	193.9	399.2
MAV	22.8	41.6	93.0	179.6	342.0	731.8
OSV	0.3	0.6	1.4	2.7	5.4	12.1
Total Revenue	**98.4**	**182.9**	**397.8**	**756.1**	**1,431.2**	**3,032.2**

Source: Steer analysis

Table 6.49: Revenue growth (With Upside Impacts) CAGR (%) for KM 46: Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	93.0%	19.3%	15.5%	15.1%	14.3%	16.0%
Mini LCV	85.8%	10.5%	7.2%	7.5%	7.4%	8.1%
Bus	81.9%	10.0%	7.7%	7.5%	7.6%	8.2%
LCV	76.6%	10.5%	7.6%	7.6%	7.5%	8.2%
2A	83.4%	15.5%	12.4%	12.1%	11.9%	12.9%
3A	80.1%	16.5%	13.3%	13.0%	12.8%	13.8%
MAV	82.5%	17.5%	14.1%	13.7%	13.5%	14.6%
OSV	91.0%	18.3%	15.0%	14.7%	14.4%	15.5%
Total	**85.9%**	**16.8%**	**13.7%**	**13.6%**	**13.3%**	**14.3%**

Source: Steer analysis

Table 6.50: Traffic forecast (With Upside Impacts) for KM 94: Kotwan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,588	18,263	29,289	46,226	71,167	115,596
Mini LCV	1,453	1,470	1,563	1,661	1,763	1,888
Bus	1,555	1,590	1,686	1,877	2,078	2,328
LCV	842	875	987	1,099	1,216	1,363
2A	2,944	3,153	4,047	5,592	7,630	10,899
3A	2,302	2,549	3,096	4,448	6,302	9,400
MAV	3,345	3,767	4,734	7,043	10,318	15,993
OSV	6	6	10	15	23	37
AADT	**29,034**	**31,674**	**45,412**	**67,961**	**100,496**	**157,504**
PCU's	**50,530**	**55,244**	**74,614**	**109,178**	**158,207**	**242,882**

Source: Steer analysis

Table 6.51: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 94: Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	10.1%	9.9%	9.6%	9.01%	8.4%	9.2%
Mini LCV	1.2%	1.2%	1.2%	1.20%	1.1%	1.2%
Bus	2.3%	1.2%	2.2%	2.05%	1.9%	1.8%
LCV	3.8%	2.4%	2.2%	2.05%	1.9%	2.1%
2A	7.1%	5.1%	6.7%	6.41%	6.1%	6.1%
3A	10.8%	4.0%	7.5%	7.22%	6.9%	6.4%
MAV	12.6%	4.7%	8.3%	7.94%	7.6%	7.1%
OSV	9.8%	9.8%	9.2%	8.82%	8.4%	9.0%
AADT	**9.1%**	**7.5%**	**8.4%**	**8.14%**	**7.8%**	**7.9%**
PCU's	**9.3%**	**6.2%**	**7.9%**	**7.70%**	**7.4%**	**7.3%**

Source: Steer analysis

Table 6.52: Revenue forecast (With Upside Impacts) for KM 94: Kotwan (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	31.9	35.2	82.2	169.8	338.5	754.7
Mini LCV	3.6	3.7	5.7	7.9	10.9	16.0
Bus	6.2	6.5	10.0	14.3	20.8	31.9
LCV	6.5	6.8	11.2	16.2	23.2	36.0
2A	27.2	29.7	56.1	100.1	177.2	350.6
3A	33.8	38.8	69.0	128.7	236.4	487.2
MAV	49.2	57.3	105.4	203.8	387.0	829.0
OSV	0.1	0.1	0.2	0.4	0.9	1.9

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
Total Revenue	**158.4**	**178.1**	**339.8**	**641.4**	**1,194.8**	**2,507.3**

Source: Steer analysis

Table 6.53: Revenue growth (With Upside Impacts) CAGR (%) for KM 94: Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	10.5%	18.5%	15.6%	14.8%	14.3%	15.7%
Mini LCV	0.9%	9.2%	6.8%	6.6%	6.6%	7.3%
Bus	4.7%	9.0%	7.5%	7.7%	7.4%	7.9%
LCV	4.7%	10.6%	7.6%	7.5%	7.6%	8.3%
2A	9.6%	13.5%	12.3%	12.1%	12.0%	12.5%
3A	14.6%	12.2%	13.3%	12.9%	12.8%	12.8%
MAV	16.6%	13.0%	14.1%	13.7%	13.5%	13.6%
OSV	**11.1%**	**18.4%**	**15.0%**	**14.6%**	**14.4%**	**15.5%**
Total	**12.4%**	**13.8%**	**13.5%**	**13.2%**	**13.1%**	**13.4%**

Source: Steer analysis

Table 6.54: Traffic forecast (With Upside Impacts) for KM 164

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,730	18,138	27,508	40,781	63,484
Mini LCV	1,535	1,553	1,651	1,755	1,862	1,994
Bus	1,383	1,414	1,531	1,704	1,886	2,113
LCV	868	901	1,017	1,132	1,253	1,404
2A	2,968	3,157	3,694	4,716	5,965	7,810
3A	2,453	2,742	3,282	4,715	6,680	9,963
MAV	3,637	4,135	5,149	7,660	11,222	17,395
OSV	6	7	11	17	26	42
AADT	**23,593**	**25,639**	**34,471**	**49,207**	**69,675**	**104,205**
PCU's	**46,151**	**50,508**	**64,382**	**90,767**	**127,104**	**188,094**

Source: Steer analysis

Table 6.55: Traffic growth AADT (With Upside Impacts) CAGR (%) for KM 164

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	9.2%	9.1%	8.7%	8.19%	7.7%	8.4%
Mini LCV	1.2%	1.2%	1.2%	1.20%	1.1%	1.2%
Bus	2.3%	1.6%	2.2%	2.05%	1.9%	1.9%
LCV	3.8%	2.4%	2.2%	2.05%	1.9%	2.1%
2A	6.4%	3.2%	5.0%	4.81%	4.6%	4.4%
3A	11.8%	3.7%	7.5%	7.22%	6.9%	6.3%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
MAV	13.7%	4.5%	8.3%	7.94%	7.6%	7.1%
OSV	9.8%	9.8%	9.2%	8.82%	8.4%	9.0%
AADT	**8.7%**	**6.1%**	**7.4%**	**7.20%**	**6.9%**	**6.9%**
PCU's	**9.4%**	**5.0%**	**7.1%**	**6.97%**	**6.8%**	**6.5%**

Source: Steer analysis

Table 6.56: Revenue forecast (With Upside Impacts) for KM 164 (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	23.5	25.8	58.3	115.0	220.0	470.4
Mini LCV	4.1	4.2	6.4	8.9	12.2	17.9
Bus	5.9	6.1	9.7	13.9	19.9	30.8
LCV	7.4	7.8	12.8	18.5	26.6	41.1
2A	29.7	32.6	55.3	91.3	150.0	271.3
3A	39.5	45.8	79.6	148.4	273.4	561.6
MAV	58.6	69.0	124.9	241.1	459.2	980.4
OSV	0.1	0.1	0.3	0.6	1.3	2.8
Total Revenue	**168.9**	**191.3**	**347.4**	**637.8**	**1,162.5**	**2,376.4**

Source: Steer analysis

Table 6.57: Revenue growth (With Upside Impacts) CAGR (%) for KM 164

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	9.9%	17.7%	14.6%	13.85%	13.5%	14.8%
Mini LCV	2.5%	9.1%	6.8%	6.38%	6.7%	7.2%
Bus	2.1%	9.9%	7.5%	7.38%	7.6%	8.0%
LCV	4.4%	10.5%	7.7%	7.49%	7.5%	8.2%
2A	9.4%	11.2%	10.5%	10.45%	10.4%	10.6%
3A	15.9%	11.7%	13.3%	13.00%	12.7%	12.7%
MAV	17.9%	12.6%	14.1%	13.76%	13.5%	13.5%
OSV	10.8%	18.4%	15.0%	14.66%	14.4%	15.6%
Total	**13.3%**	**12.7%**	**12.9%**	**12.76%**	**12.7%**	**12.7%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.59 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.58: Traffic forecast (With Downside Impacts) for KM 74: Srinagar

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,981	18,109	24,173	32,029	41,561	55,280
Mini LCV	996	1,003	1,039	1,074	1,108	1,146
Bus	1,377	1,397	1,367	1,460	1,551	1,658
LCV	850	870	938	1,002	1,065	1,138
2A	2,194	2,290	2,442	2,974	3,585	4,426
3A	1,799	1,956	1,738	2,169	2,675	3,388
MAV	3,104	3,421	3,184	4,060	5,111	6,625
OSV	12	13	17	23	29	39
AADT	**27,313**	**29,059**	**34,898**	**44,790**	**56,686**	**73,700**
PCU's	**45,640**	**48,751**	**53,991**	**68,237**	**85,241**	**109,453**

Source: Steer analysis

Table 6.59: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 74: Srinagar

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	6.6%	5.9%	5.8%	5.35%	4.9%	5.5%
Mini LCV	0.7%	0.7%	0.7%	0.62%	0.6%	0.6%
Bus	1.4%	(0.4%)	1.3%	1.22%	1.1%	0.8%
LCV	2.4%	1.5%	1.3%	1.22%	1.1%	1.3%
2A	4.4%	1.3%	4.0%	3.81%	3.6%	3.2%
3A	8.7%	(2.3%)	4.5%	4.28%	4.0%	2.6%
MAV	10.2%	(1.4%)	5.0%	4.71%	4.4%	3.2%
OSV	6.0%	6.0%	5.5%	5.24%	4.9%	5.4%
AADT	**6.4%**	**3.7%**	**5.1%**	**4.82%**	**4.5%**	**4.5%**
PCU's	**6.8%**	**2.1%**	**4.8%**	**4.55%**	**4.3%**	**3.9%**

Source: Steer analysis

Table 6.60: Revenue forecast (With Downside Impacts) for KM 74: Srinagar (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	45.2	4.4	90.4	143.9	225.3	373.2
Mini LCV	3.5	0.3	5.1	6.3	7.9	10.2
Bus	7.9	0.7	10.8	13.9	17.7	23.8
LCV	9.5	0.9	14.6	18.9	24.0	32.0
2A	28.7	2.7	44.3	65.3	94.3	145.3
3A	37.6	3.7	50.3	75.7	112.3	177.5
MAV	64.9	6.5	92.2	141.7	214.6	347.1
OSV	0.3	0.0	0.5	0.8	1.3	2.1
Total Revenue	**197.5**	**19.2**	**308.3**	**466.5**	**697.5**	**1,111.3**

Source: Steer analysis

Table 6.61: Revenue growth (With Downside Impacts) CAGR (%) for KM 74: Srinagar

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	(90.3%)	83.2%	9.7%	9.38%	8.8%	23.6%
Mini LCV	(90.9%)	74.3%	4.4%	4.51%	4.3%	18.0%
Bus	(90.9%)	72.3%	5.1%	4.98%	5.0%	18.2%
LCV	(90.7%)	75.2%	5.2%	4.99%	4.9%	18.6%
2A	(90.5%)	74.8%	8.0%	7.64%	7.5%	20.9%
3A	(90.2%)	68.5%	8.5%	8.21%	7.9%	20.2%
MAV	(90.0%)	70.1%	9.0%	8.66%	8.3%	20.9%
OSV	(90.4%)	82.9%	9.6%	9.20%	8.8%	23.5%
Total	**(90.3%)**	**74.2%**	**8.6%**	**8.38%**	**8.1%**	**21.3%**

Source: Steer analysis

Table 6.62: Traffic forecast (With Downside Impacts) for KM 164: Mahuvan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,357	14,910	19,309	24,530	31,877
Mini LCV	1,535	1,546	1,606	1,666	1,724	1,790
Bus	1,383	1,402	1,421	1,517	1,612	1,724
LCV	868	888	958	1,023	1,088	1,163
2A	2,968	3,095	3,071	3,564	4,103	4,807
3A	2,453	2,664	2,420	3,020	3,725	4,717
MAV	3,637	3,998	3,734	4,762	5,994	7,770
OSV	6	7	9	12	15	20
AADT	**23,593**	**24,958**	**28,129**	**34,873**	**42,790**	**53,867**
PCU's	**46,151**	**49,167**	**51,285**	**63,021**	**76,755**	**95,975**

Source: Steer analysis

Table 6.63: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 164: Mahuvan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	5.7%	5.6%	5.3%	4.90%	4.5%	5.0%
Mini LCV	0.7%	0.8%	0.7%	0.69%	0.6%	0.7%
Bus	1.4%	0.3%	1.3%	1.22%	1.1%	1.0%
LCV	2.4%	1.5%	1.3%	1.22%	1.1%	1.3%
2A	4.3%	(0.2%)	3.0%	2.86%	2.7%	2.1%
3A	8.6%	(1.9%)	4.5%	4.28%	4.0%	2.8%
MAV	9.9%	(1.4%)	5.0%	4.71%	4.4%	3.2%
OSV	6.0%	6.0%	5.5%	5.24%	4.9%	5.4%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
AADT	**5.8%**	**2.4%**	**4.4%**	**4.18%**	**3.9%**	**3.7%**
PCU's	**6.5%**	**0.8%**	**4.2%**	**4.02%**	**3.8%**	**3.2%**

Source: Steer analysis

Table 6.64: Revenue forecast (With Downside Impacts) for KM 164: Mahuvan (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	30.0	2.9	58.4	90.9	139.3	225.4
Mini LCV	5.2	0.5	7.7	9.6	12.0	15.5
Bus	7.7	0.7	11.0	14.1	18.0	24.1
LCV	9.7	0.9	14.8	19.1	24.3	32.4
2A	38.5	3.7	56.3	78.9	108.9	159.3
3A	51.2	5.2	71.9	108.2	160.6	253.8
MAV	76.0	7.8	111.0	170.6	258.4	418.0
OSV	0.2	0.0	0.3	0.5	0.8	1.3
Total Revenue	**218.4**	**21.6**	**331.4**	**492.0**	**722.3**	**1,129.8**

Source: Steer analysis

Table 6.65: Revenue growth (With Downside Impacts) CAGR (%) for KM 164: Mahuvan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	(90.4%)	82.6%	9.3%	8.90%	8.3%	23.1%
Mini LCV	(90.9%)	74.5%	4.4%	4.59%	4.4%	18.0%
Bus	(90.9%)	73.5%	5.1%	4.98%	5.0%	18.4%
LCV	(90.7%)	75.3%	5.2%	4.99%	4.9%	18.6%
2A	(90.4%)	72.3%	7.0%	6.65%	6.5%	19.6%
3A	(89.9%)	69.3%	8.5%	8.21%	7.9%	20.4%
MAV	(89.8%)	70.2%	9.0%	8.66%	8.3%	20.9%
OSV	(90.4%)	82.9%	9.6%	9.22%	8.8%	23.5%
Total	**(90.1%)**	**72.6%**	**8.2%**	**7.98%**	**7.7%**	**20.7%**

Source: Steer analysis

Table 6.66: Traffic forecast (With Downside Impacts) for KM 46: Prithila

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	30,016	32,096	44,056	59,161	77,301	102,807
Mini LCV	3,242	3,289	3,519	3,748	3,967	4,215
Bus	2,355	2,388	2,564	2,738	2,910	3,110
LCV	1,000	1,024	1,104	1,179	1,254	1,340
2A	1,254	1,308	1,620	1,973	2,379	2,936
3A	1,409	1,478	1,878	2,344	2,891	3,662

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
MAV	2,200	2,328	3,035	3,870	4,872	6,315
OSV	28	30	40	53	68	91
AADT	**41,504**	**43,941**	**57,817**	**75,067**	**95,642**	**124,476**
PCU's	**55,712**	**58,793**	**76,179**	**97,478**	**122,797**	**158,317**

Source: Steer analysis

Table 6.67: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 46: Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	6.9%	6.5%	6.1%	5.49%	4.9%	5.7%
Mini LCV	1.4%	1.4%	1.3%	1.14%	1.0%	1.2%
Bus	1.4%	1.4%	1.3%	1.22%	1.1%	1.3%
LCV	2.4%	1.5%	1.3%	1.22%	1.1%	1.3%
2A	4.4%	4.4%	4.0%	3.81%	3.6%	3.9%
3A	4.9%	4.9%	4.5%	4.28%	4.0%	4.4%
MAV	5.8%	5.4%	5.0%	4.71%	4.4%	4.9%
OSV	6.0%	6.0%	5.5%	5.24%	4.9%	5.4%
AADT	**5.9%**	**5.6%**	**5.4%**	**4.96%**	**4.5%**	**5.1%**
PCU's	**5.5%**	**5.3%**	**5.1%**	**4.73%**	**4.3%**	**4.8%**

Source: Steer analysis

Table 6.68: Revenue forecast (With Downside Impacts) for KM 46: Prithila (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	35.5	66.0	125.9	202.9	317.3	524.9
Mini LCV	5.3	9.7	14.5	18.6	23.4	31.0
Bus	6.2	11.2	16.5	21.2	26.9	36.1
LCV	5.6	9.7	14.4	18.5	23.7	31.7
2A	8.1	14.5	24.6	36.2	52.5	81.0
3A	14.6	25.5	44.6	67.6	99.8	157.9
MAV	22.8	40.2	72.0	111.6	168.3	272.2
OSV	0.3	0.6	1.0	1.6	2.5	4.2
Total Revenue	**98.4**	**177.5**	**313.4**	**478.2**	**714.5**	**1,138.9**

Source: Steer analysis

Table 6.69: Revenue growth (With Downside Impacts) CAGR (%) for KM 46: Prithila

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	85.9%	13.8%	10.0%	9.4%	8.8%	10.4%
Mini LCV	84.2%	8.3%	5.1%	4.8%	4.8%	5.7%

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
Bus	80.4%	8.0%	5.2%	4.9%	5.0%	5.7%
LCV	74.1%	8.1%	5.2%	5.0%	4.9%	5.8%
2A	78.7%	11.1%	8.1%	7.7%	7.5%	8.5%
3A	75.0%	11.8%	8.7%	8.1%	7.9%	9.1%
MAV	76.5%	12.3%	9.2%	8.6%	8.4%	9.5%
OSV	84.5%	12.9%	9.6%	9.2%	8.8%	10.1%
Total	**80.4%**	**12.0%**	**8.8%**	**8.4%**	**8.1%**	**9.3%**

Source: Steer analysis

Table 6.70: Traffic forecast (With Downside Impacts) for KM 94: Kotwan

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	16,588	17,630	23,575	31,307	40,711	54,275
Mini LCV	1,453	1,464	1,520	1,577	1,632	1,694
Bus	1,555	1,577	1,568	1,674	1,780	1,902
LCV	842	862	930	994	1,056	1,129
2A	2,944	3,072	3,321	4,045	4,876	6,019
3A	2,302	2,477	2,354	2,938	3,623	4,589
MAV	3,345	3,642	3,552	4,530	5,703	7,392
OSV	6	6	8	10	13	18
AADT	**29,034**	**30,731**	**36,828**	**47,076**	**59,394**	**77,018**
PCU's	**50,530**	**53,645**	**59,903**	**75,447**	**93,975**	**120,342**

Source: Steer analysis

Table 6.71: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 94: Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	6.3%	6.0%	5.8%	5.39%	4.9%	5.5%
Mini LCV	0.7%	0.8%	0.7%	0.69%	0.6%	0.7%
Bus	1.4%	(0.1%)	1.3%	1.22%	1.1%	0.9%
LCV	2.4%	1.5%	1.3%	1.22%	1.1%	1.3%
2A	4.4%	1.6%	4.0%	3.81%	3.6%	3.3%
3A	7.6%	(1.0%)	4.5%	4.28%	4.0%	3.0%
MAV	8.9%	(0.5%)	5.0%	4.71%	4.4%	3.4%
OSV	6.0%	6.0%	5.5%	5.24%	4.9%	5.4%
AADT	**5.8%**	**3.7%**	**5.0%**	**4.76%**	**4.4%**	**4.5%**
PCU's	**6.2%**	**2.2%**	**4.7%**	**4.49%**	**4.2%**	**3.9%**

Source: Steer analysis

Table 6.72: Revenue forecast (With Downside Impacts) for KM 94: Kotwan (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	31.9	34.0	62.8	99.7	155.4	261.0
Mini LCV	3.6	3.7	5.3	6.5	8.1	10.6
Bus	6.2	6.4	8.7	11.2	14.4	19.1
LCV	6.5	6.7	9.9	12.8	16.4	21.8
2A	27.2	29.0	43.1	63.8	91.7	141.3
3A	33.8	37.7	49.4	74.3	110.1	174.2
MAV	49.2	55.4	74.6	114.6	173.4	280.6
OSV	0.1	0.1	0.2	0.3	0.4	0.7
Total Revenue	**158.4**	**172.9**	**253.9**	**383.3**	**569.8**	**909.3**

Source: Steer analysis

Table 6.73: Revenue growth (With Downside Impacts) CAGR (%) for KM 94: Kotwan

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	6.7%	13.0%	9.7%	9.3%	9.0%	10.2%
Mini LCV	0.4%	7.6%	4.3%	4.4%	4.6%	5.2%
Bus	3.8%	6.2%	5.1%	5.2%	4.9%	5.3%
LCV	3.2%	8.3%	5.3%	5.0%	4.9%	5.8%
2A	6.8%	8.3%	8.2%	7.5%	7.5%	7.8%
3A	11.4%	5.6%	8.5%	8.2%	7.9%	7.6%
MAV	12.7%	6.1%	9.0%	8.6%	8.4%	8.0%
OSV	7.3%	12.9%	9.6%	9.2%	8.8%	10.1%
Total	**9.2%**	**8.0%**	**8.6%**	**8.3%**	**8.1%**	**8.2%**

Source: Steer analysis

Table 6.74: Traffic forecast (With Downside Impacts) for KM 164

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	10,743	11,357	14,910	19,309	24,530	31,877
Mini LCV	1,535	1,546	1,606	1,666	1,724	1,790
Bus	1,383	1,402	1,421	1,517	1,612	1,724
LCV	868	888	958	1,023	1,088	1,163
2A	2,968	3,095	3,071	3,564	4,103	4,807
3A	2,453	2,664	2,420	3,020	3,725	4,717
MAV	3,637	3,998	3,734	4,762	5,994	7,770
OSV	6	7	9	12	15	20
AADT	**23,593**	**24,958**	**28,129**	**34,873**	**42,790**	**53,867**
PCU's	**46,151**	**49,167**	**51,285**	**63,021**	**76,755**	**95,975**

Source: Steer analysis

Table 6.75: Traffic growth AADT (With Downside Impacts) CAGR (%) for KM 164

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	5.7%	5.6%	5.3%	4.90%	4.5%	5.0%
Mini LCV	0.7%	0.8%	0.7%	0.69%	0.6%	0.7%
Bus	1.4%	0.3%	1.3%	1.22%	1.1%	1.0%
LCV	2.4%	1.5%	1.3%	1.22%	1.1%	1.3%
2A	4.3%	(0.2%)	3.0%	2.86%	2.7%	2.1%
3A	8.6%	(1.9%)	4.5%	4.28%	4.0%	2.8%
MAV	9.9%	(1.4%)	5.0%	4.71%	4.4%	3.2%
OSV	6.0%	6.0%	5.5%	5.24%	4.9%	5.4%
AADT	**5.8%**	**2.4%**	**4.4%**	**4.18%**	**3.9%**	**3.7%**
PCU's	**6.5%**	**0.8%**	**4.2%**	**4.02%**	**3.8%**	**3.2%**

Source: Steer analysis

Table 6.76: Revenue forecast (With Downside Impacts) for KM 164 (In Cr)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY44
CJV	23.5	25.0	45.1	70.9	106.3	174.4
Mini LCV	4.1	4.1	5.9	7.4	9.1	11.9
Bus	5.9	6.0	8.4	10.8	13.7	18.4
LCV	7.4	7.7	11.4	14.7	18.7	24.9
2A	29.7	31.9	43.3	60.7	83.7	122.1
3A	39.5	44.5	55.2	83.5	123.3	195.3
MAV	58.6	66.7	85.1	131.6	198.4	321.6
OSV	0.1	0.1	0.2	0.4	0.6	1.0
Total Revenue	168.9	186.1	254.6	380.0	553.7	869.7

Source: Steer analysis

Table 6.77: Revenue growth (With Downside Impacts) CAGR (%) for KM 164

Vehicle Type	FY22-FY23	FY23-FY28	FY28-FY33	FY33-FY38	FY38-FY44	FY23-FY44
CJV	6.4%	12.5%	9.5%	8.43%	8.6%	9.7%
Mini LCV	2.1%	7.4%	4.7%	4.02%	4.6%	5.2%
Bus	1.3%	6.8%	5.2%	4.95%	5.0%	5.5%
LCV	2.9%	8.2%	5.2%	4.96%	4.9%	5.8%
2A	7.3%	6.3%	7.0%	6.61%	6.5%	6.6%
3A	12.6%	4.4%	8.6%	8.12%	8.0%	7.3%
MAV	14.0%	5.0%	9.1%	8.56%	8.4%	7.8%
OSV	7.0%	12.9%	9.7%	9.14%	8.8%	10.1%
Total	**10.2%**	**6.5%**	**8.3%**	**7.82%**	**7.8%**	**7.6%**

Source: Steer analysis

Summary outlook

6.60 Passenger movement on Km74 Srinagar is largely local in nature, connecting the high population density region of Palwal, Faridabad, New Delhi to Mathura, Vrindavan, Agra over short-medium distance. Cars are expected to see a healthy growth on the asset following the overall behavioural shift of users away from public transport. Moreover, the vicinity to the National Capital Region and increasing share of car ownership should complement healthy car growth rates in the coming future. Additionally, we have seen a positive shift towards better compliance as a result of compulsory FASTag implementation on the Asset.

6.61 This Asset greatly benefits from its geographic and strategic location. The proximity to an upgraded network of expressways like KMP and EPE provides seamless connectivity to the users. This is evident from the fact the Asset is used for the north-south movement connecting Jammu and Kashmir, Punjab, Haryana to Karnataka, Tamil Nadu, Telangana, Andhra Pradesh covering distances greater than 3000 kms at its peak. The Asset also caters to the north-east movement connecting Punjab, Haryana to Eastern Uttar Pradesh, Bihar etc.

6.62 As the Asset is already six-laned, the Level of Service (LoS) is better than the alternate National Highways and almost at par with the expressways in the vicinity. The scale of growth observed in the last few years is exemplary and although, a proportion of the growth is due to network shift, we believe that there was a significant share of natural growth of traffic. This growth is believed to continue in the future.

6.63 It has been observed that even though traffic across the country saw significant impact of COVID 19 impact and dropped to 50-60% of pre-COVID levels during first half of FY21, only to recover during the second half of the year, this asset saw a growth and subsequent stabilisation of traffic volumes. This was driven by two main reasons: network shifts which are external impacts, and secondly, the nature of commodities and regions being connected by the road. The agricultural and manufacturing goods being transported form a part of essential commodities and are expected to show a healthy growth in the future years as well.

6.64 We expect that the implementation of FASTag rules, will also help in improving the operational efficiency and overall compliance levels on the Asset and overall corridor as a whole which should result in an improved level of service, thereby resulting in an improved level of service for all users.

6.65 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.66 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Delhi NCR, Faridabad, Palwal, Agra, Mathura, Vrindavan while also catering to long distance movement to/from Chennai, Bangalore, Hyderabad etc. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

A Top 10 OD pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

Km46 Prithala

Table A.1: CJV top 10 OD pair shares at km46 Prithala

	OD Pair	Share
1.	Palwal city-Faridabad City	16.1%
2.	Palwal city-Rest of Faridabad	15.0%
3.	Central Delhi (inside ring road)-Palwal city	10.9%
4.	Mathura-Central Delhi (inside ring road)	7.3%
5.	Faridabad City-Hodal	5.8%
6.	Pirthala, Bhagola-Rest of Faridabad	5.0%
7.	Hodal-Rest of Faridabad	4.9%
8.	Central Delhi (inside ring road)-Hodal	3.9%
9.	Faridabad City-Pirthala, Bhagola	3.0%
10.	Mathura-Faridabad City	2.9%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at km46 Prithala

	OD Pair	Share
1.	Palwal city-Faridabad City	8.0%
2.	Faridabad City-Pirthala, Bhagola	7.5%
3.	Pirthala, Bhagola-Rest of Faridabad	6.8%
4.	Palwal city-Rest of Faridabad	5.7%
5.	Faridabad City-Hodal	3.8%
6.	Mathura-Faridabad City	3.3%
7.	Sikri, Piyala-Pirthala, Bhagola	3.2%
8.	Faridabad City-East Rajasthan (Alwar, Dausa(NH11), Bharartpur, Sawai Madhopur)	2.8%
9.	Central Delhi (inside ring road)-Palwal city	2.5%
10.	Hodal-Rest of Faridabad	2.3%

Source: Steer analysis of OD data

Km74 Srinagar

Table A.3: CJV top 10 OD pair shares at km74 Srinagar

	OD Pair	Share
1.	Palwal city-Hodal	10.8%
2.	Mathura-Central Delhi (inside ring road)	9.2%
3.	North East Agra-Central Delhi (inside ring road)	7.7%
4.	Faridabad City-Hodal	5.4%
5.	Mathura-Faridabad City	4.6%
6.	Mathura-Palwal city	4.5%
7.	Central Delhi (inside ring road)-Hodal	4.2%
8.	Central Delhi (inside ring road)-Vrindavan, Raya	3.5%
9.	North East Agra-Palwal city	3.5%
10.	North East Agra-Faridabad City	3.2%

Source: Steer analysis of OD data

Table A.4: MAV and OSV top 10 OD pair shares at km74 Srinagar

	OD Pair	Share
1.	North East Agra-Central Delhi (inside ring road)	5.4%
2.	Palwal city-Hodal	3.0%
3.	North East Agra-Palwal city	2.2%
4.	Central Delhi (inside ring road)-North Madhya Pradesh	2.0%
5.	Faridabad City-Hodal	2.0%
6.	Mathura-Central Delhi (inside ring road)	1.9%
7.	Mathura-North Haryana (Panipat, Ambala)	1.9%
8.	Central Delhi (inside ring road)-Tamil nadu	1.9%
9.	Central Delhi (inside ring road)-Central Madhya Pradesh	1.9%
10.	North East Agra-Punjab, Chandigarh	1.8%

Source: Steer analysis of OD data

Km94 Kotwan

Table A.5: CJV top 10 OD pair shares at km94 Kotwan

	OD Pair	Share
1.	Hodal-Hodal	8.8%
2.	Mathura-Central Delhi (inside ring road)	7.8%
3.	South West Agra including Agra City-Central Delhi (inside ring road)	6.5%
4.	Palwal city-Hodal	5.8%
5.	Central Delhi (inside ring road)-Vrindavan, Raya	5.7%

	OD Pair	Share
6.	Mathura-Palwal city	3.9%
7.	Mathura-Faridabad City	3.3%
8.	Mathura-Hodal	2.6%
9.	Faridabad City-Hodal	2.4%
10.	Central Delhi (inside ring road)-Hodal	2.1%

Source: Steer analysis of OD data

Table A.6: MAV and OSV top 10 OD pair shares at km94 Kotwan

	OD Pair	Share
1.	South West Agra including Agra City-Central Delhi (inside ring road)	3.7%
2.	Central Delhi (inside ring road)-Tamil nadu	2.3%
3.	Central Delhi (inside ring road)-North Madhya Pradesh	2.0%
4.	Central Delhi (inside ring road)-Hodal	1.9%
5.	Mathura-North Haryana (Panipat, Ambala)	1.8%
6.	Central Delhi (inside ring road)-West Maharashtra	1.7%
7.	Mathura-Central Delhi (inside ring road)	1.6%
8.	Central Delhi (inside ring road)-Karnataka	1.5%
9.	Central Delhi (inside ring road)-Central Madhya Pradesh	1.4%
10.	Mathura-Hodal	1.4%

Source: Steer analysis of OD data

Km164 Mahuvan

Table A.7: CJV top 10 OD pair shares at km164 Mahuvan

	OD Pair	Share
1.	South West Agra including Agra City-Mathura	52.9%
2.	South West Agra including Agra City-Central Delhi (inside ring road)	13.0%
3.	South West Agra including Agra City-Vrindavan, Raya	5.6%
4.	Mathura-Farah, Parkam	3.5%
5.	South West Agra including Agra City-Faridabad City	2.4%
6.	Mainpuri, Etah, Firozabad-Mathura	2.0%
7.	South West Agra including Agra City-South West Haryana (Gurugram)	1.4%
8.	Mathura-North Madhya Pradesh	1.1%
9.	South West Agra including Agra City-Hodal	1.1%
10.	South West Agra including Agra City-Refinery, Mathura, Mahuan	1.1%

Source: Steer analysis of OD data

Table A.8: MAV and OSV top 10 OD pair shares at km164 Mahuvan

	OD Pair	Share
1.	South West Agra including Agra City-Mathura	4.1%
2.	South West Agra including Agra City-Central Delhi (inside ring road)	3.6%
3.	Central Delhi (inside ring road)-Tamil nadu	3.3%
4.	Central Delhi (inside ring road)-West Maharashtra	2.7%
5.	Central Delhi (inside ring road)-West Bengal and Sikkim	2.5%
6.	Central Delhi (inside ring road)-Karnataka	2.1%
7.	Central Delhi (inside ring road)-North Madhya Pradesh	1.9%
8.	Punjab, Chandigarh-West Bengal and Sikkim	1.8%
9.	Mathura-North Madhya Pradesh	1.8%
10.	Central Delhi (inside ring road)-Chhatisgarh	1.6%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY44. The following tables show the forecast AADT for operational toll plazas.

Table A. 1: Forecasts for final (background+impacts) AADT, km74 Srinagar

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	16,981	996	1,377	850	2,194	1,799	3,104	12	**27,313**	**45,640**
FY23	18,432	1,005	1,402	876	2,318	1,983	3,476	13	**29,506**	**49,464**
FY24	19,881	1,015	1,397	897	2,369	1,929	3,439	14	**30,941**	**50,845**
FY25	21,389	1,024	1,390	914	2,419	1,859	3,370	15	**32,381**	**52,102**
FY26	23,100	1,033	1,393	931	2,485	1,850	3,374	17	**34,182**	**54,067**
FY27	24,906	1,042	1,402	948	2,572	1,913	3,493	18	**36,294**	**56,825**
FY28	26,837	1,051	1,427	965	2,712	2,030	3,729	19	**38,771**	**60,470**
FY29	28,891	1,060	1,452	982	2,859	2,153	3,978	21	**41,395**	**64,318**
FY30	31,098	1,070	1,478	999	3,010	2,282	4,239	22	**44,198**	**68,401**
FY31	33,444	1,079	1,503	1,016	3,169	2,417	4,516	24	**47,168**	**72,717**
FY32	35,933	1,089	1,529	1,033	3,335	2,559	4,808	26	**50,310**	**77,271**
FY33	38,570	1,098	1,554	1,051	3,507	2,708	5,116	27	**53,632**	**82,074**
FY34	41,363	1,107	1,580	1,068	3,687	2,864	5,440	29	**57,139**	**87,134**
FY35	44,315	1,117	1,606	1,086	3,874	3,028	5,782	31	**60,838**	**92,462**
FY36	47,432	1,126	1,632	1,103	4,069	3,199	6,142	33	**64,737**	**98,066**
FY37	50,720	1,135	1,658	1,121	4,272	3,379	6,521	36	**68,841**	**1,03,955**
FY38	54,185	1,144	1,684	1,138	4,483	3,566	6,919	38	**73,157**	**1,10,139**
FY39	57,830	1,153	1,710	1,156	4,702	3,762	7,337	41	**77,691**	**1,16,627**
FY40	61,631	1,162	1,735	1,173	4,929	3,967	7,777	43	**82,418**	**1,23,396**
FY41	65,645	1,171	1,761	1,191	5,165	4,181	8,238	46	**87,399**	**1,30,510**
FY42	69,883	1,180	1,787	1,208	5,410	4,404	8,722	49	**92,644**	**1,37,983**
FY43	74,353	1,189	1,814	1,226	5,664	4,637	9,228	53	**98,164**	**1,45,828**
FY44	79,066	1,199	1,840	1,244	5,928	4,879	9,759	56	**1,03,971**	**1,54,059**
FY45	84,032	1,208	1,866	1,262	6,200	5,132	10,315	59	**1,10,074**	**1,62,690**
FY46	89,260	1,217	1,893	1,280	6,483	5,394	10,896	63	**1,16,486**	**1,71,735**
FY47	94,762	1,226	1,920	1,298	6,775	5,668	11,503	67	**1,23,218**	**1,81,209**
FY48	1,00,547	1,235	1,947	1,316	7,077	5,952	12,138	71	**1,30,283**	**1,91,127**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY49	1,06,627	1,245	1,974	1,334	7,389	6,247	12,800	76	**1,37,691**	**2,01,502**
FY50	1,13,012	1,254	2,001	1,353	7,711	6,554	13,490	80	**1,45,455**	**2,12,350**

Source: Steer analysis.

Table A. 2 Forecasts for final (background + impacts) AADT growth rates (%), km74 Srinagar

Vehicle Category	FY22	FY23	FY24	FY25	FY30	FY35	FY40	FY44
CJV	52.5%	8.5%	7.9%	7.6%	7.6%	7.1%	6.6%	6.3%
Mini LCV	52.5%	0.9%	0.9%	0.9%	0.9%	0.8%	0.8%	0.8%
LCV	41.6%	1.8%	(0.4%)	(0.4%)	1.7%	1.6%	1.5%	1.5%
Bus	45.9%	3.1%	2.5%	1.9%	1.7%	1.6%	1.5%	1.5%
2A	45.9%	5.7%	2.2%	2.1%	5.3%	5.1%	4.8%	4.6%
3A	43.3%	10.2%	(2.7%)	(3.6%)	6.0%	5.7%	5.4%	5.2%
MAV	43.3%	12.0%	(1.1%)	(2.0%)	6.6%	6.3%	6.0%	5.8%
Total	49.5%	8.0%	4.9%	4.7%	6.8%	6.5%	6.1%	5.9%
PCU	47.3%	8.4%	2.8%	2.5%	6.3%	6.1%	5.8%	5.6%

Source: Steer analysis.

Table A. 3: Forecasts for final (background+impacts) AADT, km164 Mahuvan

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	10,743	1,535	1,383	868	2,968	2,453	3,637	6	**23,593**	**46,151**
FY23	11,532	1,550	1,408	894	3,124	2,701	4,063	7	**25,279**	**49,798**
FY24	12,376	1,565	1,418	917	3,132	2,636	4,008	7	**26,059**	**50,377**
FY25	13,282	1,580	1,427	934	3,134	2,551	3,915	8	**26,830**	**50,785**
FY26	14,261	1,596	1,435	951	3,146	2,542	3,919	8	**27,858**	**51,871**
FY27	15,281	1,611	1,447	968	3,227	2,649	4,096	9	**29,288**	**54,170**
FY28	16,366	1,627	1,473	985	3,359	2,812	4,373	10	**31,005**	**57,231**
FY29	17,514	1,643	1,498	1,003	3,495	2,982	4,664	10	**32,810**	**60,442**
FY30	18,741	1,659	1,525	1,020	3,634	3,161	4,971	11	**34,721**	**63,821**
FY31	20,037	1,675	1,551	1,038	3,778	3,348	5,295	12	**36,733**	**67,372**
FY32	21,403	1,691	1,577	1,056	3,926	3,545	5,637	13	**38,848**	**71,100**
FY33	22,843	1,707	1,604	1,073	4,078	3,751	5,998	14	**41,069**	**75,010**
FY34	24,359	1,723	1,631	1,091	4,235	3,967	6,379	15	**43,399**	**79,109**
FY35	25,953	1,739	1,657	1,109	4,396	4,194	6,779	16	**45,843**	**83,403**
FY36	27,626	1,755	1,684	1,127	4,562	4,431	7,201	17	**48,404**	**87,899**
FY37	29,382	1,771	1,711	1,145	4,733	4,680	7,646	18	**51,084**	**92,602**
FY38	31,221	1,787	1,737	1,163	4,908	4,939	8,112	19	**53,887**	**97,518**
FY39	33,146	1,803	1,764	1,181	5,088	5,211	8,603	21	**56,817**	**1,02,654**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY40	35,143	1,818	1,791	1,198	5,273	5,495	9,118	22	**59,858**	**1,08,000**
FY41	37,242	1,834	1,817	1,216	5,462	5,791	9,659	23	**63,045**	**1,13,589**
FY42	39,446	1,850	1,844	1,234	5,656	6,100	10,226	25	**66,381**	**1,19,432**
FY43	41,759	1,866	1,871	1,252	5,856	6,422	10,820	27	**69,872**	**1,25,536**
FY44	44,185	1,882	1,899	1,271	6,060	6,758	11,443	28	**73,524**	**1,31,910**
FY45	46,729	1,898	1,926	1,289	6,269	7,108	12,094	30	**77,341**	**1,38,561**
FY46	49,394	1,914	1,953	1,307	6,483	7,472	12,775	32	**81,330**	**1,45,499**
FY47	52,185	1,930	1,981	1,326	6,702	7,850	13,487	34	**85,494**	**1,52,732**
FY48	55,105	1,946	2,009	1,344	6,926	8,244	14,231	36	**89,841**	**1,60,267**
FY49	58,159	1,963	2,036	1,363	7,155	8,653	15,008	38	**94,375**	**1,68,114**
FY50	61,352	1,979	2,064	1,382	7,389	9,077	15,818	40	**99,101**	**1,76,281**

Source: Steer analysis.

Table A. 4 Forecasts for final (background + impacts) AADT growth rates (%), km164 Mahuvan

Vehicle Category	FY22	FY23	FY24	FY25	FY30	FY35	FY40	FY44
CJV	25.6%	7.3%	7.3%	7.3%	7.0%	6.5%	6.0%	5.8%
Mini LCV	25.6%	1.0%	1.0%	1.0%	1.0%	0.9%	0.9%	0.9%
LCV	10.5%	1.8%	0.7%	0.7%	1.7%	1.6%	1.5%	1.5%
Bus	21.5%	3.1%	2.5%	1.9%	1.7%	1.6%	1.5%	1.5%
2A	21.5%	5.3%	0.2%	0.1%	4.0%	3.8%	3.6%	3.5%
3A	8.7%	10.1%	(2.4%)	(3.2%)	6.0%	5.7%	5.4%	5.2%
MAV	8.7%	11.7%	(1.3%)	(2.3%)	6.6%	6.3%	6.0%	5.8%
Total	**19.2%**	**7.1%**	**3.1%**	**3.0%**	**5.8%**	**5.6%**	**5.4%**	**5.2%**
PCU	**16.0%**	**7.9%**	**1.2%**	**0.8%**	**5.6%**	**5.4%**	**5.2%**	**5.1%**

Source: Steer analysis.

6.67 Further, the following tables provide the forecast AADT for the upcoming/planned toll plazas.

Table A. 5: Forecasts for final (background+impacts) AADT, km46 Prithila

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	30,016	3,242	2,355	1,000	1,254	1,409	2,200	28	**41,504**	**55,712**
FY23	32,676	3,302	2,398	1,031	1,324	1,498	2,366	31	**44,625**	**59,667**
FY24	35,531	3,362	2,443	1,056	1,401	1,595	2,541	33	**47,961**	**63,877**
FY25	38,535	3,421	2,488	1,076	1,481	1,699	2,722	36	**51,458**	**68,275**
FY26	41,785	3,482	2,535	1,096	1,566	1,808	2,915	38	**55,226**	**72,999**
FY27	45,191	3,541	2,580	1,116	1,653	1,921	3,115	41	**59,159**	**77,912**
FY28	48,827	3,600	2,626	1,136	1,743	2,039	3,325	44	**63,342**	**83,122**
FY29	52,708	3,660	2,672	1,156	1,837	2,163	3,547	48	**67,790**	**88,645**
FY30	56,932	3,721	2,719	1,176	1,935	2,292	3,780	51	**72,607**	**94,586**
FY31	61,420	3,782	2,766	1,196	2,037	2,428	4,027	55	**77,711**	**1,00,871**
FY32	66,177	3,843	2,813	1,217	2,143	2,571	4,287	59	**83,109**	**1,07,509**

FY33	71,211	3,904	2,860	1,237	2,254	2,720	4,562	63	**88,812**	**1,14,511**
FY34	76,531	3,965	2,908	1,258	2,370	2,877	4,851	67	**94,826**	**1,21,888**
FY35	82,143	4,025	2,955	1,278	2,490	3,041	5,156	72	**1,01,161**	**1,29,651**
FY36	88,054	4,086	3,003	1,299	2,615	3,214	5,477	77	**1,07,824**	**1,37,809**
FY37	94,270	4,146	3,051	1,319	2,746	3,394	5,815	82	**1,14,822**	**1,46,372**
FY38	1,00,794	4,205	3,098	1,340	2,881	3,582	6,170	88	**1,22,159**	**1,55,347**
FY39	1,07,633	4,265	3,146	1,361	3,022	3,779	6,543	94	**1,29,842**	**1,64,742**
FY40	1,14,678	4,323	3,193	1,381	3,168	3,985	6,935	100	**1,37,763**	**1,74,453**
FY41	1,22,125	4,381	3,241	1,402	3,320	4,200	7,346	107	**1,46,122**	**1,84,680**
FY42	1,29,992	4,440	3,289	1,422	3,478	4,424	7,777	114	**1,54,936**	**1,95,447**
FY43	1,38,299	4,499	3,337	1,443	3,641	4,657	8,229	121	**1,64,227**	**2,06,775**
FY44	1,47,064	4,559	3,386	1,464	3,810	4,901	8,702	129	**1,74,015**	**2,18,688**
FY45	1,56,309	4,618	3,434	1,485	3,985	5,155	9,198	137	**1,84,322**	**2,31,210**
FY46	1,66,054	4,678	3,483	1,507	4,167	5,419	9,716	146	**1,95,169**	**2,44,366**
FY47	1,76,320	4,739	3,533	1,528	4,355	5,693	10,257	155	**2,06,579**	**2,58,179**
FY48	1,87,129	4,799	3,582	1,549	4,549	5,979	10,823	164	**2,18,574**	**2,72,676**
FY49	1,98,504	4,860	3,632	1,571	4,749	6,275	11,414	174	**2,31,179**	**2,87,882**
FY50	2,10,468	4,921	3,682	1,592	4,956	6,583	12,030	185	**2,44,416**	**3,03,823**

Source: Steer analysis.

Table A. 6 Forecasts for final (background + impacts) AADT growth rates (%), km46 Prithila

Vehicle Category	FY22	FY23	FY24	FY25	FY30	FY35	FY40	FY44
CJV	54.7%	8.9%	8.7%	8.5%	8.0%	7.3%	6.5%	6.3%
Mini LCV	54.7%	1.8%	1.8%	1.8%	1.7%	1.5%	1.4%	1.3%
LCV	27.4%	1.8%	1.9%	1.9%	1.7%	1.6%	1.5%	1.5%
Bus	20.9%	3.1%	2.5%	1.9%	1.7%	1.6%	1.5%	1.5%
2A	20.9%	5.7%	5.8%	5.8%	5.3%	5.1%	4.8%	4.6%
3A	16.7%	6.4%	6.5%	6.5%	6.0%	5.7%	5.4%	5.2%
MAV	16.7%	7.5%	7.4%	7.1%	6.6%	6.3%	6.0%	5.8%
Total	**46.5%**	**7.5%**	**7.5%**	**7.3%**	**7.1%**	**6.7%**	**6.1%**	**6.0%**
PCU	**38.3%**	**7.1%**	**7.1%**	**6.9%**	**6.7%**	**6.4%**	**5.9%**	**5.8%**

Source: Steer analysis.

Table A. 7: Forecasts for final (background+impacts) AADT, km94 Kotwan

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	16,588	1,453	1,555	842	2,944	2,302	3,345	6	**29,034**	**50,530**
FY23	17,928	1,467	1,583	868	3,110	2,511	3,701	6	**31,175**	**54,398**
FY24	19,307	1,481	1,584	890	3,182	2,467	3,674	6	**32,591**	**55,847**
FY25	20,791	1,496	1,584	906	3,252	2,407	3,613	7	**34,056**	**57,213**
FY26	22,474	1,511	1,586	923	3,340	2,430	3,668	8	**35,940**	**59,493**
FY27	24,247	1,525	1,595	940	3,463	2,535	3,827	8	**38,141**	**62,596**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY28	26,142	1,540	1,624	957	3,652	2,691	4,086	9	**40,700**	**66,553**
FY29	28,159	1,555	1,652	973	3,849	2,854	4,358	9	**43,410**	**70,728**
FY30	30,328	1,570	1,681	990	4,053	3,025	4,645	10	**46,303**	**75,152**
FY31	32,635	1,585	1,710	1,008	4,267	3,204	4,948	11	**49,368**	**79,826**
FY32	35,084	1,601	1,739	1,025	4,489	3,393	5,267	12	**52,610**	**84,757**
FY33	37,681	1,616	1,769	1,042	4,722	3,590	5,604	12	**56,036**	**89,954**
FY34	40,432	1,631	1,798	1,059	4,964	3,797	5,960	13	**59,654**	**95,428**
FY35	43,341	1,646	1,827	1,077	5,216	4,014	6,335	14	**63,470**	**1,01,190**
FY36	46,416	1,661	1,857	1,094	5,478	4,241	6,729	15	**67,491**	**1,07,248**
FY37	49,660	1,677	1,886	1,111	5,751	4,479	7,144	16	**71,725**	**1,13,613**
FY38	53,080	1,692	1,916	1,129	6,035	4,728	7,580	17	**76,177**	**1,20,295**
FY39	56,681	1,707	1,945	1,146	6,330	4,988	8,039	18	**80,854**	**1,27,304**
FY40	60,438	1,721	1,975	1,163	6,636	5,259	8,520	20	**85,732**	**1,34,618**
FY41	64,407	1,736	2,004	1,181	6,954	5,543	9,025	21	**90,871**	**1,42,302**
FY42	68,600	1,751	2,034	1,198	7,284	5,838	9,555	22	**96,282**	**1,50,369**
FY43	73,024	1,766	2,063	1,216	7,626	6,147	10,110	24	**1,01,977**	**1,58,835**
FY44	77,692	1,781	2,093	1,233	7,981	6,468	10,692	25	**1,07,966**	**1,67,713**
FY45	82,612	1,796	2,124	1,251	8,348	6,803	11,300	27	**1,14,261**	**1,77,019**
FY46	87,795	1,812	2,154	1,269	8,728	7,151	11,937	29	**1,20,874**	**1,86,768**
FY47	93,251	1,827	2,184	1,287	9,121	7,514	12,602	30	**1,27,816**	**1,96,975**
FY48	98,991	1,842	2,215	1,305	9,527	7,890	13,297	32	**1,35,101**	**2,07,655**
FY49	1,05,027	1,858	2,246	1,323	9,948	8,282	14,023	34	**1,42,740**	**2,18,824**
FY50	1,11,369	1,874	2,276	1,341	10,381	8,688	14,780	36	**1,50,745**	**2,30,497**

Source: Steer analysis.

Table A. 8 Forecasts for final (background + impacts) AADT growth rates (%), km94 Kotwan

Vehicle Category	FY20	FY21	FY22	FY23	FY24	FY25	FY30	FY35	FY40	FY44
CJV	-	-	-	8.1%	7.7%	7.7%	7.7%	7.2%	6.6%	6.4%
Mini LCV	-	-	-	1.0%	1.0%	1.0%	1.0%	0.9%	0.9%	0.9%
LCV	-	-	-	1.8%	0.0%	(0.0%)	1.7%	1.6%	1.5%	1.5%
Bus	-	-	-	3.1%	2.5%	1.9%	1.7%	1.6%	1.5%	1.5%
2A	-	-	-	5.7%	2.3%	2.2%	5.3%	5.1%	4.8%	4.6%
3A	-	-	-	6.4%	(1.7%)	(2.4%)	6.0%	5.7%	5.4%	5.2%
MAV	-	-	-	7.5%	(0.7%)	(1.6%)	6.6%	6.3%	6.0%	5.8%
Total	**-**	**-**	**-**	**6.8%**	**4.4%**	**4.3%**	**6.6%**	**6.4%**	**6.0%**	**5.8%**
PCU	**-**	**-**	**-**	**6.5%**	**2.5%**	**2.2%**	**6.2%**	**6.0%**	**5.7%**	**5.6%**

Source: Steer analysis.

Table A. 9: Forecasts for final (background+impacts) AADT, km164 (new)

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	10,743	1,535	1,383	868	2,968	2,453	3,637	6	**23,593**	**46,151**
FY23	11,532	1,550	1,408	894	3,124	2,701	4,063	7	**25,279**	**49,798**
FY24	12,376	1,565	1,418	917	3,132	2,636	4,008	7	**26,059**	**50,377**
FY25	13,282	1,580	1,427	934	3,134	2,551	3,915	8	**26,830**	**50,785**
FY26	14,261	1,596	1,435	951	3,146	2,542	3,919	8	**27,858**	**51,871**
FY27	15,281	1,611	1,447	968	3,227	2,649	4,096	9	**29,288**	**54,170**
FY28	16,366	1,627	1,473	985	3,359	2,812	4,373	10	**31,005**	**57,231**
FY29	17,514	1,643	1,498	1,003	3,495	2,982	4,664	10	**32,810**	**60,442**
FY30	18,741	1,659	1,525	1,020	3,634	3,161	4,971	11	**34,721**	**63,821**
FY31	20,037	1,675	1,551	1,038	3,778	3,348	5,295	12	**36,733**	**67,372**
FY32	21,403	1,691	1,577	1,056	3,926	3,545	5,637	13	**38,848**	**71,100**
FY33	22,843	1,707	1,604	1,073	4,078	3,751	5,998	14	**41,069**	**75,010**
FY34	24,359	1,723	1,631	1,091	4,235	3,967	6,379	15	**43,399**	**79,109**
FY35	25,953	1,739	1,657	1,109	4,396	4,194	6,779	16	**45,843**	**83,403**
FY36	27,626	1,755	1,684	1,127	4,562	4,431	7,201	17	**48,404**	**87,899**
FY37	29,382	1,771	1,711	1,145	4,733	4,680	7,646	18	**51,084**	**92,602**
FY38	31,221	1,787	1,737	1,163	4,908	4,939	8,112	19	**53,887**	**97,518**
FY39	33,146	1,803	1,764	1,181	5,088	5,211	8,603	21	**56,817**	**1,02,654**
FY40	35,143	1,818	1,791	1,198	5,273	5,495	9,118	22	**59,858**	**1,08,000**
FY41	37,242	1,834	1,817	1,216	5,462	5,791	9,659	23	**63,045**	**1,13,589**
FY42	39,446	1,850	1,844	1,234	5,656	6,100	10,226	25	**66,381**	**1,19,432**
FY43	41,759	1,866	1,871	1,252	5,856	6,422	10,820	27	**69,872**	**1,25,536**
FY44	44,185	1,882	1,899	1,271	6,060	6,758	11,443	28	**73,524**	**1,31,910**
FY45	46,729	1,898	1,926	1,289	6,269	7,108	12,094	30	**77,341**	**1,38,561**
FY46	49,394	1,914	1,953	1,307	6,483	7,472	12,775	32	**81,330**	**1,45,499**
FY47	52,185	1,930	1,981	1,326	6,702	7,850	13,487	34	**85,494**	**1,52,732**
FY48	55,105	1,946	2,009	1,344	6,926	8,244	14,231	36	**89,841**	**1,60,267**
FY49	58,159	1,963	2,036	1,363	7,155	8,653	15,008	38	**94,375**	**1,68,114**
FY50	61,352	1,979	2,064	1,382	7,389	9,077	15,818	40	**99,101**	**1,76,281**

Source: Steer analysis.

Table A. 10 Forecasts for final (background + impacts) AADT growth rates (%), km164 (new)

Vehicle Category	FY22	FY23	FY24	FY25	FY30	FY35	FY40	FY44
CJV	25.6%	7.3%	7.3%	7.3%	7.0%	6.5%	6.0%	5.8%
Mini LCV	25.6%	1.0%	1.0%	1.0%	1.0%	0.9%	0.9%	0.9%
LCV	10.5%	1.8%	0.7%	0.7%	1.7%	1.6%	1.5%	1.5%

Bus	21.5%	3.1%	2.5%	1.9%	1.7%	1.6%	1.5%	1.5%
2A	21.5%	5.3%	0.2%	0.1%	4.0%	3.8%	3.6%	3.5%
3A	8.7%	10.1%	(2.4%)	(3.2%)	6.0%	5.7%	5.4%	5.2%
MAV	8.7%	11.7%	(1.3%)	(2.3%)	6.6%	6.3%	6.0%	5.8%
Total	**19.2%**	**7.1%**	**3.1%**	**3.0%**	**5.8%**	**5.6%**	**5.4%**	**5.2%**
PCU	**16.0%**	**7.9%**	**1.2%**	**0.8%**	**5.6%**	**5.4%**	**5.2%**	**5.1%**

Source: Steer analysis.

Revenue forecasts

B.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY44.

Table A. 11: **Forecasts for annual revenue, (INR crores), km74 Srinagar**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY22	45	3	8	10	29	38	65	0
FY23	4	0	1	1	3	4	7	0
FY24	62	4	9	12	36	47	84	0
FY25	70	4	10	13	39	47	86	0
FY26	80	5	10	13	42	50	91	0
FY27	90	5	11	14	46	54	99	1
FY28	102	5	12	15	51	61	111	1
FY29	115	6	12	16	56	67	124	1
FY30	130	6	13	17	61	74	138	1
FY31	145	6	14	19	68	83	154	1
FY32	165	7	15	20	75	91	172	1
FY33	185	7	16	21	82	101	191	1
FY34	205	7	17	22	90	112	212	1
FY35	230	8	18	24	99	123	236	1
FY36	258	8	19	25	109	137	263	1
FY37	287	8	20	27	119	150	290	2
FY38	323	9	21	28	131	166	322	2
FY39	361	10	23	30	143	183	357	21
FY40	401	10	24	32	158	202	396	2
FY41	448	11	25	34	173	222	438	3
FY42	497	11	27	36	188	245	485	3
FY43	554	12	29	38	206	269	536	3
FY44	618	12	31	41	227	297	595	4
FY45	687	13	32	43	247	326	656	4
FY46	760	14	34	46	271	359	726	4
FY47	843	14	37	49	296	395	801	5
FY48	935	15	39	52	324	434	886	5
FY49	1,036	16	41	55	353	476	975	6
FY50	1,152	17	44	58	385	522	1,075	7

Source: Steer analysis

Table A. 12: **Forecasts for annual revenue, (INR crores), km164 Mahuvan**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY22	30	5	8	10	38	51	76	0
FY23	3	0	1	1	4	5	8	0
FY24	41	6	9	12	48	66	100	0
FY25	46	7	10	13	51	67	103	0
FY26	52	7	10	14	54	70	108	0
FY27	58	7	11	15	58	77	119	0
FY28	66	8	12	16	63	86	134	0
FY29	73	8	12	17	69	95	149	0
FY30	82	9	13	18	75	106	166	0
FY31	91	9	14	19	82	118	186	1
FY32	103	10	15	20	89	130	207	1
FY33	115	11	16	21	96	144	230	1
FY34	127	11	17	23	104	159	255	1
FY35	141	12	18	24	114	175	284	1
FY36	158	12	19	26	123	195	317	1
FY37	175	13	20	27	133	214	349	1
FY38	196	14	21	29	145	236	388	1
FY39	218	14	23	31	157	261	430	12
FY40	240	15	24	33	170	288	477	1
FY41	267	16	26	34	184	316	527	2
FY42	295	17	27	37	199	348	584	2
FY43	327	18	29	39	215	383	646	2
FY44	363	19	31	41	234	423	716	2
FY45	401	20	32	44	252	464	790	2
FY46	442	21	34	46	273	511	874	3
FY47	488	22	37	49	296	561	964	3
FY48	539	23	39	52	320	618	1,067	3
FY49	594	25	41	55	345	677	1,174	4
FY50	657	26	44	59	373	743	1,295	4

Source: Steer analysis

Table A. 13: **Forecasts for annual revenue, (INR crores), km46 Prithila**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY22	35	5	6	6	8	15	23	0
FY23	67	10	11	10	15	26	41	1
FY24	84	11	13	12	18	32	51	1
FY25	97	12	14	12	20	36	57	1
FY26	111	13	15	13	22	40	64	1
FY27	125	14	16	14	25	45	73	1
FY28	144	15	17	15	27	50	82	1
FY29	161	16	18	16	30	56	91	1
FY30	181	17	20	17	33	61	101	1
FY31	205	18	21	18	37	68	113	2
FY32	232	19	22	20	40	76	126	2

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY33	261	21	23	21	44	84	140	2
FY34	294	22	25	22	49	92	156	2
FY35	327	23	26	24	53	102	173	3
FY36	370	25	28	25	59	113	193	3
FY37	411	26	30	27	64	124	213	3
FY38	460	28	32	28	70	137	237	4
FY39	513	29	34	30	77	151	262	41
FY40	575	31	36	32	85	168	292	5
FY41	636	33	38	34	93	184	322	5
FY42	710	35	41	36	102	202	356	6
FY43	788	37	43	38	111	223	394	6
FY44	883	39	46	40	123	246	437	7
FY45	973	41	48	43	133	270	481	8
FY46	1,082	44	51	45	146	297	532	9
FY47	1,205	47	54	48	160	326	588	10
FY48	1,337	49	58	51	175	359	650	11
FY49	1,478	52	61	54	190	393	715	12
FY50	1,646	55	65	57	208	432	789	13

Source: Steer analysis *commissioning of new toll plazas (km46 and km94) and de-commissioning of km74 expected in October FY22. Revenues here however reflect full-year revenue at these transitioning toll plazas for FY22. Red shading reflects potentially non-operational years. Green reflects actuals.

Table A. 14: **Forecasts for annual revenue, (INR crores), km94 Kotwan**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY22	32	4	6	6	27	34	49	0
FY23	34	4	6	7	29	38	56	0
FY24	42	4	7	8	35	43	64	0
FY25	49	5	8	9	37	44	66	0
FY26	55	5	8	9	40	47	71	0
FY27	62	5	9	10	44	52	79	0
FY28	70	5	9	11	49	58	88	0
FY29	79	6	10	11	54	64	98	0
FY30	90	6	10	12	60	72	110	0
FY31	102	6	11	13	66	79	122	0
FY32	115	7	12	14	72	88	137	0
FY33	128	7	13	14	79	97	151	0
FY34	144	8	13	15	87	107	168	0
FY35	163	8	14	16	95	118	187	0
FY36	181	8	15	17	105	131	208	0
FY37	201	9	16	18	115	144	230	1
FY38	225	9	17	19	126	159	255	1
FY39	251	10	18	21	138	176	284	7
FY40	280	10	19	22	152	194	314	1
FY41	314	11	20	23	166	214	348	1
FY42	351	12	22	25	182	235	384	1
FY43	388	12	23	26	200	259	425	1

FY44	433	13	25	28	218	286	472	1
FY45	483	14	26	29	238	313	521	1
FY46	534	14	28	31	261	345	576	1
FY47	591	15	29	33	285	379	635	2
FY48	663	16	31	35	313	416	702	2
FY49	731	17	33	37	340	457	773	2
FY50	814	18	35	39	372	501	853	2

Source: Steer analysis *commissioning of new toll plazas (km46 and km94) and de-commissioning of km74 expected in October FY22. Revenues here however reflect full-year revenue at these transitioning toll plazas for FY22.

Table A. 15: **Forecasts for annual revenue, (INR crores), km164 Mahuvan (new)**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV
FY22	23	4	6	7	30	39	59	0
FY23	25	4	6	8	32	45	68	0
FY24	32	5	7	9	37	50	77	0
FY25	35	5	8	10	39	51	79	0
FY26	40	5	8	10	41	54	83	0
FY27	45	6	8	11	44	59	92	0
FY28	50	6	9	12	49	66	103	0
FY29	56	6	10	13	53	73	115	0
FY30	64	7	10	14	58	82	128	0
FY31	71	7	11	15	62	90	143	0
FY32	80	8	12	15	68	100	159	0
FY33	88	8	12	16	74	111	177	0
FY34	99	9	13	17	80	122	196	1
FY35	109	9	14	19	87	135	218	1
FY36	123	9	15	20	95	149	243	1
FY37	136	10	16	21	102	164	268	1
FY38	151	11	17	22	111	181	298	1
FY39	168	11	17	24	121	200	330	10
FY40	186	12	19	25	131	221	367	1
FY41	206	12	20	26	141	243	406	1
FY42	226	13	21	28	153	267	448	1
FY43	253	14	22	30	166	296	498	1
FY44	281	15	24	32	180	325	551	2
FY45	309	15	25	34	194	357	607	2
FY46	341	16	27	36	210	393	671	2
FY47	377	17	28	38	227	431	741	2
FY48	419	18	30	40	245	475	820	2
FY49	458	19	32	43	265	521	903	3
FY50	508	20	34	45	286	571	995	3

Source: Steer analysis *commissioning of new toll plazas (km46 and km94) and de-commissioning of km74 expected in October FY22. Revenues here however reflect full-year revenue at these transitioning toll plazas for FY22.

C Data Collection Exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at Km74 Srinagar

Date	CJV	LCV	Bus	2A	3A	MAV	OSV	Total
05-03-2021	12,985	1,900	700	1,974	1,862	3,104	16	22,541
06-03-2021	19,682	2,070	745	1,807	1,792	3,187	15	29,298
07-03-2021	18,780	1,988	778	1,748	1,854	3,308	7	28,463
08-03-2021	13,486	1,839	756	1,558	1,602	2,743	18	22,002
09-03-2021	12,232	1,835	699	1,925	1,751	2,801	16	21,259
10-03-2021	12,806	1,981	686	2,011	1,943	3,204	7	22,638
11-03-2021	11,205	1,904	644	1,909	1,631	3,112	6	20,411

Source: Steer analysis

Table C.2: WADT TVC vs TMS at Km74 Srinagar

	Source	CJV +Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
TP1	TVC	62%	8%	3%	7%	7%	12%	0%	100%
	TMS	63%	5%	2%	9%	-	20%	0%	100%

Source: Steer analysis

Table C.3: 7-day TVC counts at Km164 Mahuvan

Date	CJV	LCV	Bus	2A	3A	MAV	OSV	Total
05-03-2021	8,742	2,398	724	2,836	2,704	4,069	4	21,477
06-03-2021	9,425	2,337	792	2,706	2,776	4,210	5	22,251
07-03-2021	11,049	2,312	848	2,714	2,870	4,218	6	24,017
08-03-2021	9,253	1,933	835	2,270	2,396	3,451	10	20,148
09-03-2021	8,641	2,093	788	2,817	2,536	3,484	4	20,363
10-03-2021	9,004	2,226	792	2,760	2,714	4,216	11	21,723
11-03-2021	7,222	2,189	761	2,844	2,558	3,867	7	19,448

Source: Steer analysis

Table C.4: WADT TVC vs TMS Km164 Mahuvan

	Source	CJV +Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
TP2	TVC	46%	10%	3%	12%	12%	17%	0%	100%
	TMS	47%	6%	3%	14%	-	30%	0%	100%

Source: Steer analysis

Table C.5: 7-day TVC counts at Km46 Prithla

Date	CJV	LCV	Bus	2A	3A	MAV	OSV	Total
05-03-2021	26,374	4,096	1,076	1,339	1,648	2,643	29	37,205
06-03-2021	29,578	3,885	1,035	1,291	1,885	2,844	25	40,543
07-03-2021	27,660	2,405	939	966	1,509	2,550	31	36,060
08-03-2021	26,985	3,702	1,142	1,337	1,657	2,651	29	37,503
09-03-2021	25,579	3,883	1,088	1,284	1,515	2,483	44	35,876
10-03-2021	25,781	4,138	1,052	1,467	2,064	3,002	40	37,544
11-03-2021	22,649	3,577	925	1,412	1,746	2,609	44	32,962

Source: Steer analysis

Table C.6: WADT TVC vs TMS at Km46 Prithla

	Source	CJV +Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
TP3	TVC	74%	9%	3%	3%	4%	7%	0%	100%

Source: Steer analysis

Table C.7: 7-day TVC counts at Km94 Kotwan

Date	CJV	LCV	Bus	2A	3A	MAV	OSV	Total
05-03-2021	12,253	2,395	685	2,495	2,650	3,761	5	24,244
06-03-2021	22,215	2,506	755	2,536	2,691	3,836	11	34,550
07-03-2021	20,192	2,602	750	2,405	2,749	4,021	8	32,727
08-03-2021	12,811	2,175	754	2,073	2,267	3,296	11	23,387
09-03-2021	11,793	2,184	678	2,542	2,406	3,367	3	22,973
10-03-2021	12,057	2,361	701	2,566	2,661	3,884	1	24,231
11-03-2021	11,378	2,263	608	2,615	2,404	3,742	4	23,014

Source: Steer analysis

Table C.8: WADT TVC vs TMS at Km94 Kotwan

	Source	CJV +Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
TP4	TVC	53%	8%	3%	9%	9%	13%	0%	100%

Source: Steer analysis

7 days TVC count (client data)

C.2 To derive the factors for calculation of traffic at Km46 and Km94. The client shared the TVC data collected by them from 23 August 2021 to 29 August 2021 and 27 August 2021 to 2 September 2021.

Table 6-78: 7-day TVC counts at Km74 Srinagar

Date	CJV	LCV	Bus	2A	3A	MAV
23-08-2021	16,078	1,442	595	1,324	1,427	2,137
24-08-2021	15,732	1,782	642	1,561	1,476	2,295
25-08-2021	14,436	2,005	754	1,751	1,572	2,700
26-08-2021	12,622	2,081	674	1,848	1,650	2,707
27-08-2021	14,539	2,091	683	1,802	1,650	2,802
28-08-2021	22,170	2,179	699	1,662	1,823	2,748
29-08-2021	19,865	1,976	624	1,879	1,695	2,893

Table 6-79: 7-day TVC counts at Km46

Date	CJV	LCV	Bus	2A	3A	MAV
23-08-2021	30,437	2,896	887	958	1,024	1,678
24-08-2021	30,867	3,243	827	1,004	1,032	1,814
25-08-2021	31,031	3,464	862	1,220	1,142	1,866
26-08-2021	27,782	3,744	892	1,112	1,258	2,053
27-08-2021	32,859	3,772	931	1,012	1,266	2,109
28-08-2021	31,986	3,663	844	1,007	1,310	2,114
29-08-2021	28,896	2,453	691	759	1,060	1,709

Table 6-80: 7-day TVC counts at Km94

Date	CJV	LCV	Bus	2A	3A	MAV
27-08-2021	14,375	2,324	645	2,609	2,350	3,136
28-08-2021	24,154	2,385	632	2,414	2,560	3,026
29-08-2021	21,246	2,319	560	2,576	2,619	3,217
30-08-2021	17,772	1,884	567	1,946	2,737	3,065
31-08-2021	16,657	1,921	605	2,052	2,308	2,649
01-09-2021	11,579	2,053	535	2,099	2,249	2,913
02-09-2021	10,069	2,421	624	2,122	2,186	2,956

Zone list

Zone No	Zone Name	State
1	Lucknow	Uttar Pradesh
2	Unnao	Uttar Pradesh
3	Kanpur	Uttar Pradesh
4	Sitapur, Hardoi	Uttar Pradesh
5	Kannauj, Farrukabad	Uttar Pradesh
6	Etawah	Uttar Pradesh
7	Mainpuri, Etah, Firozabad	Uttar Pradesh
8	North East Agra	Uttar Pradesh
9	South West Agra including Agra City	Uttar Pradesh
10	Aligarh	Uttar Pradesh

Zone No	Zone Name	State
11	Hathras	Uttar Pradesh
12	Kasganj	Uttar Pradesh
13	Shahjahapur, Lakhimpur	Uttar Pradesh
14	Pilibhit, Barelly, Budaun	Uttar Pradesh
15	Muradabad, Sambhal, Rampur	Uttar Pradesh
16	Bulandshahar	Uttar Pradesh
17	Mathura	Uttar Pradesh
18	Hapur, Amroha	Uttar Pradesh
19	Bijnor, Muzaffarnagar	Uttar Pradesh
20	Meerut	Uttar Pradesh
21	Gaziabad	Uttar Pradesh
22	Bhangel, Noida	Uttar Pradesh
23	Greater Noida	Uttar Pradesh
24	South Gautambudhnagar including Jewar, Bilaspur	Uttar Pradesh
25	Baghpat, Shamli	Uttar Pradesh
26	Shahranpur	Uttar Pradesh
27	BaraBanki, Raebareli, Amethi, Pratapgarh	Uttar Pradesh
28	Fatehpur, Allahabad, Kausambi	Uttar Pradesh
29	Sultanpur,Jaunpur, Akbarpur, Azamgarh	Uttar Pradesh
30	Varanasi, Mirzapur, Sonbadra	Uttar Pradesh
31	Bharaich, Deoria, Faizabad, Gorakhpur and North East of UttarPradesh	Uttar Pradesh
32	Lalitpur, Jhansi	Uttar Pradesh
33	Orai,Kanpur rural, Akbarpur, Hamirpur	Uttar Pradesh
34	Central Delhi (inside ring road)	NCT of Delhi
35	North Delhi (NH1)	NCT of Delhi
36	West Delhi (NH10)	NCT of Delhi
37	South West Delhi (NH8)	NCT of Delhi
38	South East Delhi (NH2)	NCT of Delhi
39	East Delhi (Anand Vihar, Noida Expressway)	NCT of Delhi
40	North East Delhi (NH24)	NCT of Delhi
41	North Haryana (Panipat, Ambala)	Haryana
42	West Haryana (Hisar, Sirsa)	Haryana
43	Central Haryana (Bhiwani, Dadri)	Haryana
44	Rothak	Haryana
45	Jhajjar	Haryana
46	South West Haryana (Gurugram)	Haryana
47	South West Haryana (Rewari)	Haryana
48	Palwal city	Haryana
49	Faridabad City	Haryana
50	North Madhya Pradesh	Madhya Pradesh
51	Central Madhya Pradesh	Madhya Pradesh
52	East Madhya Pradesh	Madhya Pradesh
53	West Madhya Pradesh	Madhya Pradesh
54	Jaipur City	Rajasthan
55	East Rajasthan (Alwar, Dausa(NH11), Bharartpur, Sawai Madhopur)	Rajasthan
56	Bhiwadi	Rajasthan
57	South Rajasthan (Jalor, Ajmer, Kota, Tong, Baran)	Rajasthan
58	West Rajasthan (Jaisalmer, Barmer)	Rajasthan

Zone No	Zone Name	State
59	North Rajasthan (Bikaner, Nagaur)	Rajasthan
60	East Maharashtra	Maharashtra
61	West Maharashtra	Maharashtra
62	Punjab, Chandigarh	Punjab
63	Himachal Pradesh	Himachal Pradesh
64	Uttarakhand	Uttarakhand
65	Jammu and Kashmir	Jammu & Kashmir
66	Gujarat	Gujarat
67	Telangana	Telangana
68	Chhatisgarh	Chhattisgarh
69	Odisha	Odisha
70	Bihar	Bihar
71	Jharkhand	Jharkhand
72	West Bengal and Sikkim	West Bengal
73	Goa	Goa
74	Andhra Pradesh	Andhra Pradesh
75	Karnataka	Karnataka
76	Kerala	Kerala
77	Tamil nadu	Tamil nadu
78	Assam, Sikkim	Assam
79	Arunanchal Pradesh	Arunanchal Pradesh
80	Nagaland	Nagaland
81	Manipur, Mizoram, Tripura, Meghalaya	Manipur
82	Jait	Uttar Pradesh
83	Naujhil, Ahuri, Siyaraha	Uttar Pradesh
84	Dankaur	Uttar Pradesh
85	Dadri	Uttar Pradesh
86	Sikri, Piyala	Haryana
87	Pirthala, Bhagola	Haryana
88	Bamnikhera, Aurangabag, Rundhi, Pingor	Haryana
89	Sholaka, Banchari	Haryana
90	Hodal	Haryana
91	Kushak, Kashipur, Hasanpur, Bhandoli, Barauli	Haryana
92	Hathin, Kot, Gharot, Mandkola	Haryana
93	Dhatir	Haryana
94	Dhadota, Gori	Haryana
95	Ballabgarh	Haryana
96	Rest of Faridabad	Haryana
97	Kosi kalan, chhata	Uttar Pradesh
98	Refinery, Mathura, Mahuan	Uttar Pradesh
99	Farah, Parkam	Uttar Pradesh
100	Jugsana, Bisawar, baldeo, Gokul	Uttar Pradesh
101	Vrindavan, Raya	Uttar Pradesh
102	Govardhan, Aring, Saunkh, Mogori	Uttar Pradesh
103	Barsana, Sahar, Rai, nandgaon	Uttar Pradesh
104	Khurja	Uttar Pradesh
105	Sikandrabad	Uttar Pradesh
106	Gopalpur, Rajarampur, Jokhabad, Luharli	Uttar Pradesh
107	Gabhana, Somna	Uttar Pradesh

Source: Steer analysis

Direction-wise commodity distribution

Table 6-81: Commodity distribution towards Hodal for Km74 Srinagar

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	11%	8%	17%	21%
Construction	1%	-	0%	1%
Stone	-	0%	-	0%
Groceries	11%	15%	27%	16%
Minerals	-	-	0%	0%
Manufacturing	17%	22%	18%	23%
Petroleum	1%	1%	1%	5%
Miscellaneous	37%	39%	20%	15%
Machinery	5%	4%	5%	3%
Container	-	0%	-	1%
Empty	16%	11%	11%	14%
Sand	-	0%	-	-

Source: Steer analysis

Table 6-82: Commodity distribution towards Faridabad for Km74 Srinagar

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	19%	12%	15%	10%
Construction	0%	-	2%	1%
Stone	1%	0%	1%	1%
Groceries	6%	9%	15%	18%
Minerals	-	0%	1%	1%
Manufacturing	18%	22%	24%	34%
Petroleum	2%	2%	3%	4%
Miscellaneous	25%	27%	24%	18%
Machinery	2%	3%	1%	1%
Container	-	1%	0%	0%
Empty	27%	25%	12%	13%
Sand	-	-	2%	0%

Source: Steer analysis

Table 6-83: Commodity distribution towards Mathura for Km164 Mahuvan

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	20%	9%	21%	16%
Construction	-	0%	0%	1%

Stone	-	-	-	0%
Groceries	10%	6%	13%	12%
Minerals	1%	-	0%	1%
Manufacturing	13%	22%	23%	33%
Petroleum	2%	6%	2%	4%
Miscellaneous	23%	21%	20%	14%
Machinery	1%	2%	2%	1%
Container	-	0%	0%	0%
Empty	33%	33%	17%	17%
Sand	-	-	-	0%

Source: Steer analysis

Table 6-84: Commodity distribution towards Agra for Km164 Mahuvan

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	10%	6%	11%	24%
Construction	0%	-	1%	4%
Stone	-	-	-	-
Groceries	8%	9%	26%	13%
Minerals	-	0%	-	0%
Manufacturing	15%	27%	14%	25%
Petroleum	4%	13%	9%	9%
Miscellaneous	20%	29%	23%	13%
Machinery	3%	2%	2%	1%
Container	-	-	-	0%
Empty	40%	13%	14%	11%
Sand	-	-	-	-

Source: Steer analysis

Table 6-85: Commodity distribution towards Palwal for Km46 Prithala

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	7%	1%	6%	7%
Construction	0%	-	0%	0%
Stone	0%	-	-	0%
Groceries	9%	2%	5%	5%
Minerals	0%	-	0%	-
Manufacturing	21%	18%	17%	26%
Petroleum	4%	6%	13%	6%
Miscellaneous	12%	22%	9%	10%
Machinery	4%	11%	8%	4%

Container	-	-	-	1%
Empty	42%	39%	41%	41%
Sand	-	-	-	-

Source: Steer analysis

Table 6-86: Commodity distribution towards Ballabhgarh for Km46 Prithala

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	10%	5%	11%	7%
Construction	0%	-	1%	3%
Stone	-	-	-	0%
Groceries	4%	6%	4%	8%
Minerals	1%	-	-	3%
Manufacturing	17%	28%	14%	25%
Petroleum	1%	3%	8%	2%
Miscellaneous	8%	8%	5%	5%
Machinery	4%	4%	3%	1%
Container	-	-	-	2%
Empty	55%	45%	52%	44%
Sand	-	-	1%	-

Source: Steer analysis

Table 6-87: Commodity distribution towards Hodal for Km94 Kotwan

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	27%	14%	20%	16%
Construction	-	0%	1%	0%
Stone	-	0%	0%	0%
Groceries	11%	14%	24%	25%
Minerals	-	1%	0%	2%
Manufacturing	18%	14%	23%	25%
Petroleum	2%	3%	3%	7%
Miscellaneous	8%	17%	10%	7%
Machinery	1%	4%	3%	1%
Container	-	-	-	0%
Empty	33%	32%	17%	17%
Sand	-	1%	0%	1%

Source: Steer analysis

Table 6-88: Commodity distribution towards Mathura for Km94 Kotwan

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV

Agriculture	19%	11%	11%	17%
Construction	-	1%	-	2%
Stone	-	-	-	-
Groceries	13%	13%	28%	20%
Minerals	0%	-	-	-
Manufacturing	28%	40%	21%	31%
Petroleum	2%	-	1%	4%
Miscellaneous	24%	17%	22%	13%
Machinery	3%	10%	4%	6%
Container	-	-	-	-
Empty	11%	8%	12%	8%
Sand	-	-	0%	1%

Source: Steer analysis

Trip length distribution

Table 6-89: Trip length distribution at Km74 Srinagar

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	21%	12%	15%	9%	7%	8%
65-300 km	65%	64%	41%	37%	27%	24%
300-500 km	7%	16%	12%	13%	14%	13%
500-1000 km	4%	6%	13%	14%	13%	18%
>1000 km	3%	2%	20%	26%	40%	38%

Source: Steer analysis

Table 6-90: Trip length distribution at Km164 Mahuvan

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	5%	3%	7%	6%	3%	1%
65-300 km	85%	78%	61%	31%	18%	17%
300-500 km	6%	12%	15%	15%	13%	13%
500-1000 km	3%	4%	10%	13%	12%	18%
>1000 km	1%	4%	8%	35%	54%	51%

Source: Steer analysis

Table 6-91: Trip length distribution at Km46 Prithala

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	72%	33%	72%	54%	49%	49%
65-300 km	25%	50%	18%	23%	29%	29%
300-500 km	2%	13%	3%	6%	5%	5%
500-1000 km	1%	3%	3%	4%	4%	4%

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
>1000 km	1%	1%	4%	12%	13%	13%

Source: Steer analysis

Table 6-92: Trip length distribution at Km94 Kotwan

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	28%	1%	19%	6%	6%	5%
65-300 km	61%	80%	40%	30%	23%	23%
300-500 km	4%	12%	12%	16%	10%	13%
500-1000 km	3%	6%	12%	14%	15%	17%
>1000 km	4%	2%	17%	33%	47%	42%

Source: Steer analysis

D Impact analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the asset.

D.2 Please find below the table for comparison of generalised journey cost for Delhi-Mumbai movement via the Asset route and via Delhi-Mumbai Expressway.

Table D.1: GJC comparison for level of service improvement

	via Asset			Via Delhi Mumbai Expressway		
	CJV	LCV	MAV	CJV	LCV	MAV
Existing Toll rates (INR)	1,695	2,661	10,140	2,064	3,354	10,836
Length (Km)	1,354	1,354	1,354	1,290	1,290	1,290
GJC (INR)	11,937	22,003	76,674	10,553	19,986	65,780

Source: Steer analysis

D.3 Please find below the table for comparison of generalised journey cost for Delhi-Lucknow movement via the Asset route and via Ganga Expressway.

Table D.2: GJC comparison for level of service improvement

	via Asset			Via Ganga Expressway		
	CJV	LCV	MAV	CJV	LCV	MAV
Existing Toll rates (INR)	672	973	3,373	865	1,409	4,316
Length (Km)	544	544	544	491	491	491
GJC (INR)	4,851	8,864	30,706	4,170	7,844	25,718

Source: Steer Analysis

D.4 Please find below the table for comparison of generalised journey cost for Delhi-Lucknow movement via the Asset route and via Palwal Tappal Aligarh.

Table D.3: GJC comparison for level of service improvement

	via Asset			Via Alternate		
	CJV	LCV	MAV	CJV	LCV	MAV
Existing Toll rates (INR)	646	934	3,295	847	1,225	3,836

	via Asset			Via Alternate		
Length (Km)	571	571	571	463	463	463
GJC (INR)	5,018	9,189	30,693	4,528	8,621	28,308

Source: Steer Analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre, Vatika Triangle, MG Road, Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Anshika Saxena;Mohd Wasey Khan

Reviewer/approver

Samhita Indurkar

Other contributors

Vaibhav Gupta

Distribution

Client: Steer:

Version control/issue number

V2.0

Date

April 2021

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence
Farakka - Raiganj Highways Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741302
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence Farakka - Raiganj Highways Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741302

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer ..... **viii**

Glossary Items ..... **i**

1 Introduction **1**

Our approach 2

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Asset context 7

Concession and tolling details 8

Key economic activities 10

Alternate and feeder routes 10

Alternate routes 10

Feeder routes 11

Overloading 11

PCU Factor assumption for Forecasts 11

3 Traffic Description **12**

Introduction 12

Historical trend 12

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes 15

Toll Frequencies 16

Impact of FASTag implementation 16

Overloading 19

Data Collection exercise 21

Key findings of the TVC data analysis 21

WADT estimates 21

TVC v/s TMS analysis 22

Key findings of origin-destination analysis 24

Overview 24

Sample rates 25

Zone categories 25
Zonal influence 26
Internal External analysis 27
Commodity distribution 28
Trip length analysis 32
Conclusions 34

4 Socio Economic Context 36

Introduction 36
Population growth 36
National Level 36
State Level 36
Economic growth 37
GDP and GSDP Growth 37
Economic activity in the state 38

5 Traffic growth analysis 39

Introduction 39
Estimation of background elasticities 39
CJV 41
LCV, 2A/Bus 41
3A/MAV Trucks 42
Forecasts for background elasticities 43
Forecasts for growth drivers 44
National GDP 44
West Bengal GSDP 45

6 Forecasts: Base year AADT and Impacts 46

Introduction 46
Seasonality Correction factors 46
Base year FY22 AADT estimates 47
Analysis of potential impacts 48
Alternate routes and improvements 48
Impact assessment for network/other developments 50

Overloading 51
Revenue forecasting assumptions 51
Toll segmentation 51
Trip factors 52
Toll evolution 53
Revenue reconciliation 53
Traffic and Revenue forecasts 54
Upside and Downside Cases 58
Traffic and Revenue Forecasts-Upside case 60
Traffic and Revenue Forecasts-Downside case 63
Concession agreement: effect of variations in target traffic growth 66
Summary outlook 66
Risks 67

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4
Figure 2.1: Asset location in the regional road network 6
Figure 2.2: Asset context 8
Figure 2.3: Typical cross-section and toll plazas on the Asset 9
Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1 Lakshmipur 14
Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2 Gazole 14
Figure 3.3: MADT FY21 vs FY20 AADT, Asset Level 15
Figure 3.4: Ticket-segmentation for CJV, TP1 Lakshmipur 17
Figure 3.5: Ticket-segmentation for MAV, TP1 Lakshmipur 18
Figure 3.6: Ticket-segmentation for CJV, TP2 Gazole 18
Figure 3.7: Ticket Segmentation for MAV, TP2 Gazole 19
Figure 3.8: Overloading percentage wrt to single ticket shares upto Mar 2022, TP1 Lakshmipur 19
Figure 3.9: Overloading percentage wrt to single ticket shares, TP2 Gazole 20
Figure 3.10: WADT by vehicle type 22
Figure 3.11: Comparison between TVC and TMS daily traffic data, TP1 Lakshmipur 23
Figure 3.12: Comparison between TVC and TMS daily traffic data, TP2 Gazole 23

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs 24
Figure 3.14: Zonal influence, TP1 Lakshmipur 26
Figure 3.15: Zonal influence, TP2 Gazole 27
Figure 3.16: Internal-External distribution, TP1 Lakshmipur 28
Figure 3.17: Internal-External distribution, TP2 Gazole 28
Figure 3.18: Commodity distribution, TP1 Lakshmipur (Total) 30
Figure 3.19: Commodity distribution, TP1 Lakshmipur (Towards Farraka) 30
Figure 3.20: Commodity distribution, TP1 Lakshmipur (Towards Raiganj) 31
Figure 3.21: Commodity distribution, TP2 Gazole (Total) 31
Figure 3.22: Commodity distribution, TP2 Gazole (towards Farraka) 32
Figure 3.23: Commodity distribution, TP2 Gazole (towards Raiganj) 32
Figure 3.24: Trip length distribution, TP1 Lakshmipur 33
Figure 3.25: Trip length distribution, TP2 Gazole 34
Figure 4.1: Evolution of West Bengal's state GDP and national GDP 37
Figure 4.2: Sectoral contribution to West Bengal's GSDP 38
Figure 5.1: 12-month floating average for CJV 41
Figure 5.2: 12-month floating average for LCV and 2A/Bus 42
Figure 5.3: 12-month floating average for 3A and MAV 43
Figure 5.4: GDP-GSDP forecast 45
Figure 6.1: Alternate routes and Asset route shown against the regional network context 49
Figure 6.2: Forecast traffic and growth rates in PCUs - Background and final, TP1 58
Figure 6.3: Forecast traffic and growth rates in PCUs - Background and final, TP2 58

Tables

Table 1-1: Scope of work and sources of data 1
Table 2-1: Key concession details 8
Table 2-2: Single toll rates on the Asset (INR), FY22 9
Table 2-3: PCU factors 11
Table 3-1: Historical evolution in AADT by vehicle class at TP1 12
Table 3-2: Historical YoY growth rates and CAGR by vehicle class at TP1 13
Table 3-3: Table 3.2: Historical evolution in AADT by vehicle class at TP2 13

Table 3-4: Historical revenue evolution (in INR crores)..... 15
Table 3.5: Typical ticket types sold at NHAI plazas..... 16
Table 3.6: Timeline of national ETC implementation..... 16
Table 3-7: Percentage of transactions via FastTag, Mar-2022..... 17
Table 3-8: Overloading penalties on Asset..... 20
Table 3-9: Data collection schedule..... 21
Table 3-10: Sample rates for OD data..... 25
Table 3-11: Zone aggregations for zonal influence analysis..... 25
Table 3-12: Aggregate commodity categories..... 29
Table 4-1: CAGR of population in India..... 36
Table 4-2: Population Growth in India (2001 – 2011)..... 37
Table 5-1: Vehicle-wise growth and CAGR (%), TP1 Lakshmipur..... 39
Table 5-2: Vehicle-wise growth and CAGR (%), TP2 Gazole..... 40
Table 5-3: Identified growth drivers to model traffic growth..... 40
Table 5-4: Assumed forecast elasticities for background growth..... 43
Table 6-1: Key intermediate and final outputs in the forecast..... 46
Table 6-2: Seasonality correction factors for TP1 Lakshmipur and TP2 Gazole..... 47
Table 6.3 Monthly MADT and Adopted AADT for FY22 - TP1 Lakshmipur..... 47
Table 6.4 Monthly MADT and Adopted AADT for FY22 – TP2 Gazole..... 48
Table 6-5: List of network/other developments..... 49
Table 6-6: Impact of completion of construction on Asset for TP1 and TP2..... 50
Table 6-7: Impact of completion of construction on Asset..... 50
Table 6-8: FY22 average overloading penalty factors..... 51
Table 6-9: Toll segmentation for the forecast years, TP1 Lakshmipur..... 52
Table 6-10: Toll segmentation for the forecast years, TP2 Gazole..... 52
Table 6-11: Trip factors for the forecast years, TP1 Lakshmipur..... 52
Table 6-12: Trip factors for the forecast years, TP2 Gazole..... 52
Table 6-13: WPI growth forecast assumptions..... 53
Table 6-14: Toll estimation overview..... 53
Table 6.15: Revenue reconciliation summary for March 2022..... 54
Table 6-16: Final (background plus impacts) traffic forecast for TP1 Lakshmipur..... 54
Table 6-17: Final (background plus impacts) traffic CAGR (%) for TP1 Lakshmipur..... 55

Table 6-18: Final (background plus impacts) Revenue forecast (INR Crores) for TP1 Lakshmipur 55
Table 6-19: Final (background plus impacts) Revenue CAGR (%) for TP1 Lakshmipur 56
Table 6-20: Final (background plus impacts) traffic forecast for TP2 Gazole 56
Table 6-21: Final (background plus impacts) traffic CAGR (%) for TP2 Gazole 56
Table 6-22: Final (background plus impacts) Revenue forecast (INR Crores) for TP2 Gazole 57
Table 6-23: Final (background plus impacts) Revenue CAGR (%) for TP2 Gazole 57
Table 6.24: Summary of Macro Assumptions for upside and downside cases 59
Table 6.25: Summary of impacts on the Assets 59
Table 6.26: Summary of impacts on the Assets 60
Table 6.27: Traffic forecast (With Upside Impacts) for TP1: Lakshmipur 60
Table 6.28: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Lakshmipur 60
Table 6.29: Revenue forecast (With Upside Impacts) for TP1: Lakshmipur (In Cr) 61
Table 6.30: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Lakshmipur 61
Table 6.31: Traffic forecast (With Upside Impacts) for TP2: Gazole 61
Table 6.32: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Gazole 62
Table 6.33: Revenue forecast (With Upside Impacts) for TP2: Gazole (In Cr) 62
Table 6.34: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Gazole 62
Table 6.35: Traffic forecast (With Downside Impacts) for TP1: Lakshmipur 63
Table 6.36: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Lakshmipur 63
Table 6.37: Revenue forecast (With Downside Impacts) for TP1: Lakshmipur 64
Table 6.38: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Lakshmipur 64
Table 6.39: Traffic forecast (With Downside Impacts) for TP2: Gazole 64
Table 6.40: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Gazole 65
Table 6.41: Revenue forecast (With Downside Impacts) for TP2: Gazole (In Cr) 65
Table 6.42: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Gazole 65
Table 6-43: Target Traffic: Concession agreement vs the forecast traffic 66

Appendices

A Top 10 OD Pairs

B Detailed Forecasts

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

1.1 Cube Highways Fund Advisors Private Limited (referred to as 'Client' hereafter) has commissioned Steer Davies Gleave India Private Limited (hereafter called 'Steer') for a traffic due diligence to be carried out on Farakka Raiganj Highways Limited Road (hereafter called 'Asset').

1.2 Our scope of work for the traffic and revenue forecasts process includes:

Table 1-1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line based on client inputs and RBI (WPI FY23)

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on existing/brownfield Assets.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from FY12 to FY22.
  - Concession agreement and toll notifications
  - Previous studies
- Steer-commissioned TVC counts from 20th to 26th March 2021
- Steer conducted OD surveys on behalf of the client in September 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.

- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the asset against our Steer knowledge base (e.g., similar asset types in the same state or on the same corridor), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes major network and other impacts including change in toll rates and more. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

1.9 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until May 3rd 2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March and 20th April. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

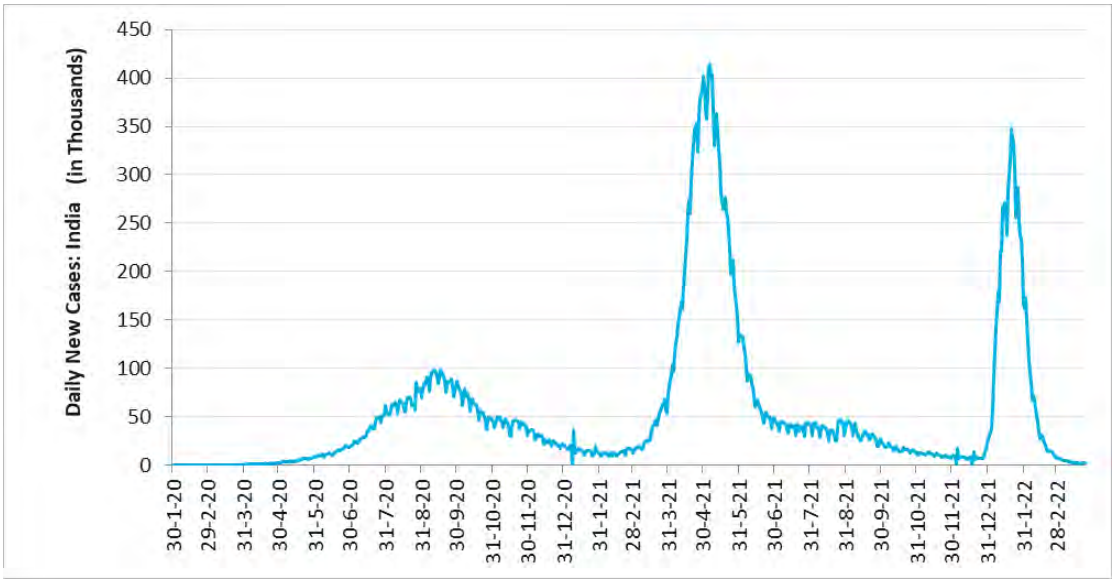
1.11 Data from various roads across the country indicates that the largest impact on MAV traffic was experienced between the months of March 2020 to May 2020, with rest of the FY21 showing MAV volumes par FY20 levels. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, and as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption

/production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to Feb-2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for one quarter. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe in comparison to fatality rate, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave.

1.16 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus service. For example, once a family starts using a personal CJV for

inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence ;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset, and summarises our approach and results on estimating background traffic demand growth; and,
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

Introduction

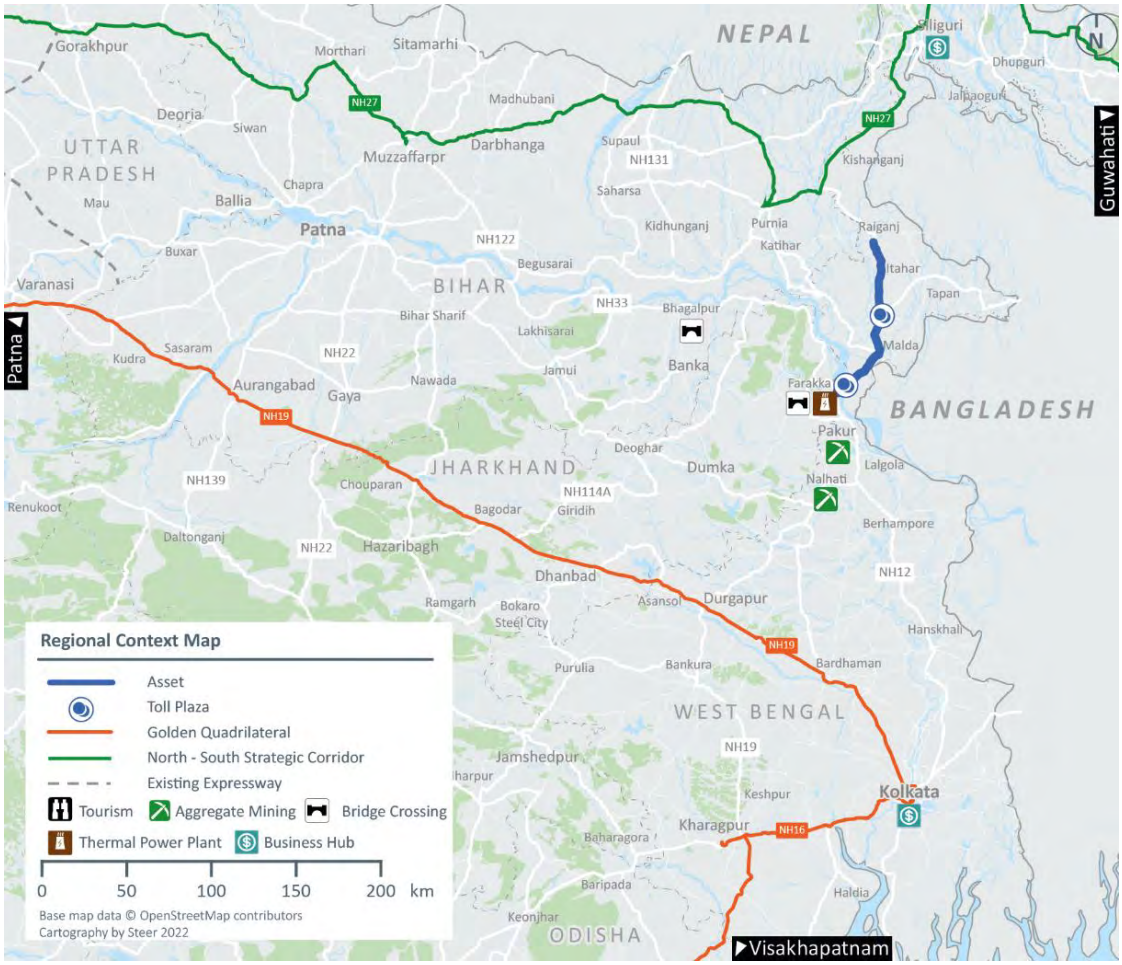
2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of West Bengal, connecting the cities of Farakka and Raiganj where it also passes through another city – Malda - and is located very close to the international border with Bangladesh.

2.3 The figure below shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional road network



Source: Steer cartography using OpenStreetMap data.

2.4 As the Asset sits near the border, it also provides connectivity to international land ports on India-Bangladesh border at Mahadipur and Hili connected to the Asset at Malda and Gazole respectively.

2.5 Traffic on the project road is primarily commercial traffic carrying goods to different parts of the state of West Bengal, the north-eastern states, adjoining western states (Bihar and Jharkhand) and some southern states (such as Andhra Pradesh and Tamil Nadu).

2.6 The Asset primarily caters to three different types of strategic movements:

- **Short-distance trips** between Malda and other towns in Malda and Murshidabad districts.
- **Medium-distance** trips between southern and northern parts of West Bengal, including movements between Pakur region, Malda and Bangladesh.
- **Long-distance trips** between South and East India including Kolkata, and Northeast India. Kolkata is the largest urban agglomeration and one of the four older metropolitan cities of India and is both a large attractor and generator of consumption-linked commodities in East and Northeast India.

2.7 Essentially, both medium-distance and long-distance movements need to cross the two-lane Farakka Barrage, on the Ganges River, located just at the southern end of the Asset which makes the Asset a crucial funnelling link between southern and northern parts of West Bengal state. Traffic between Kolkata/Durgapur/ Bardhaman and Kishanganj/northeast regions use this barrage, and it is the only bridge crossing available near these places or on this route NH12. Hence, it can be reaffirmed that the Asset forms part of a strategic corridor serving long distance carrying commercial traffic majorly.

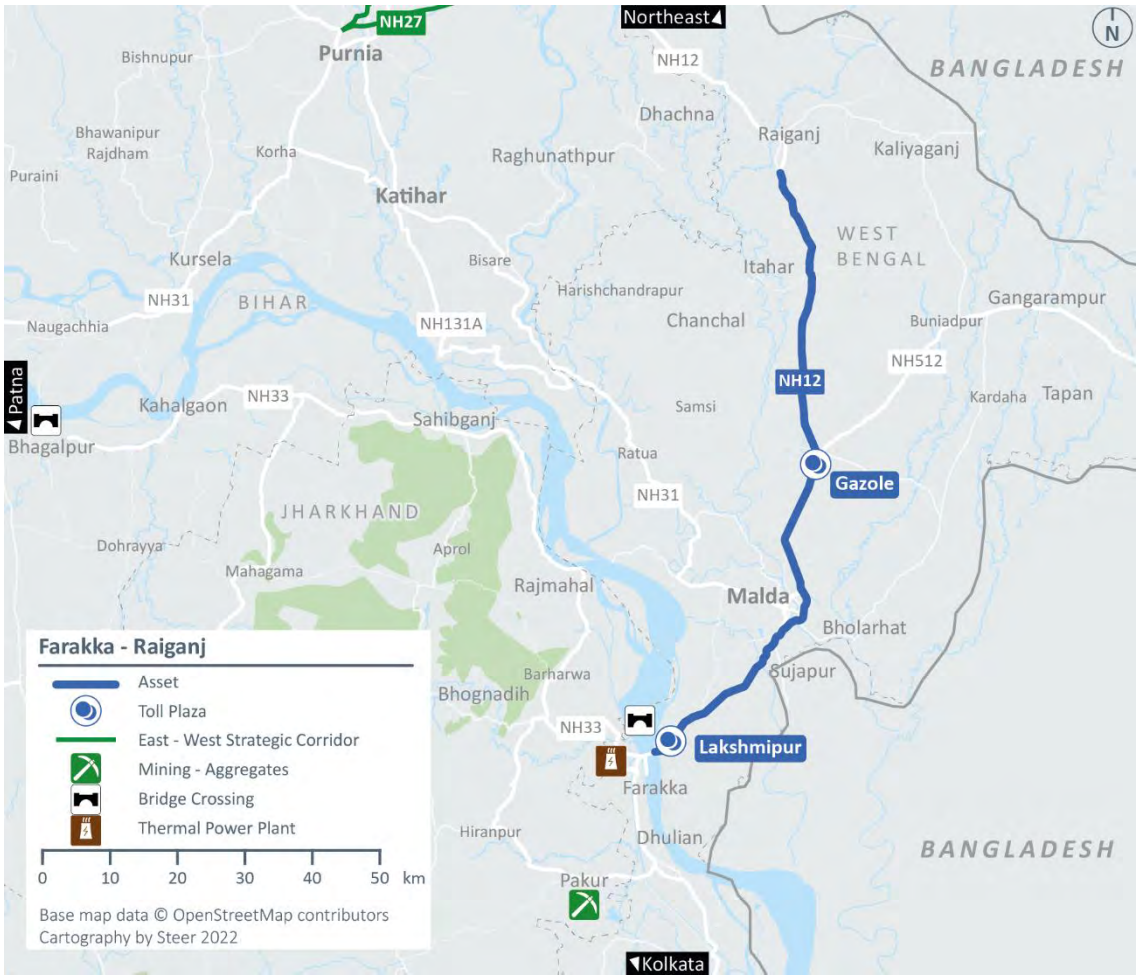
Asset context

2.8 The Asset is a 100.05 km toll road which forms a part of NH 12 in West Bengal. It is a four-lane road with two toll plazas, namely, Lakshmipur (TP1) at Km 297.9 (closer to Farakka in the south) and Gazole (TP2) at Km 351.4 (closer to Malda).

2.9 Malda, Gazole are the major settlements situated along the Asset majorly influencing the short to medium distance traffic especially passenger traffic and acts as major generators/attractors of traffic on the Asset.

2.10 The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.11 The toll plazas on the Asset have been operational since October 2016 and the Client took over the operations in September 2020. There are 19 years left in the concession period with FY41 expected to be the last year of concession. The following table summarises key aspects of the concession.

Table 2-1: Key concession details

	Particulars
State	West Bengal
Highway and lane configuration	NH12 four-lane
Toll plazas	• TP1: Lakshmipur • TP2: Gazole
Appointed date	February 2011
Commencement of operations*	October 2016
Operated by Client since	September 2020
Concession period	30 years
Last year of concession	FY41

	Particulars
Tollable length (Km) as per concession agreement, applicable	• TP1: 47.67 km • TP2: 43.38 km • Malda Bypass: 9.05 km

Source: Client Data

2.12 Figure 2.3 shows a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross-section and toll plazas on the Asset

Source: Steer site visit

2.13 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling. As you can see from the table below, Malda Bypass was commissioned in early FY22 resulting in significant increase in toll rates for Lakshmipur toll plaza.

Table 2-2: Single toll rates on the Asset (INR), FY22

Type of Vehicle	Single Journey Fee	
	TP1 Lakshmipur	TP2 Gazole
CJV	120	55
LCV	185	85
Bus/Truck	380	180
3A/MAV	585	285
HCM/EME/OSV	745	345

Source: NHAI Revision of User fee Rate w.e.f 01.04.2021

Key economic activities

2.14 Traffic on Asset is primarily commercial traffic carrying goods to different parts of the state of West Bengal, the north-eastern states, adjoining western states (Bihar and Jharkhand) and some southern states (such as Andhra Pradesh and Tamil Nadu).

2.15 Key economic activities along the Asset includes agriculture (cotton, rice and vegetables being the major commodities that are produced) and aggregate mining and distribution.

2.16 Out of this, Pakur, which is situated at 25km south of the Asset, is a major generator of traffic carrying stone aggregate to Bangladesh through landports at Hili, Mahadipur on the border and Northeast India. Further, given that Jharkhand has ~600 licensed quarries, with stone aggregates as the major output, this industry significantly contributes to the economic activity happening around the state, of which, Pakur along with Hiranpur are in the vicinity of the Asset.

2.17 Given that West Bengal is considered to be the gateway for India's Act East Policy which aims to boost India's strategic, economic and cultural ties with the Southeast Asian countries including Bangladesh, the Asset forms an important link between India and Bangladesh as the Asset provides connectivity to international land ports on the India-Bangladesh border at Mahadipur from Malda and Hili from Gazole as mentioned earlier.

Alternate and feeder routes

Alternate routes

2.18 Further to the previous section on the strategic network context of the Asset, this section provides brief details of the alternate routes possible and currently available to road users. We have conducted a thorough assessment to further analyse these routes and consider those, we believe, would impact the Asset significantly, as presented in Chapter 6.

- For long-distance traffic, there is an alternate route through NH14 via the Bhagalpur bridge. This bridge is the only next available road option west of the Asset to cross the Ganga River.
  - For trips between Kharagpur and Siliguri, this alternate road provides a distance of (around 655 km) and time (15 hours 30 minutes) as per Google Map estimates.
  - For trips between Kolkata and Siliguri, the Asset Road is the main route and the alternate road is not competitive, being much longer both by distance (about 670 km against 560 km) and time (about 13 hours against 15 hours).
- For medium-distance traffic primarily carrying aggregate commodities between the Pakur region and Malda/Bangladesh, there is no alternative by road. However, as per interviews with truck drivers during our site visits, we understand that the informal Ro-Ro service, between Manikchak on the northern bank and Rajmahal on the southern bank, provides an alternative to the road route through Asset. This alternate route is especially used during very bad traffic jams at several locations on the Asset, partially attributable to construction-related closures. Considering the completion of the construction on the Asset and from the site it is understood that the service provided currently is of informal set up, we have assumed there would not be a major impact on the Asset from this route.
- **Sahibganj impact:** A four-lane bridge of length 6Km on the Ganges River near Sahibganj, is planned to be constructed between Sahibganj and Manihari. It is expected to be completed by FY27-28. This would provide a route choice to the OD pairs including but not limited to, south of Farakka (including Kolkata, Bardhaman, Pakur) and North of Raiganj (area between Kishanganj and Supaul including Purnia, Katihar). This impact is evaluated in chapter 6.

Feeder routes

2.19 The construction of pending stretches on the Asset is expected to be completed and would contribute to improve in the quality of service on the road. Further, the northern section of the Asset between Raiganj-Dalkhola along with Dalkhola bypass is getting upgraded, increase in the Level of Service (LOS) is expected from this improvement. This is further discussed in detail in Chapter 6.

Overloading

2.20 Overloading of commercial vehicles is highly prevalent on this corridor. This is attributed to the fact that the major commodities carried on the Asset include aggregates and construction materials, with the important crushing and mining centres such as Pakur and Hiranpur is present in the vicinity. This is charged through staggered overloading penalty system with truckers paying up to 10 times the toll as penalty. Hence, overloading on the Asset is further analysed in the chapter 3 and 6, on how it is charged and the assumptions going forward.

PCU Factor assumption for Forecasts

2.21 In addition, please see the PCU factors considered in the table below.

Table 2-3: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.2
OSV	4.5

Source: Steer analysis

2.22 For MAV, based on the discussion with client, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For rigid trailer trucks we have assumed a PCU factor of 3, whereas for trailer trucks we have assumed a PCU factor of 4.5.

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Toll plaza data is used as the primary basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trend

3.4 The following table indicate the historical variation in traffic volume at the toll plaza, in terms of vehicle shares and total AADT.

3.5 As discussed earlier in chapter 2, In terms of vehicle composition, 3A and MAV are the biggest contributor on the Asset with a share of around 50% since the Asset acts as a feeder between Bihar, Jharkhand on the west and southern states of Andhra Pradesh, Tamil Nadu. In addition, the Asset also observes economic activities such as, agriculture (cotton, rice and vegetables being the major commodities that are produced) and aggregate mining and distribution which also contribute to the high volume of 2A and MAV.

Table 3-1: Historical evolution in AADT by vehicle class at TP1

Class	FY17	FY18	FY19	FY20	FY21	FY22
CJV	2,168	2,536	2,479	2,822	3,660	3,661
LCV	678	800	868	861	741	421
2A	1,239	1,293	1,350	1,317	1,328	1,286
3A	1,933	1,770	954	1,039	961	774
MAV	2,648	3,515	3,216	4,347	4,060	4,436
Total	**8,666**	**9,915**	**8,867**	**10,385**	**10,751**	**10,578**
PCU	**21,174**	**24,175**	**20,983**	**25,090**	**24,632**	**24,667**

Source: Steer analysis of the Client data

3.6 With the opening of Malda bypass in FY21 there has been an overall improvement in level of service on the corridor. This coupled with preference for personal mobility post COVID-19

related behavioural changes, and non-resumption of bus and train networks to pre pandemic levels has helped higher growth in CJV volumes on the toll plaza.

3.7 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Table 3-2: Historical YoY growth rates and CAGR by vehicle class at TP1

Class	FY18	FY19	FY20	FY21	FY22	CAGR (FY19-20)	CAGR (FY19-22)	CAGR (FY20-22)
CJV	17%	(2%)	14%	30%	(4%)	14%	13%	12%
LCV	18%	9%	(1%)	(11%)	(4%)	(1%)	(5%)	(7%)
2A/Bus	4%	4%	(2%)	(2%)	6%	(2%)	0%	2%
3A	(8%)	(46%)	9%	(6%)	11%	9%	4%	2%
MAV	33%	(9%)	35%	(10%)	14%	35%	12%	2%
Total	**14.4%**	**(10.6%)**	**17.1%**	**2.3%**	**5.4%**	**17.1%**	**8.1%**	**3.8%**
PCU	**24.6%**	**(5.1%)**	**24.3%**	**(4.5%)**	**9.9%**	**22.2%**	**8.5%**	**2.3%**

3.8 The CAGR for this Asset was comprised of a positive 8.5% PCU level during the FY19-22 and a positive 2.3% level during FY20-22.

Table 3-3: Table 3.2: Historical evolution in AADT by vehicle class at TP2

Class	FY17	FY18	FY19	FY20	FY21	FY22
CJV	2,984	3,498	3,895	4,283	4,802	5,145
LCV	663	651	637	658	538	323
2A/Bus	1,527	1,655	1,658	1,679	1,566	1,621
3A	1,464	1,321	851	999	913	797
MAV	2,046	2,452	2,501	3,337	3,222	3,313
Total	**8,683**	**9,577**	**9,541**	**10,956**	**11,041**	**11,200**
PCU	**19,498**	**21,249**	**20,379**	**23,983**	**23,356**	**23,487**

3.9 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

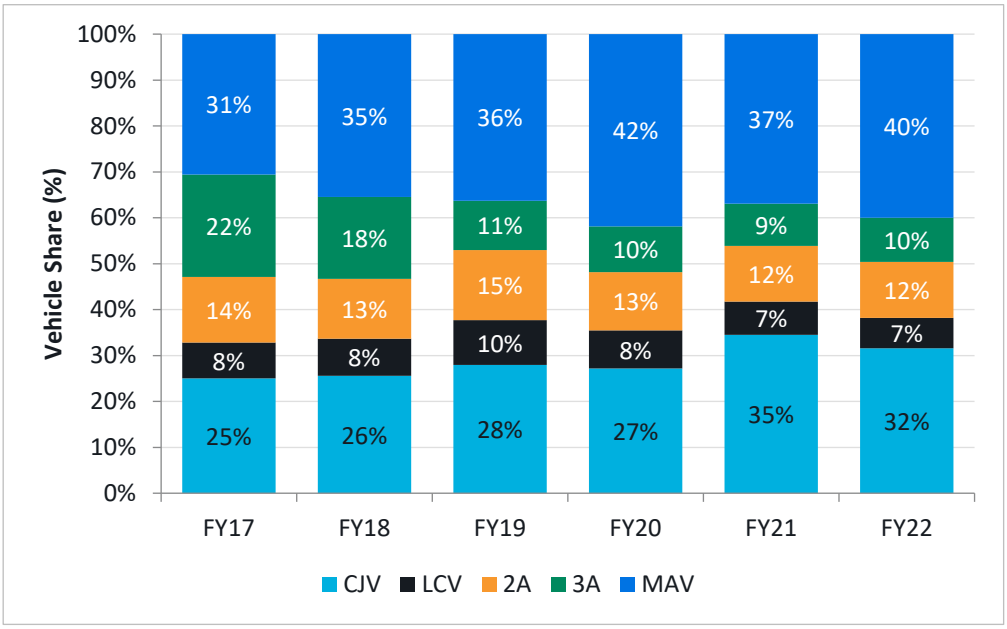
Class	FY18	FY19	FY20	FY21	FY22	CAGR (FY19-20)	CAGR (FY19-22)	CAGR (FY20-22)
CJV	17%	11%	10%	12%	(6%)	10%	5%	3%
LCV	(2%)	(2%)	3%	(13%)	4%	3%	(2%)	(5%)
2A	8%	0%	1%	(8%)	14%	1%	2%	2%
3A	(10%)	(36%)	17%	(7%)	12%	17%	7%	2%
MAV	20%	2%	33%	(5%)	8%	33%	11%	1%
Total	**10.3%**	**(0.4%)**	**14.8%**	**0.7%**	**3.0%**	**14.8%**	**6.0%**	**1.8%**
PCU	**15.6%**	**3.0%**	**20.4%**	**(2.8%)**	**6.4%**	**19.9%**	**7.4%**	**1.7%**

3.10 We can see that the Asset carries a particularly high volume of 3A/MAVs, comparable with that of CJV volumes. While the southern TP1 Lakshmipur has more than 5,500 3A/MAVs, TP2 Gazole has roughly 1,000 less at around 4,400 3A/MAVs at an AADT level. On the contrary, at the AADT

level TP2 Gazole has around 1,000 CJVs more than TP1, as TP2 is closer to the town of Malda. Additionally, 2A/Bus hold a considerable volume, at around 1,300 and 1,700 at TP1 and TP2 respectively.

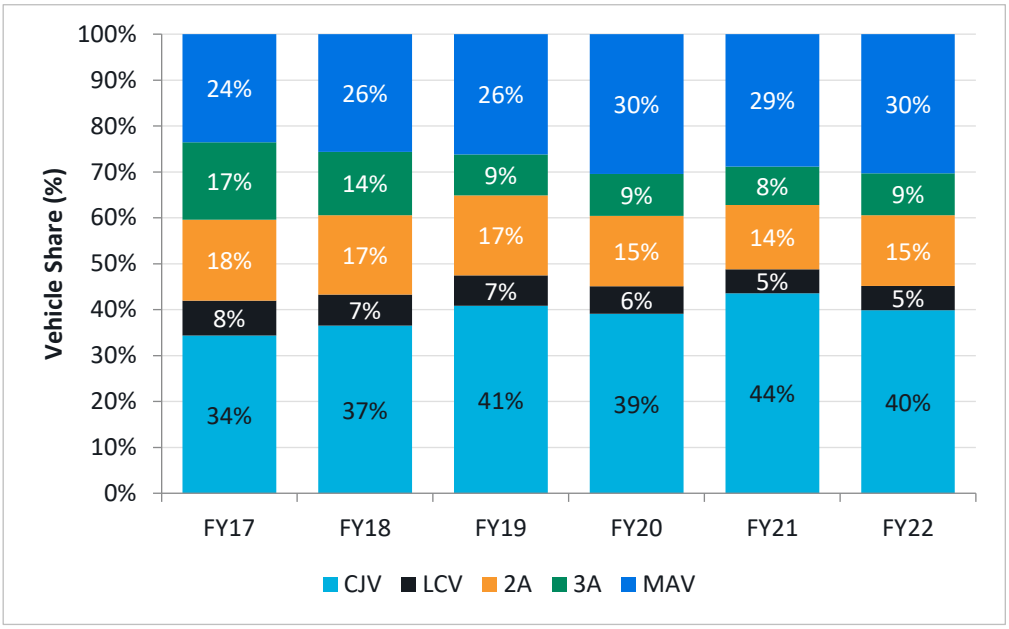
3.11 The figure below presents the vehicle shares as they have evolved from FY17 upto FY22.

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1 Lakshmipur



Source: Steer analysis of the Client data (FY17 data includes October 2016 – March 2017 only and data includes only the operational days for April 2020)

Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2 Gazole



Source: Steer analysis of the Client data

3.12 The table below presents the reported historical revenue including overloading revenue of the Asset.

Table 3-4: Historical revenue evolution (in INR crores)

	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
Annual Revenue (INR Crore)	67.67	151.57	106.83	167.14	167.14	201.96

3.13 The opening of the Malda bypass in early FY22 has resulted in a significant increase in toll rates on TP1, resulting in higher revenue realisation from traffic as compared to TP2 and overall revenue as well.

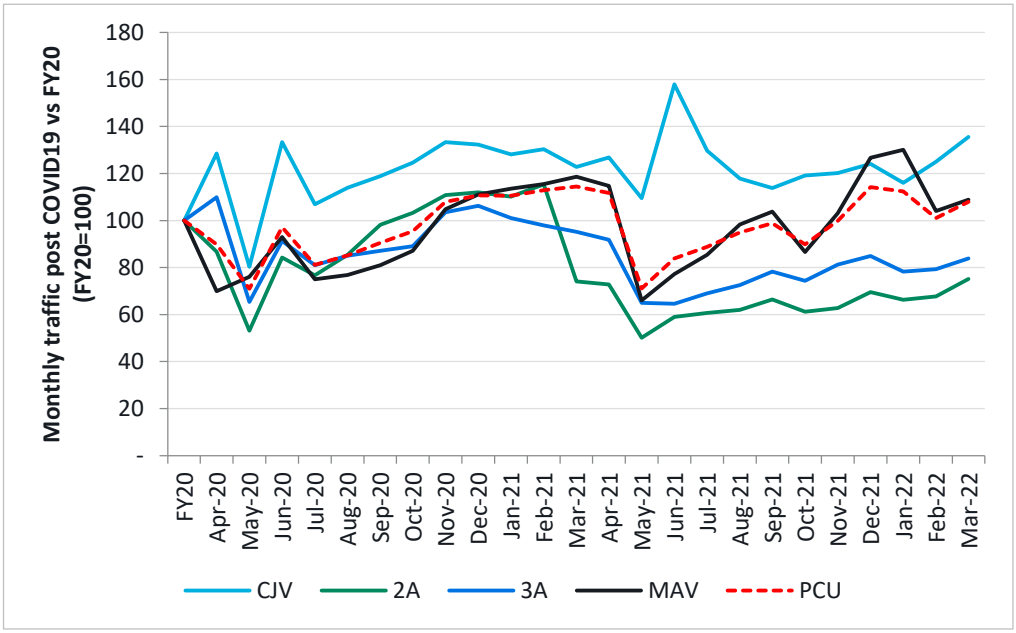
Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.14 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. Further extensions until 17th May and again until 31st May featured relaxations in 'green' and 'orange' zones. Starting 8th June 2020, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States.

3.15 In direct relation to these 'Lockdown' and 'Unlock' phases, traffic on roads across the country dropped significantly in the last week of March 2020 continuing into April and May 2020. While traffic for LCVs/2As and MAVs had a quick recovery in September and October respectively back to FY20 AADT, the other vehicle classes have seen longer recovery trends, as can be seen in the following chart.

3.16 The evolution of monthly traffic volumes indexed to FY20 AADT is presented in the figure below:

Figure 3.3: MADT FY21 vs FY20 AADT, Asset Level



Source: Steer analysis of Client TMS data

3.17 As can be seen from the figures above, since June 2020 in the CJV category has seen volumes surpassing FY20 levels driven primarily by opening of Malda bypass and preference for personal mobility. MAVs, 3As and 2A/Buses have all shown a similar, but slower recovery pattern. Whilst volumes of these categories steadily increased from June 2020 onwards, they only reached the

FY20 pre COVID-19 levels in November 2020. In 2021 volumes of all categories have showed declines, converging to or even below the pre COVID-19 FY20 level.

Toll Frequencies

3.18 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.19 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this trend may vary for each asset and each toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.20 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.5: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows the vehicle to cross the plaza twice in a day at discounted rates.
Monthly Pass	Discounted ticket for all road users issued at toll plaza who intend to undertake multiple single trips using the toll plaza. 50 trips are allowed on a discounted rate to be used within 30 days of issue.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

Impact of FASTag implementation

3.21 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via “FASTag”. The timeline of ETC implementation is presented in the following table.

Table 3.6: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.

Date	ETC Development
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.22 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

3.23 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation.

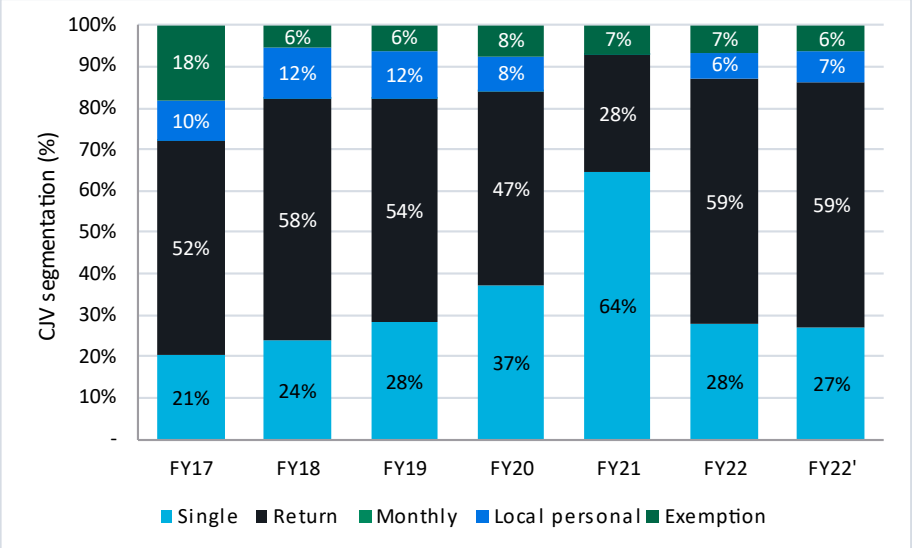
3.24 The table below presents the proportion of transactions via FASTag as of March 2022. We can see that commercial vehicle types have attained 99% FASTag penetration and as for CJVs, they have achieved 95%+ share as of March 2022. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time.

Table 3-7: Percentage of transactions via FastTag, Mar-2022

Toll Plaza	CJV	LCV	Bus/2A	3A/MAV
TP1 Lakshmipur	98%	99%	100%	100%
TP2 Gazole	97%	97%	100%	100%

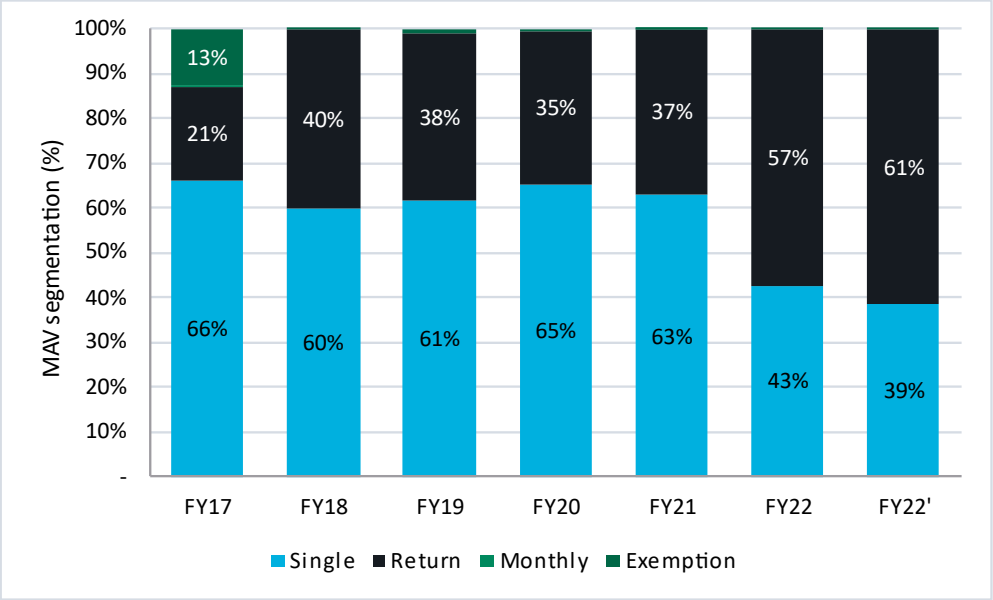
3.25 The figures below present the ticket type shares for CJV and MAV at the toll plazas on the Asset.

Figure 3.4: Ticket-segmentation for CJV, TP1 Lakshmipur



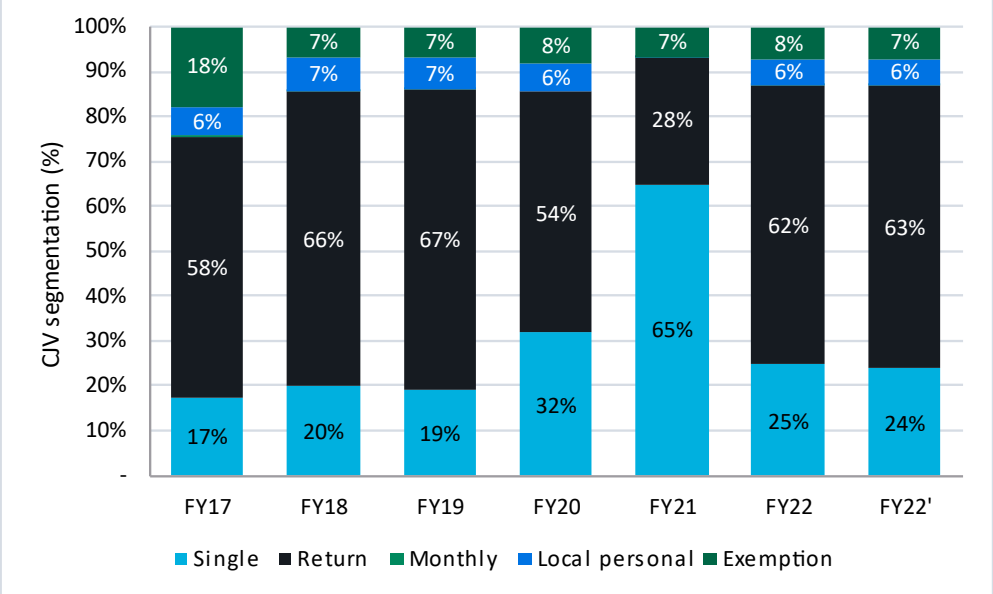
Source: Steer analysis of the Client data, ** FY22 is the annual level segmentation*
**FY22' is the averaged Oct-Mar segmentation, *FY21 segmentation of Feb-21 (post implementation of FASTag)*

Figure 3.5: Ticket-segmentation for MAV, TP1 Lakshmipur



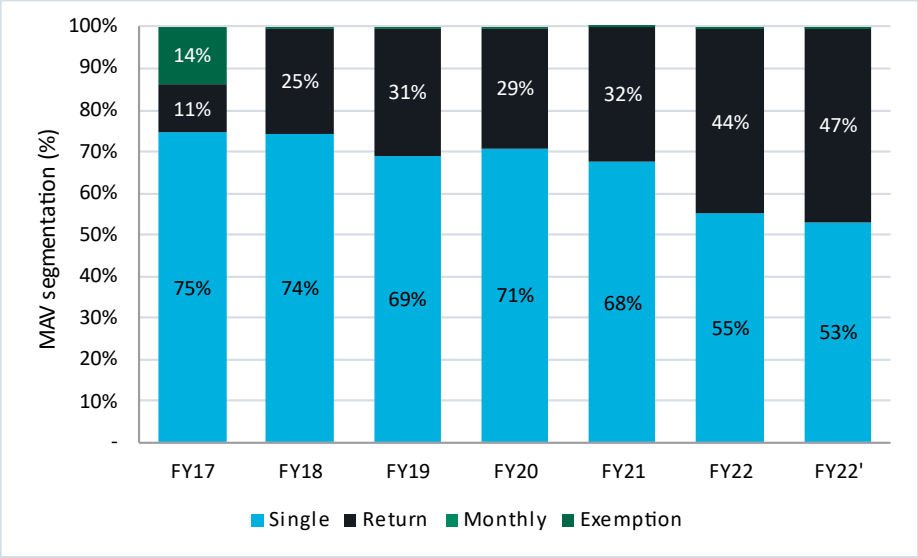
Source: Steer analysis of the Client data, **FY21 segmentation of Feb-21 (post implementation of FASTag)*
** FY22 is the annual level segmentation* **FY22' is the averaged Oct-Mar segmentation*

Figure 3.6: Ticket-segmentation for CJV, TP2 Gazole



Source: Steer analysis of the Client data
** FY22 is the annual level segmentation* **FY22' is the averaged Oct-Mar segmentation*

Figure 3.7: Ticket Segmentation for MAV, TP2 Gazole

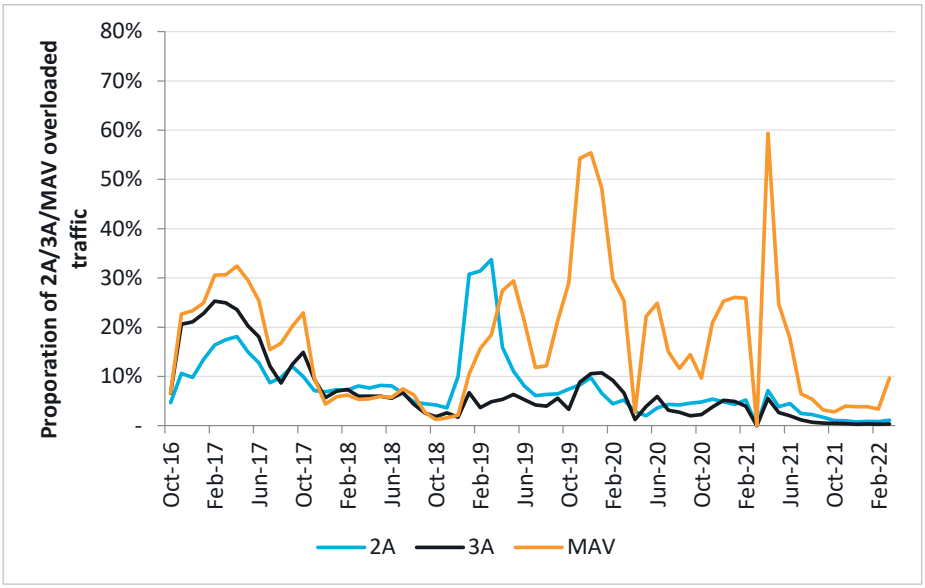


Source: Steer analysis of the Client data
** FY22 is the annual level segmentation* **FY22' is the averaged Oct-Mar segmentation*

Overloading

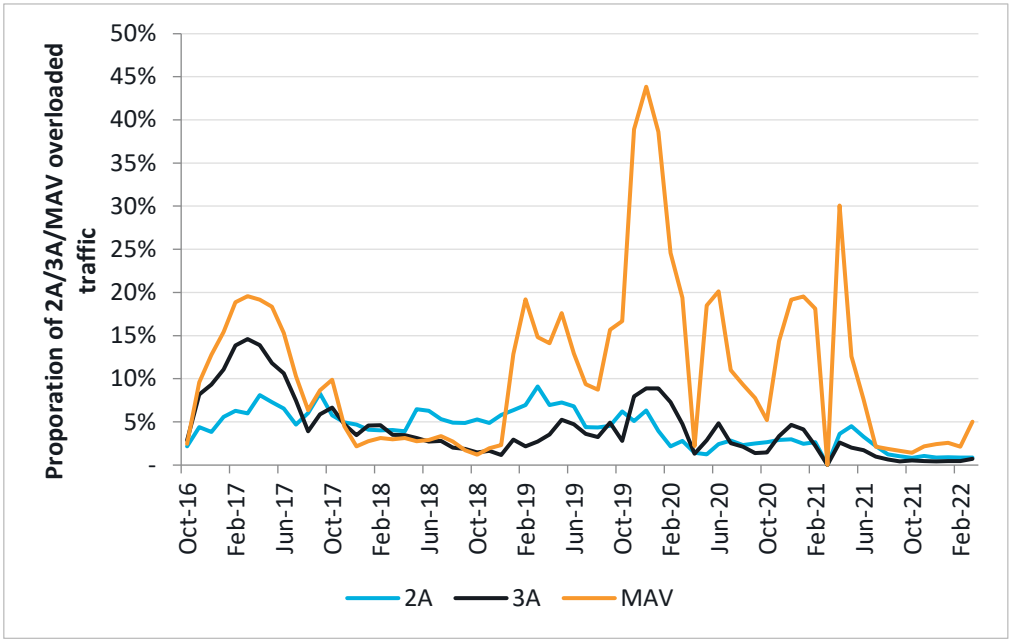
3.26 Based on our analysis of the historical data as shown in the figures below, the Asset shows a significant share of overloaded vehicles, especially for 2A, 3A and MAV. As shown in the commodity distribution charts later in this chapter and mentioned in Chapter 2, this is because of the high shares of denser commodities like aggregate and stone being carried from Pakur region on the Asset. The figure below presents the %age of 2A/3A/MAV vehicles overloaded compared to single tickets bought by users. This is due to the fact that overloaded vehicles almost always buy single tickets at the plaza.

Figure 3.8: Overloading percentage wrt to single ticket shares upto Mar 2022, TP1 Lakshmipur



Source: Steer analysis of Client data

Figure 3.9: Overloading percentage wrt to single ticket shares, TP2 Gazole



Source: Steer analysis of Client data

3.27 Historical overloading trends show large variations due to exogenous impacts as, Local authorities restrictions leading to the drops of Jan-18 to Jul-18 and Jul-19, monsoons, repair works of Farakka Barrage and COVID-19. Similar impact of authorities banning overloading is visible in late FY22 as well, where overloading has dropped to <1% of traffic recently. This results in high variability of overloaded revenue on the Asset. We assume that current levels of overloading will prevail in the future, and any increase in overloading from current levels will be an upside on revenue on this Asset.

3.28 Historically, overloaded vehicles were charged a flat nine-times penalty of the Single fee for the vehicle type, on the Asset. However, based on an NHAI circular[1] dated 25 September 2018, the Client has been charging overloading penalties as per the slabs, staggered penalty system, shown in the table below. It is important to note that as per the information available 75% of the overloaded revenue is allocated to the old Concessionaire[2] and 25% of the overloaded revenue will be allocated to the new concessionaire.

Table 3-8: Overloading penalties on Asset

Percentage of excess load over Maximum Permissible Gross Vehicular Weight	Multiplying factor to Single rate of fees (including normal fees)	Penalty
0% to 20%	2	Single fee multiplied by multiplying factor
>20% to 40%	4	
>40% to 60%	6	
>60% to 80%	8	

[1] NHAI circular numbered F. No. H-25016/1/2018-Toll

[2] HCC is the old Concessionaire and the Client is the new Concessionaire

Percentage of excess load over Maximum Permissible Gross Vehicular Weight	Multiplying factor to Single rate of fees (including normal fees)	Penalty
>80% and above	10	

Source: NHAI circular [F. No. H-25016/1/2018-Toll]

3.33 From our analysis, It is observed that the average overloading penalty factor for MAVs in FY21 is around 5.3, which implies that most of the times MAVs are 50% overloaded above the maximum allowed weight, this falls under the slab of >40% to 60% as mentioned above. It has reduced to 2 recently in Q4FY22.

3.34 Also, apart from the NHAI rules on overloading and penalties for the same, the local administration around the Asset has introduced bans on overloading at various times and lifted them later in the history of the Asset's operation. This reflects in the swinging shares of overloading observed on the Asset. As changes in the ability to overload change the number of trucks required to operate a certain payload, we observe associated swings also in the truck volumes during these periods. We discuss this in further detail in Chapter 6.

Data Collection exercise

3.35 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3-9: Data collection schedule

TP1#	7-day videography based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	Start time
TP1	9 Dec 2020	15 Dec 2020	0000-2359	12 Nov 2019	1000 hours
TP2	9 Dec 2020	15 Dec 2020	0000-2359	13 Nov 2019	0900 hours

Source: Steer analysis

3.36 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we had collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

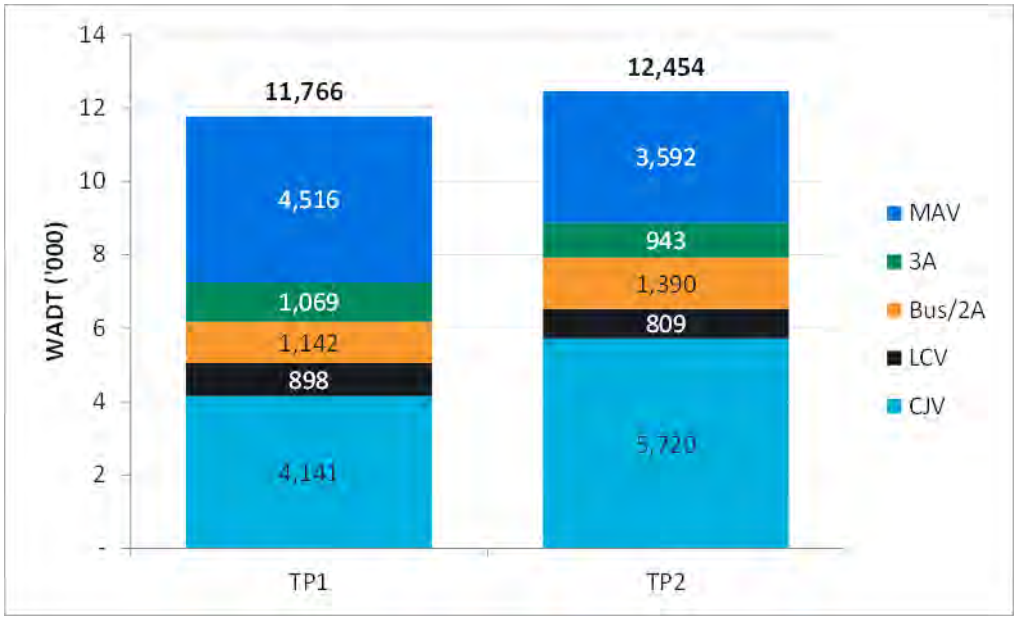
WADT estimates

3.37 Taking an average of the seven-day TVC counts (9th -15th December 2020, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicle such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicle,

government vehicle and other vehicle types officially allowed as 'exempted' under the concession agreement.

3.38 As can be seen in the figure below, MAVs are largest vehicle category at TP1 (4,516), closely followed by CJVs at 4,141. However, at TP2, CJVs are the largest vehicle category (5,720), followed by MAVs (3,592). (Higher truck volumes at TP1 are partly contributed by the movement of aggregate commodities from the Pakur region to Malda and Bangladesh. Higher CJV volumes at TP2 are partly due to the proximity to the more populated Malda town compared to Farakka.

Figure 3.10: WADT by vehicle type



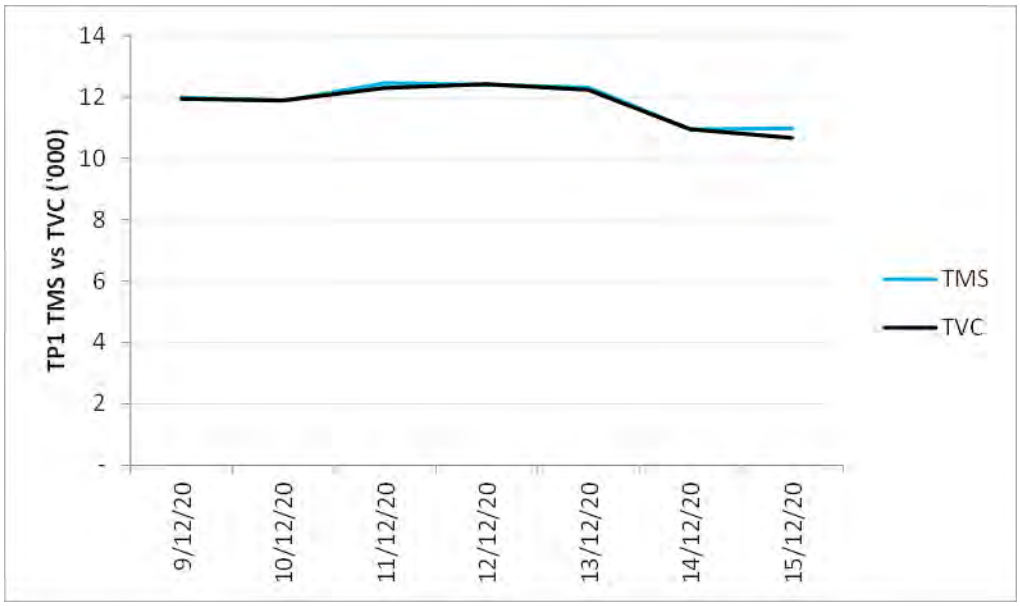
Source: Steer analysis of Client TVC data

TVC v/s TMS analysis

3.39 We used our TVC data to validate the toll plaza data for the same days, as supplied by the Client via their toll management system (TMS). This TMS data was then used as the base data, for our forecasting model.

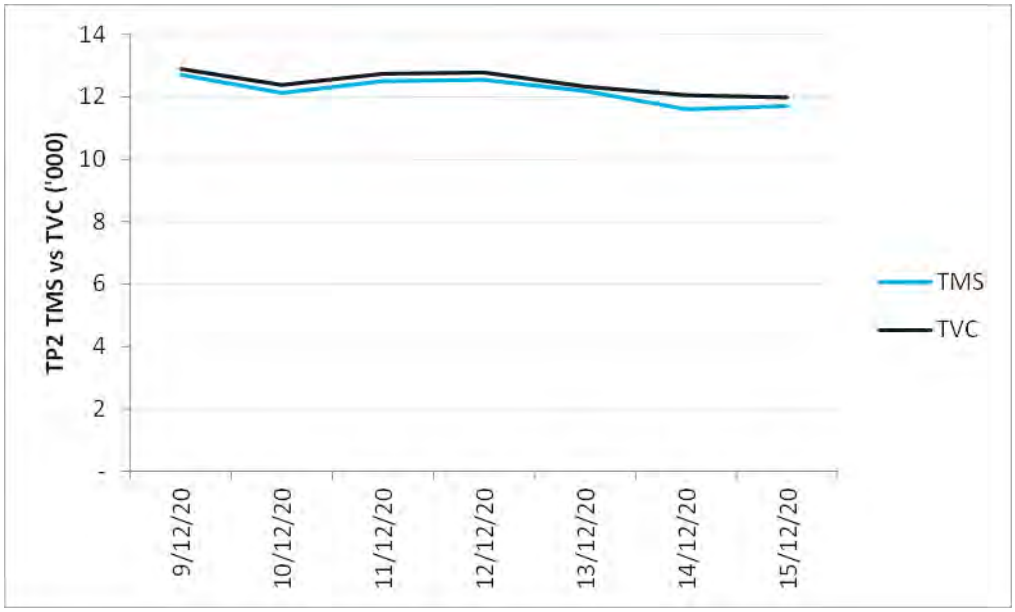
3.40 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas.

Figure 3.11: Comparison between TVC and TMS daily traffic data, TP1 Lakshmipur



Source: Steer analysis of TVC and Client TMS data

Figure 3.12: Comparison between TVC and TMS daily traffic data, TP2 Gazole



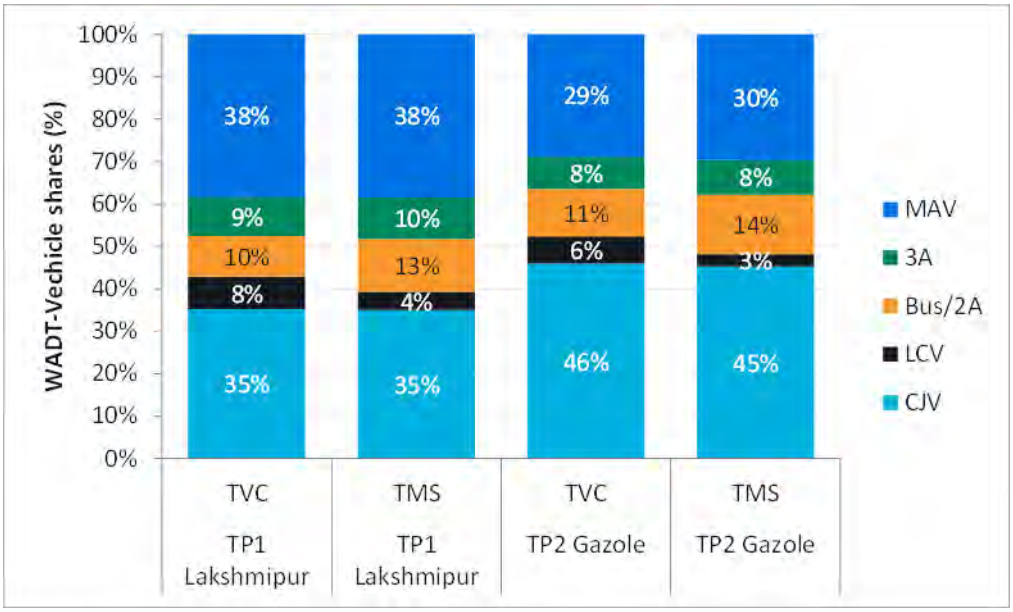
Source: Steer analysis of TVC and Client TMS data

The figures above and just below show the comparison between daily traffic data and shares of vehicle categories in TVC and TMS for the two toll plazas. As can be seen in the charts below, the difference between daily traffic from both sources is minimal at TP1. At TP2 the differences are still slight, but the TVC is consistently 1-2% higher than the TMS across the week. These differences can be attributed to technical differences between the two independent traffic counting systems.

3.41 Further, the figures below compare the shares of vehicle types at both plazas, between TVC and TMS data. As seen below, there is a good fit between TVC and TMS data in terms of proportions, except for LCV and Buses/2A. However, as we have observed in several toll roads across the

country, this can be attributed to classification differences in different counting systems, especially observed for LCV and Buses/2A often.

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and client TMS data

3.42 Upon combining vehicle categories into two super-categories, as shown in the table below, we see that the difference comes down to about 6% and 3% at TP1 and TP2, respectively, for light vehicles including CJV, LCV, 2A and Buses. Heavy vehicles comprising 3A and MAV show minimal differences at less than 2%. Given the overall good fit of the data at a WADT level and minimal variation between the TVC and TMS data for the largest revenue generator (3A and MAVs), we believe the base year traffic calculated using the Client TMS data forms a reasonable estimate.

Key findings of origin-destination analysis

Overview

3.43 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in November 2019. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred in this period.

3.44 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.45 While zonal analysis and list of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed

forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.46 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TVC data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at both the toll plazas. We believe that the sample rates of the OD data are reasonable.

Table 3-10: Sample rates for OD data

Vehicle type	TP1 Lakshmipur	TP2 Gazole
CJV	33%	28%
Bus	51%	58%
LCV	35%	57%
2A Truck	57%	58%
3A Truck	65%	65%
MAV	61%	75%
Total	**51%**	**51%**

Source: Steer analysis of OD data

Zone categories

3.47 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the following table.

Table 3-11: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	On or very close to the Asset.
Immediate area of influence (IAOI)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of West Bengal	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Odisha	All the trips that originate or end in the neighbouring state of Odisha
Bihar	Bihar
North East India	North east Indian states
Chhattisgarh	Chhattisgarh
Jharkhand	Jharkhand
Madhya Pradesh	Madhya Pradesh
West India	Rajasthan, Gujarat
Maharashtra	Maharashtra (including Mumbai)
North India	Uttarakhand, Jammu and Kashmir, Delhi NCR, Uttar Pradesh, Punjab
South India	Andhra Pradesh, Tamil Nadu, Karnataka, Kerala
Rest of India	Rest of Indian states.

Aggregate Zone	Description
Outside India	Nepal, Bhutan, Bangladesh.

Source: Steer analysis

Zonal influence

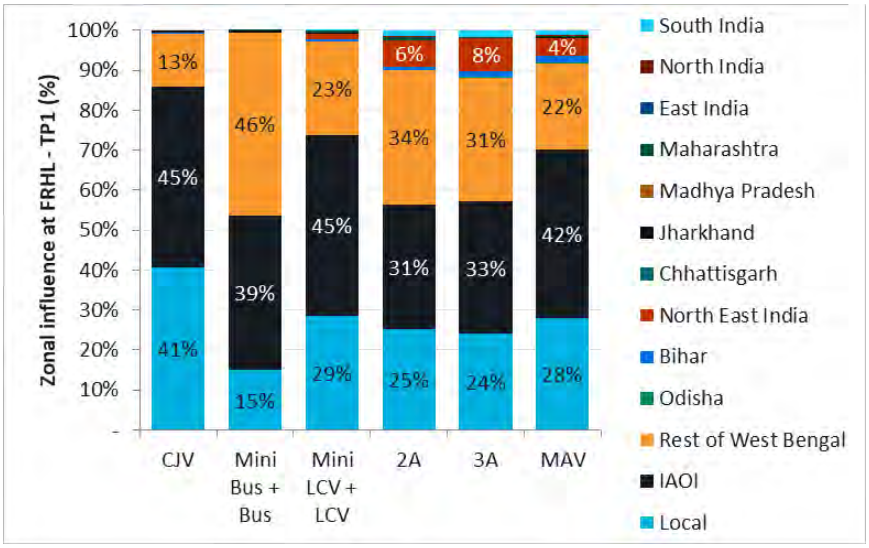
3.48 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[3] at each toll plaza of each Asset, aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed on trip ends and not trips.

3.49 The figures below present the zonal influence on various vehicle types the toll plaza. We can see that 'IAOI' trips make up the largest share for all vehicle types. This follows from the earlier observation in high share of 'return' trips. Generally smaller vehicles see a higher share of shorter trips compared to trucks. We observe the highest share of IAOI trips for CJVs (45% TP1, 60% TP2). Trips between Farakka and Malda are the largest contributor to the CJV traffic on TP1, whereas Malda and Gazole contribute to almost 36% of the total CJV trips at TP2.

3.50 In case of 3A/MAVs too, we see a very high share of IAOI trips at 42% and 34% respectively, at TP1 and TP2. Local trips make up almost 30% of 3A/MAV trips at both the toll plazas, while Rest of West Bengal contributes to about 20% of traffic volume. The trip ends with highest zonal influence for 3A/MAV on the Asset are Farakka, Raiganj, Kolkata and Darjeeling, with each of these contributing to about 10-15% of the total trips on the Asset.

3.51 Other contributors are North-east India with about 5-8% share in 3A/MAV vehicles and South India with about 3-4% share in 3A/MAV category.

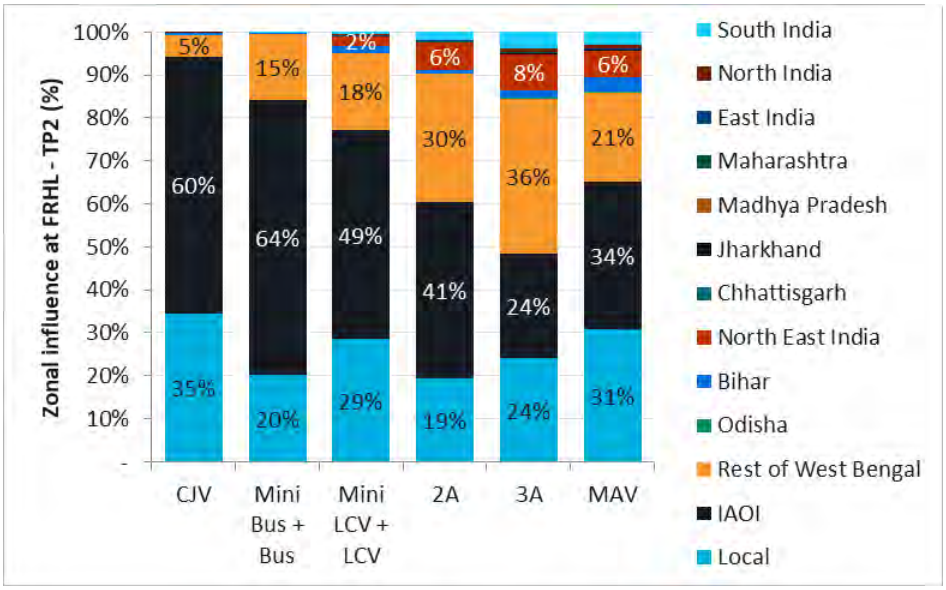
Figure 3.14: Zonal influence, TP1 Lakshmipur



Source: Steer analysis of OD data

[3] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad is 50% since one trip end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.15: Zonal influence, TP2 Gazole



Source: Steer analysis of OD data

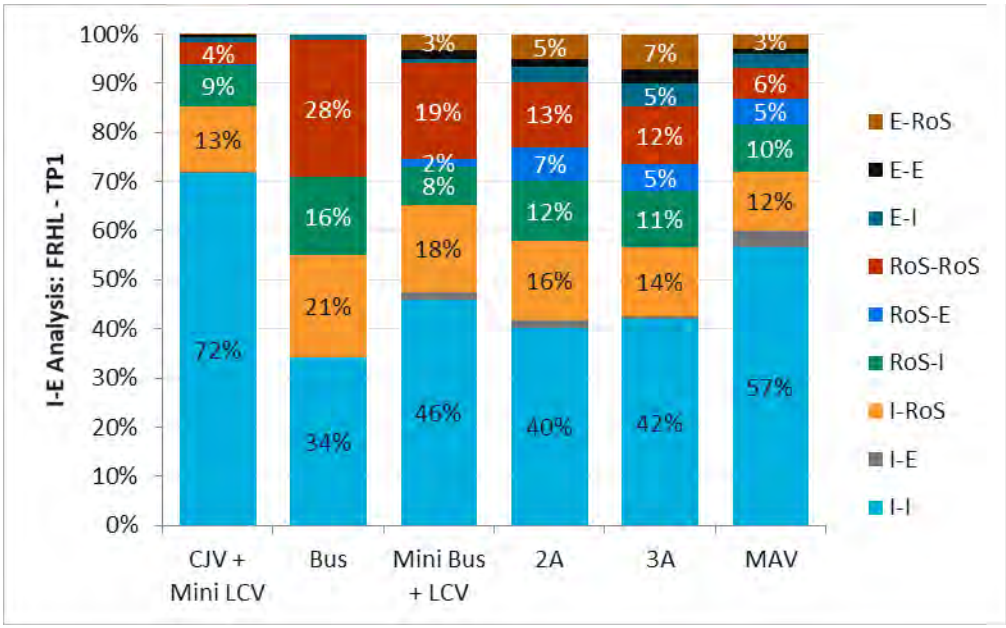
Internal External analysis

3.52 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

3.53 The graphs below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation but at a trip level.

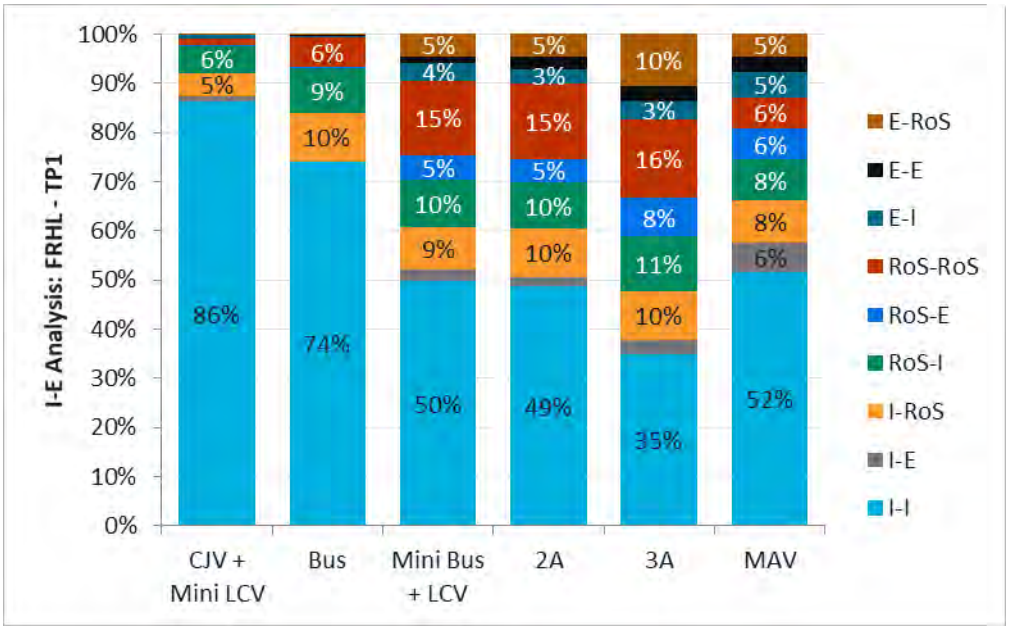
3.54 We see a significant share of I-I of trips across all vehicle categories at both toll plazas due to significant generators of economic activity like Pakur located slightly away from the Asset, as also observed during the site visits and from the zonal analysis. There is very less E-E movements even for heavy goods vehicle as also supported by the trip length analysis discussed in the next section.

Figure 3.16: Internal-External distribution, TP1 Lakshmipur



Source: Steer analysis of OD data

Figure 3.17: Internal-External distribution, TP2 Gazole



Source: Steer analysis of OD data

Commodity distribution

3.55 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3-12: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

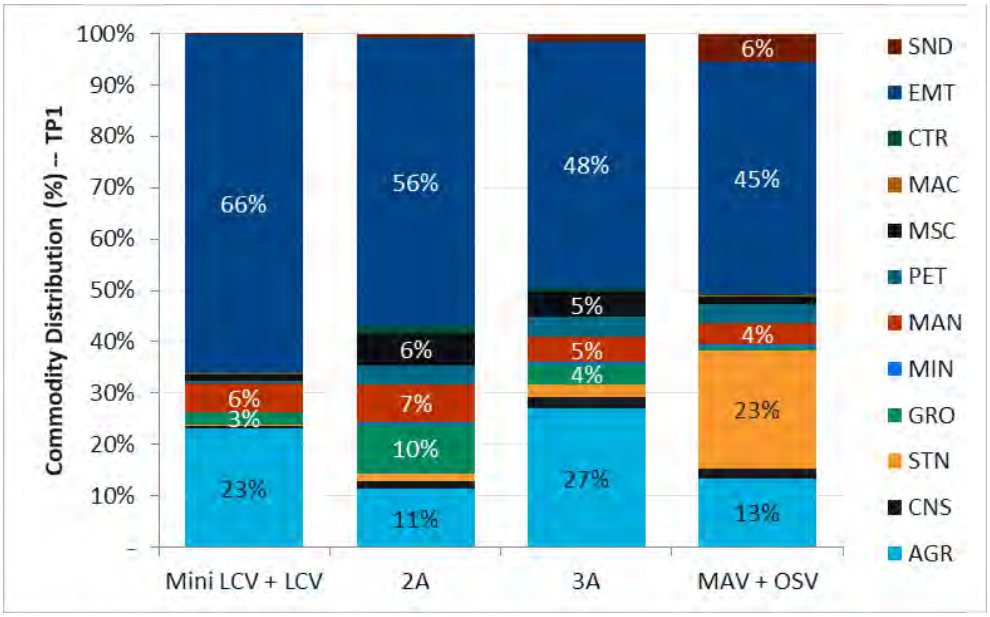
3.56 The following figures show the commodity distribution at each toll plaza, at the total level and also by direction. The commodity distribution for goods vehicles, clearly substantiates the presence and impact of stone quarries and crushers in the immediate vicinity of the asset. About 23% and 25% vehicles carry stone at TP1 Lakshmipur and TP2 Gazole, respectively. Based on the analysis of the OD movements of the STN category, we observe the movement of stone and other building material originating from the nearby towns of Pakur and Nalhati to the Bangladesh border and parts of North Bengal.

3.57 Agricultural and related products are carried by a significant share (17-18% at TP1 and 25% at TP2) of 3A/MAVs. These trips are generally between agricultural areas of northern West Bengal, including tea plantations in Darjeeling, and large urban consumption centres like Kolkata and cities in other southern states.

3.58 The share of empty vehicles is high, being 45% at TP1 and 35% at TP2. This is mainly due to the high share of trucks carrying aggregate material at TP1, which tend to return empty. We also observe a 5-6% of share of petroleum-related products which are transported to the power plant at Farakka, which in turn supplies fly ash (a by-product) as construction material to

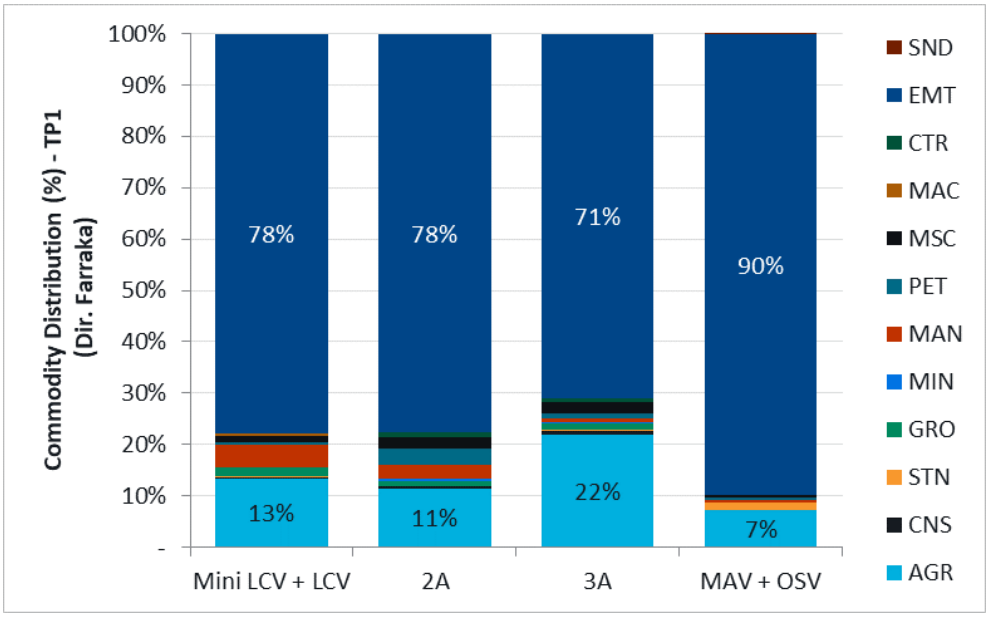
North-eastern states. The remaining commodities are a heterogeneous mix, comprising of machinery, automobile, cotton, jute, petroleum products and containers.

Figure 3.18: Commodity distribution, TP1 Lakshmipur (Total)



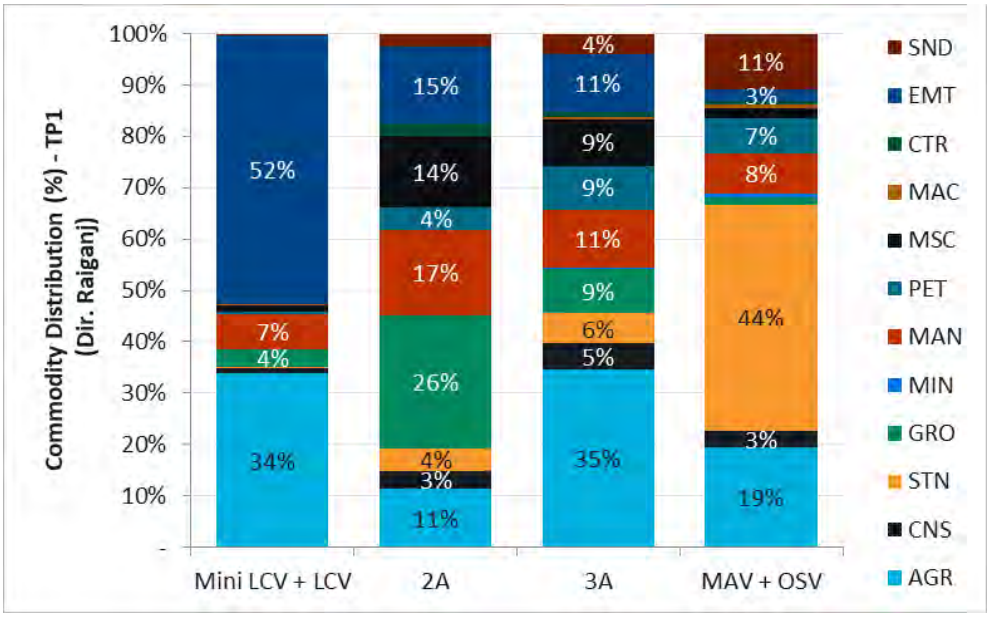
Source: Steer analysis of OD data

Figure 3.19: Commodity distribution, TP1 Lakshmipur (Towards Farraka)



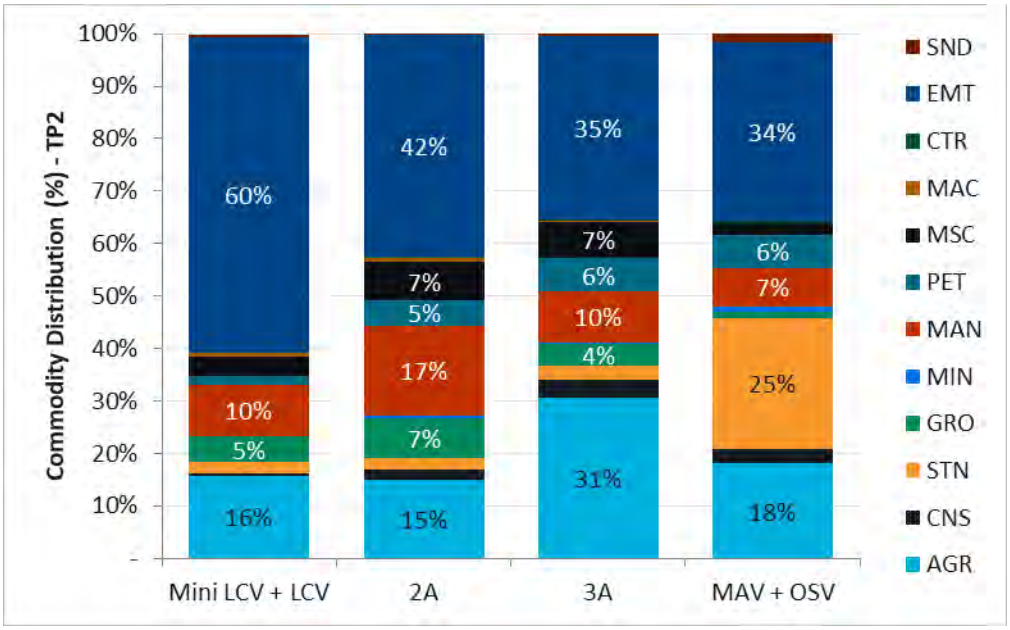
Source: Steer analysis of OD data

Figure 3.20: Commodity distribution, TP1 Lakshmipur (Towards Raiganj)



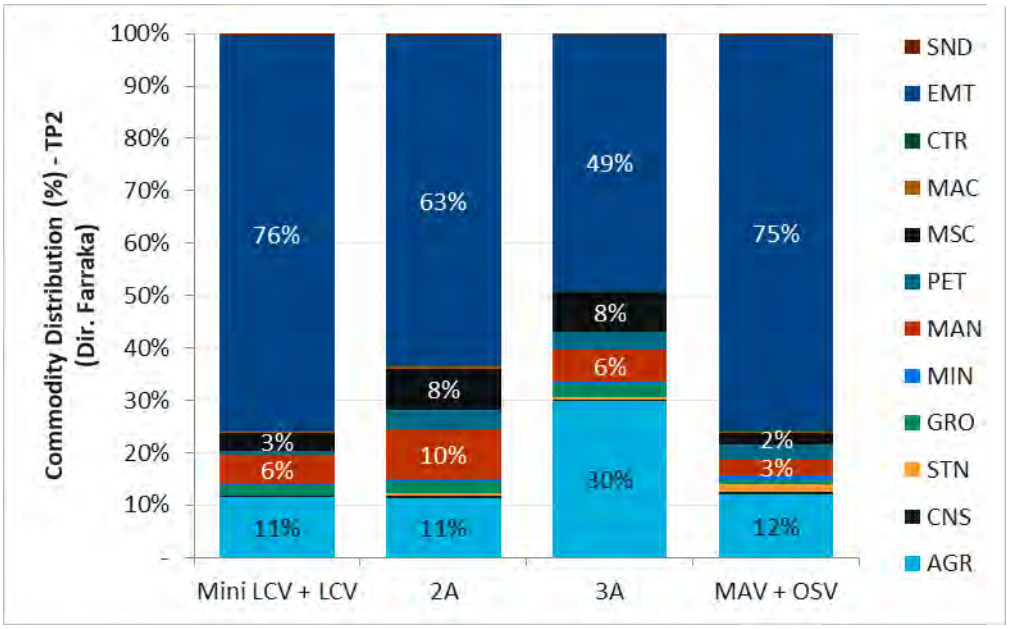
Source: Steer analysis of OD data

Figure 3.21: Commodity distribution, TP2 Gazole (Total)



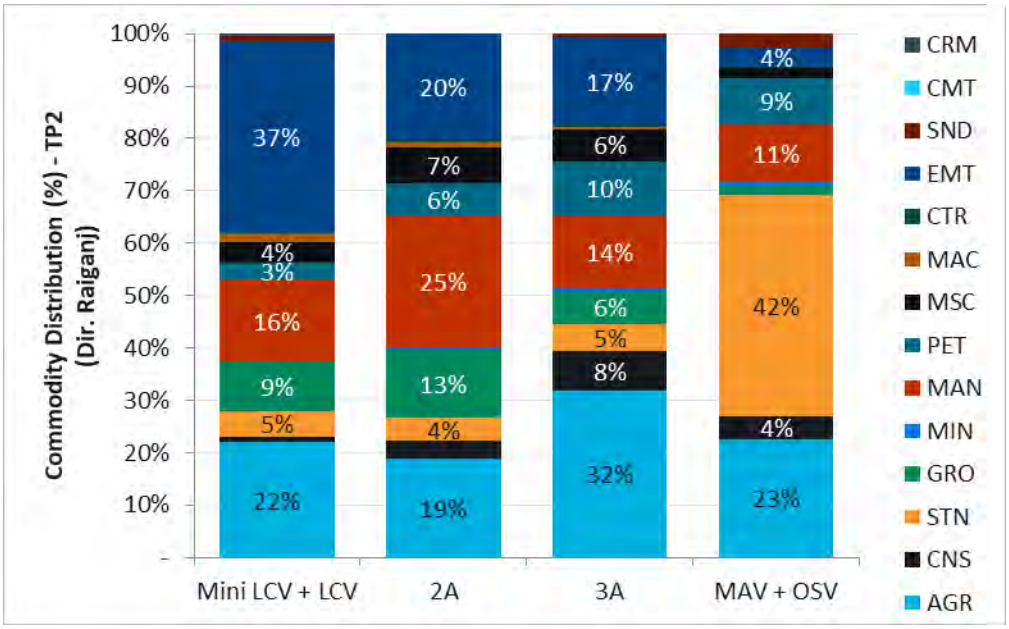
Source: Steer analysis of OD data

Figure 3.22: Commodity distribution, TP2 Gazole (towards Farraka)



Source: Steer analysis of OD data

Figure 3.23: Commodity distribution, TP2 Gazole (towards Raiganj)



Source: Steer analysis of OD data

Trip length analysis

3.59 Trip-length distribution provides the distance-based profile of various vehicle types. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups –– local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[4]

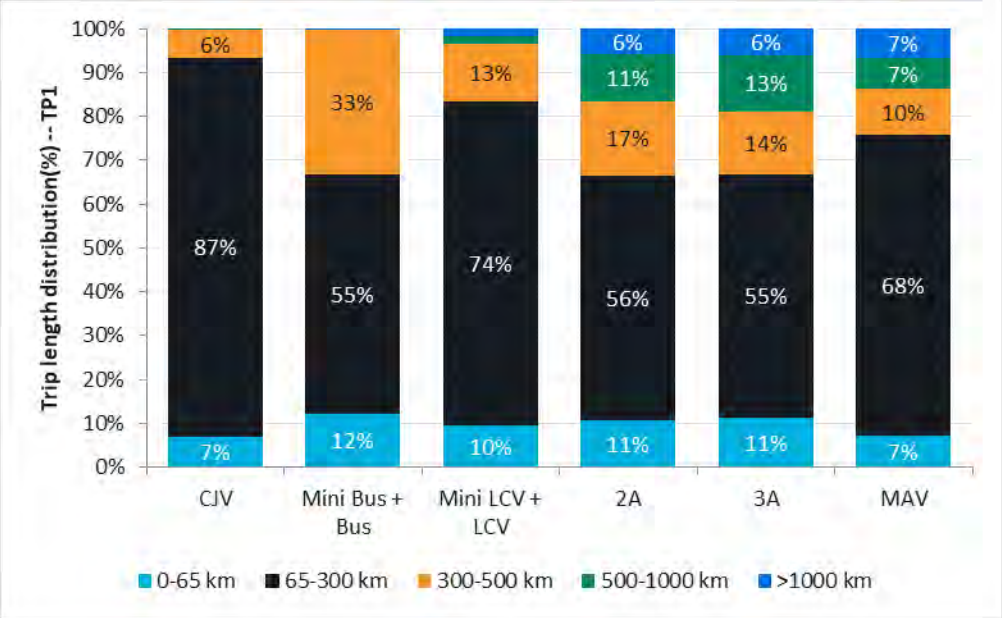
3.60 Traffic on the project road is primarily commercial traffic carrying goods to/from different parts of the state of West Bengal, the north-eastern states, adjoining western states (Bihar and Jharkhand) and some southern states (such as Andhra Pradesh and Tamil Nadu). In addition, as mentioned previously, a significant proportion of commercial traffic is moving cross-border (into/out of Bangladesh) and a small share of traffic carries goods to Nepal and Bhutan.

3.61 As can be seen by these graphs, there is minimal long-distance (considered as >500km) movement even for even heavier vehicle categories. Generally, smaller vehicles have shorter-distance trips as compared to goods-carrying heavy vehicles, but in case of the Asset, we see that trips distances in the range of 65 to 300km are most common, which was also evident from the zonal influence in the Asset earlier discussed in the chapter, where a majority of influence belonged to the IAOI zones. These primarily serve trips between stone-mining sites in the Pakur region, and the Bangladesh border-crossing and sand-distribution hubs located near Malda.

3.62 Generally, smaller vehicles have shorter-distance trips as compared to goods-carrying heavy vehicles, but in case of the Asset, we see that trips distances in the range of 65 to 300km are most common, which was also evident from the zonal influence in the Asset earlier discussed in the chapter, where a majority of influence belonged to the IAOI zones.

3.63 3A and MAVs have a considerable share at 17% and 23% respectively at TP1 and TP2, of vehicles undertaking long-distance trips covering more than 300 km but less than 1000 km. Share of vehicles undertaking very long-distance trips of greater than 1000 km, including those with trip ends in the southern states, is 7% and 12% at TP1 and TP2, respectively.

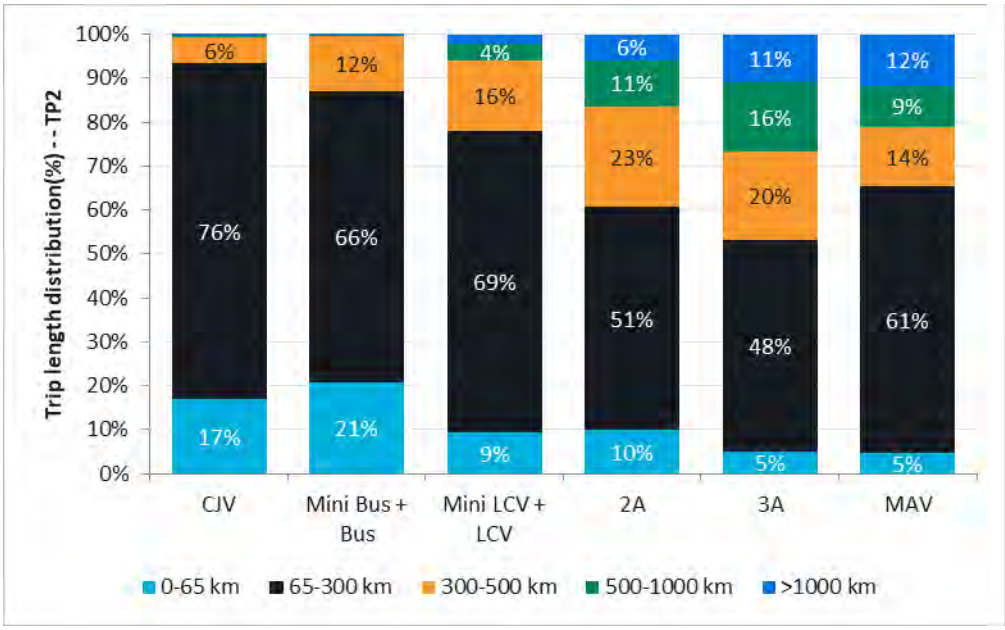
Figure 3.24: Trip length distribution, TP1 Lakshmipur



[4] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Source: Steer analysis of OD data

Figure 3.25: Trip length distribution, TP2 Gazole



Source: Steer analysis of OD data

Conclusions

3.64 In summary, TP1 has a higher share of MAVs (42% compared to 30% at TP2), whereas TP2 has a higher share of CJVs (39% compared to 27% at TP1). Shares of other vehicle categories are fairly similar, varying by only 1-2% between plazas..

3.65 Historically across the period FY17 to FY20, both toll plazas have shown strong average growth; over this period TP1 grew at a CAGR of 6.2% and TP2 higher at 8.1%. Both toll plazas experienced traffic declines in FY19, this was largely driven by the closure of Farakka Barrage to heavy traffic due to repair works. The implication on the heavy traffic resulted in a steeper decline at TP1, the plaza with a higher share of heavy goods vehicles. When considering ticket segmentation, for CJVs both plazas have experienced a trend of an increasing share of Single tickets and a reduction in the share of Return tickets. A similar, but less dramatic trend is seen for MAVs, given they had a higher starting share of Single tickets in FY17. COVID-19 impacted FY21 and FY22 thereby impacting traffic volumes on the Asset. CJV's increased due to improved LOS after opening of Malda Bypass and preference for personal mobility due to behavioural changes post COVID-19

3.66 The TVC does shows minimal variation on the TMS, at the total level TMS is 1% higher than TVC at TP1, and 2% lower TVC at TP2. The differences in the vehicle shares of the two dominant categories, CJVs and MAVs, is also minimal.

3.67 The OD analysis found that in terms of zonal influence, 'IAOI' trips make up the largest share for all vehicle types. This follows from the earlier observation in high share of 'return' trips. Trips between Farakka and Malda are the largest contributor to the CJV traffic on TP1, whereas Malda and Gazole contribute to almost 36% of the total CJV trips at TP2. The commodity distribution reflects the Asset's vicinity to stone quarries and crushers, with Stone holding a 23% commodity share at TP1 and 25% share at TP2. Agricultural products also hold a considerable share at each

plaza. TP1 has a particularly high share of Empty (45%), this is mainly due to the high share of trucks carrying aggregate material at TP1, which tend to return empty.

3.68 When considering the internal and external distribution, E-E trips are dominant at both plazas for all vehicle categories. CJVs do however show a considerably more balanced share between the 4 internal-external options, compared to the other vehicle categories. The high E-E share indicates the 'through' nature of traffic on Asset. It is important to note that the zonal influence findings prove that these through trips are not very long distance, primarily IAOI trips. The trip length analysis further supports this, with the dominant trip length across all vehicle categories being short distance trips, under 300km. Even for 3A and MAVs, which typically travel longer distance trips, at this Asset less than 20% of these vehicle travel over 500km.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and,
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4-1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of West Bengal (containing the Asset), compared to that of the country. Overall, urbanisation is seen at both the state and national levels, as shown by the fact that the rural population is growing slower than the urban

population. West Bengal has grown at a rate which is similar to the country average, in the decade between 2001 and 2011.

Table 4-2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
West Bengal	80	58	22	91	62	29	1.3%	0.7%	2.6%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of urbanisation, and the dynamic nature of local population migration (both of which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

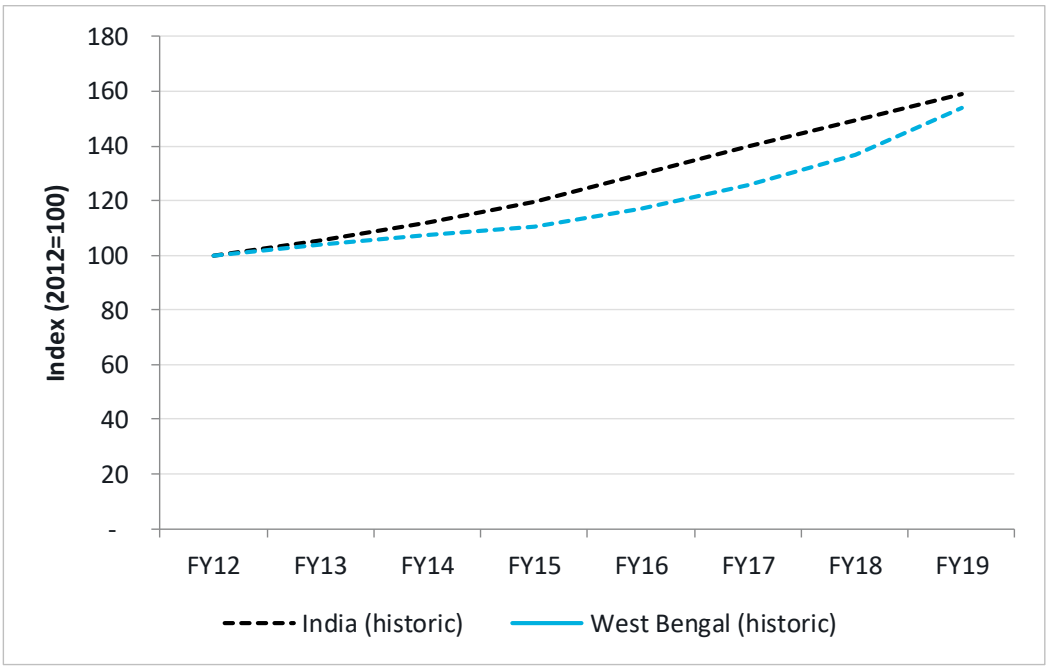
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of West Bengal has been weaker than the country as a whole. The state contributes approximately 5.5% to India's GDP. The following figures illustrate the evolution of West Bengal's GSDP.

Figure 4.1: Evolution of West Bengal's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

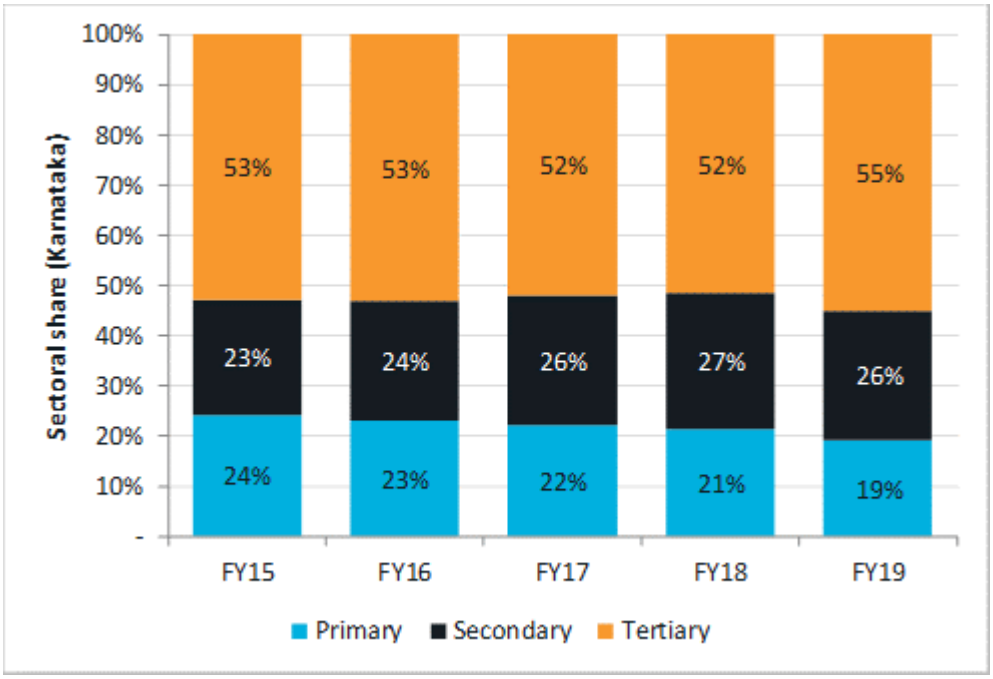
4.9 West Bengal, the fourth most populated state in India, is home to about 8% of the country's total population and is the second-most densely populated state in India.

4.10 The state economy is largely driven by the tertiary sector which contributes close to 55% to state GSDP. The tertiary sector is followed by the secondary and primary sectors, with shares varying slightly during the last five years, increasing contribution of tertiary and secondary.

4.11 In terms of secondary sector, the state has key industrial areas in Dankuni and Khargpur (railway locomotive manufacturing), Haldia (petrochemical) and Durgapur (steel and iron ore). The state also has a major port in Kolkata and Haldia and an Indian Oil Corporation's refinery at Haldia.

4.12 The key primary industries in the state include agro and food processing and crop production. The state is mainly known for production of tea (in Darjeeling and Jalpaiguri) and rice.

Figure 4.2: Sectoral contribution to West Bengal's GSDP



Source: Central Statistics Organisation

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 To understand the historical traffic trends in relation to these growth drivers, we carry out regression analyses to determine the historical relationship between each traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.4 Typically, passenger and light commercial vehicle traffic like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state in which the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because the majority of light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.5 Elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in growth drivers of traffic. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.6 Following the brief note on historical trends shown in Chapter 3, we now delve deeper into results of the historical growth analysis for each major vehicle type. The table below shows the historical CAGRs on the Asset by vehicle type.

Table 5-1: Vehicle-wise growth and CAGR (%), TP1 Lakshmipur

Class	FY18	FY19	FY20	FY21	FY22	CAGR (FY19-20)	CAGR (FY19-22)	CAGR (FY20-22)
CJV	17%	(2%)	14%	30%	(4%)	14%	13%	12%
LCV	18%	9%	(1%)	(11%)	(4%)	(1%)	(5%)	(7%)
2A/Bus	4%	4%	(2%)	(2%)	6%	(2%)	0%	2%
3A	(8%)	(46%)	9%	(6%)	11%	9%	4%	2%

Class	FY18	FY19	FY20	FY21	FY22	CAGR (FY19-20)	CAGR (FY19-22)	CAGR (FY20-22)
MAV	33%	(9%)	35%	(10%)	14%	35%	12%	2%
Total	**14.4%**	**(10.6%)**	**17.1%**	**2.3%**	**5.4%**	**17.1%**	**8.1%**	**3.8%**
PCU	**24.6%**	**(5.1%)**	**24.3%**	**(4.5%)**	**9.9%**	**22.2%**	**8.5%**	**2.3%**

Source: Steer analysis of Client TMS data

Table 5-2: Vehicle-wise growth and CAGR (%), TP2 Gazole

Class	FY18	FY19	FY20	FY21	FY22	CAGR (FY19-20)	CAGR (FY19-22)	CAGR (FY20-22)
CJV	17%	11%	10%	12%	(6%)	10%	5%	3%
LCV	(2%)	(2%)	3%	(13%)	4%	3%	(2%)	(5%)
2A	8%	0%	1%	(8%)	14%	1%	2%	2%
3A	(10%)	(36%)	17%	(7%)	12%	17%	7%	2%
MAV	20%	2%	33%	(5%)	8%	33%	11%	1%
Total	**10.3%**	**(0.4%)**	**14.8%**	**0.7%**	**3.0%**	**14.8%**	**6.0%**	**1.8%**
PCU	**15.6%**	**3.0%**	**20.4%**	**(2.8%)**	**6.4%**	**19.9%**	**7.4%**	**1.7%**

Source: Steer analysis of Client TMS data

5.7 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5-3: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP West Bengal
Car		100%
LCV		100%
Bus		100%
2A		100%
3A	100%	
MAV	100%	

Source: Steer analysis of Client data

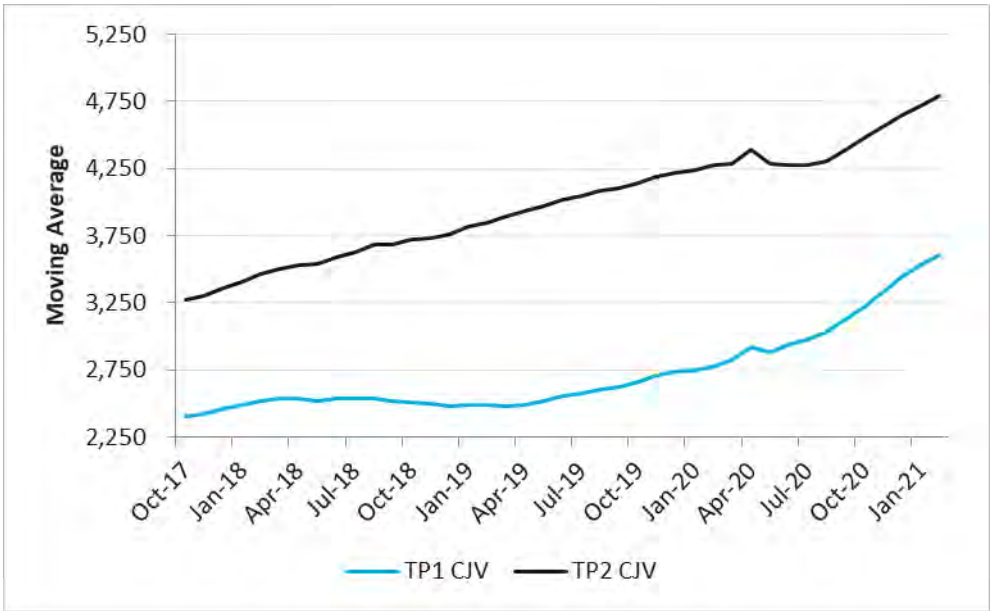
5.8 As mentioned before, this historical period of tolling is chequered with variations in traffic growth between years for certain vehicle types, due to a large drop in traffic volumes in FY19 due to closure of the Farakka Barrage. Therefore, we have not relied on regression directly to estimate elasticities. Instead, we have based our forecast elasticities on benchmarks.

5.9 Please note that in our historical growth analysis, we have used the combined traffic for toll categories as data for historical years were available only in combined form. For example, CJV includes CJV and Mini-LCV, while 3A and MAV are generally analysed together to understand heavy vehicle growth.

CJV

5.10 We see from the OD data that the CJVs primarily cater to regional movements between Farakka, Malda, Gazole, Raiganj and other towns lying on the Asset. We have therefore taken West Bengal GSDP to be the growth driver to model the growth of CJV traffic. The following figure shows the 12-month floating average for CJV traffic at the toll plazas.

Figure 5.1: 12-month floating average for CJV



Source: Steer analysis of Client TMS data

5.11 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. This assumption is very contextual and subject to change as there are changes in economic policies of government and overall economic stability nationally and globally.

5.12 Considering the good growth in CJV traffic observed over the operational historical period with trips largely seen between urban areas in and around the Asset, we have assumed a forecast background elasticity of 1.1 for CJVs at both toll plazas, with respect to West Bengal GSDP. This is line with benchmarks we have observed at toll roads across the country, which have a considerable concentration of inter-urban areas.

LCV, 2A/Bus

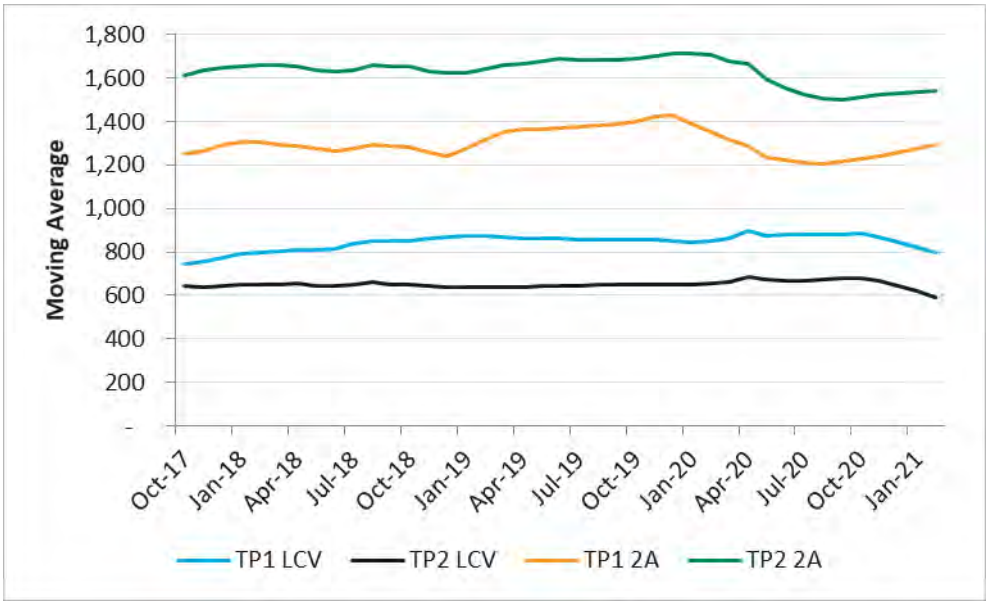
LCV and 2A

5.13 Compared to heavy vehicles like 3A and MAV, LCV and 2A have more regional movements within the state – West Bengal in this case, as seen in the OD data analysis. More than 75% of LCVs and 85% of 2As have both trip ends within West Bengal. We have therefore taken GSDP of West Bengal to be the growth driver to model growth of LCV+2A traffic. The following figure shows the 12-month floating average for CJV traffic at the toll plazas.

5.14 As seen in the tables above, we observe that both LCV and 2A had high growth in the second year of operations FY18. However, traffic volumes see lower but positive growth in FY19 and

FY20. Though other toll roads across the country have shown preferences either for LCV or 2A after the new axle load norms that increased axle load limits, the Asset does not show big differences between the vehicle types.

Figure 5.2: 12-month floating average for LCV and 2A/Bus



Source: Steer analysis of Client TMS data

5.15 However, TP1 shows better historical growth compared to TP2. Considering the growth and benchmarks available, we have assumed elasticities of 0.5/0.4 at TP1/TP2 for LCVs and 0.50 for 2As, with respect to West Bengal GSDP growth.

Bus

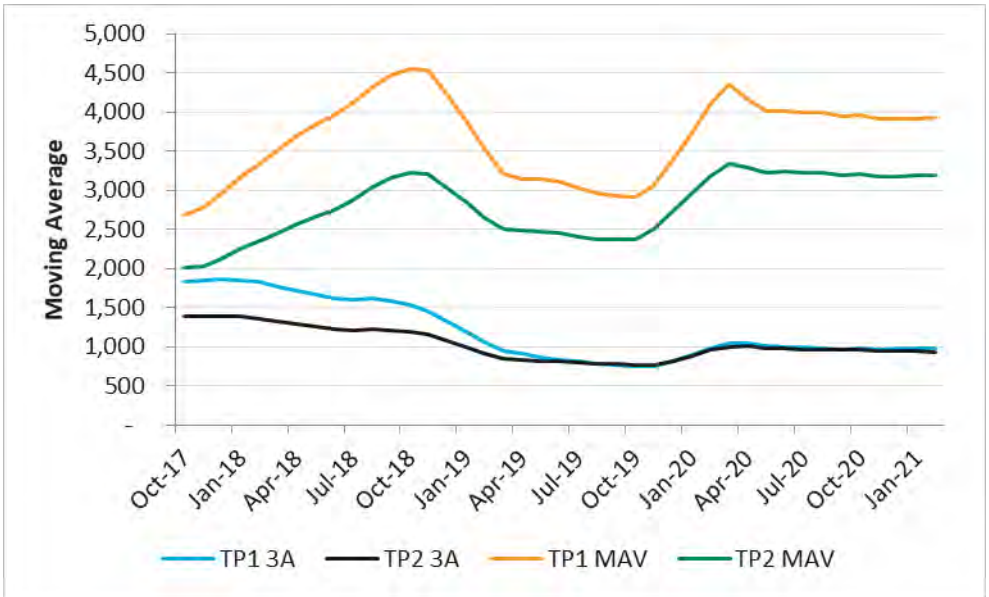
5.16 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at intervals of time. Based on our experience across the country, buses on inter-urban and tourism corridors show elasticities of 0.4 to 0.6 with respect to the GSDP.

5.17 In our TMS data, we have bus data combined with 2A with the splits available only for FY19 based on TVC data. With 2A and bus numbers fairly being similar with about 800 to 900 buses observed, we observe good growth in FY18 and very small growth in FY19 and FY20, as discussed in the previous section. Considering benchmarks, we have assumed an elasticity of 0.25 with respect to GSDP West Bengal going forward.

3A/MAV Trucks

5.18 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in their commodity distribution which means that traffic growth in 3A and MAV is dependent on industry demand-supply ecosystems spread across the country, we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

Figure 5.3: 12-month floating average for 3A and MAV



Source: Steer analysis of Client TMS data

5.19 As seen in the table and charts presented above, MAV has seen a good growth overall in the past three years. Though late FY19 saw a big temporary drop in traffic due to the closure of the Farakka Barrage for six months, FY20 showed a strong recovery growth, before the start of the pandemic.

5.20 3A has grown slower as compared to MAV due to a shift in the historical years, as there is an increasing preference seen for MAVs instead of 3As for long-distance movements. This is because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are likely certain commodities or movements which are best served by 3As.

5.21 Based on the above points, benchmarks, and improved outlook after completion of construction on the corridor, we have assumed elasticities of 0.9 for MAV at TP1 and TP2 respectively, with respect to India GDP. Likewise, we have assumed elasticities of 0.3 for 3A.

Forecasts for background elasticities

5.22 The below table presents a summary of the assumed forecast elasticities for background traffic growth.

5.23 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5-4: Assumed forecast elasticities for background growth

Vehicle type	Growth driver	Forecast	
		Assumed forecast elasticity	Evolution of elasticity
TP1 Lakshmipur			

Vehicle type	Growth driver	Forecast	
		Assumed forecast elasticity	Evolution of elasticity
Car	GSDP West Bengal	1.10	No change
Mini LCV	GSDP West Bengal	1.00	No change
LCV	GSDP West Bengal	0.50	No change
Bus	GSDP West Bengal	0.25	No change
2A	GSDP West Bengal	0.50	No change
3A	GDP	0.30	No change
MAV	GDP	0.90	No change
TP2 Gazole			
Car	GSDP West Bengal	1.10	No change
Mini LCV	GSDP West Bengal	1.00	No change
LCV	GSDP West Bengal	0.40	No change
Bus	GSDP West Bengal	0.25	No change
2A	GSDP West Bengal	0.50	No change
3A	GDP	0.30	No change
MAV	GDP	0.90	No change

Source: Steer analysis of Client data

Forecasts for growth drivers

5.24 Following the discussion in Chapter 4 on the nature of economic activity in the state of West Bengal, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. In particular, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.25 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.26 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in Figure 5.4.

5.27 Based on that, GDP is forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.28 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

West Bengal GSDP

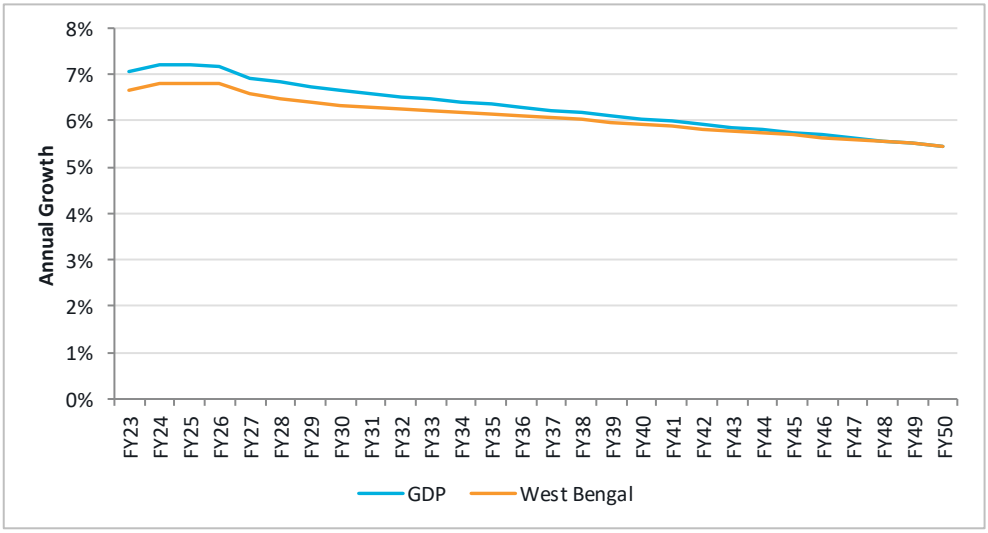
5.29 As per Client projections, West Bengal's GSDP growth assumes to continue to stay below the national GDP throughout the concession period but quickly catch up to the GDP level in the next decade.

5.30 There are significant investments expected to take place as part of the state's plan and West Bengal is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher-than-expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to West Bengal's state economy.

5.31 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.32 The GDP-GSDP lines are expected to converge by FY47. The chart below shows the forecast growth lines for GDP and West Bengal GSDP.

Figure 5.4: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP forecast based on client GDP data

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on estimated and assumed forecast background growth rates in the previous chapter, this chapter first deals with the forecasting assumptions around base year AADT and potential impacts on traffic growth on the Asset. Later, it also presents the assumed toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to estimate the forecast revenue based on the forecast traffic. In the final section, the chapter summarises the traffic growth rates for the forecast years. The following table lists key intermediate and final outputs that have presented in chapter 5 and 6.

Table 6-1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Background historical elasticities with respect to growth drivers	Chapter 3, 5, Appendix B
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix B
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer

6.2 All traffic is presented as AADT by vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Though FY41 is the last year of concession, we have presented our forecasts until FY42, for Client's reference. Appendix B presents detailed forecasts until FY45.

Seasonality Correction factors

6.3 Seasonality gives the monthly variation of traffic on the Asset, to understand any factor internally or externally impacting the traffic on the Asset.

6.4 As the Asset has been impacted by exogenous events such as bridge closures, overloading clampdown etc. we have benchmarked SCFs to the nearest asset as pe the data available from the Client. We have benchmarked the FY20 SCFs derived from the toll plaza data and compared it to the SCFs (FY16-FY20) from the benchmark Asset and adopted the SCFs for both the toll plazas of the Asset.

6.5 The seasonality factors adopted for individual vehicle types, same for both the toll plazas, are shown in the table below.

Table 6-2: Seasonality correction factors for TP1 Lakshmipur and TP2 Gazole

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	1.00	0.92	0.83	0.99	1.04	1.04	1.03	1.02	1.15	1.14	1.03	0.95
LCV	0.97	0.89	0.82	1.19	1.27	1.08	1.14	1.05	1.14	1.13	0.94	0.81
Bus	0.89	0.93	0.94	1.09	1.11	1.02	1.08	0.99	1.09	1.06	0.95	0.93
2A	0.89	0.93	0.94	1.09	1.11	1.02	1.08	0.99	1.09	1.06	0.95	0.93
3A	0.86	0.89	0.94	1.07	1.15	0.98	1.08	0.95	1.08	1.14	1.00	0.97
MAV	0.91	0.95	1.01	1.21	1.29	1.07	1.13	0.93	1.01	1.05	0.90	0.82

Source: Steer analysis of Client historical TMS data

Base year FY22 AADT estimates

6.6 As discussed earlier in chapter 1, The second wave of COVID-19 infections peaked in the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22.

6.7 In Q2FY22 including October 2021, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.8 The period starting November 2021 up until March 2022 is devoid of any significant event except of the 3rd wave of COVID19 in Jan-22, However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes. Further, we believe that the traffic levels observed during the November 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the asset and not a result of temporary shifts or impacts. The adopted AADT for FY22 is presented below:

Table 6.3 Monthly MADT and Adopted AADT for FY22 - TP1 Lakshmipur

Vehicle category	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted (FY22*)
CJV	3,513	3,613	3,409	3,630	3,943	3,829
LCV	379	374	373	379	464	396
Bus	482	489	425	447	474	464
2A	879	931	881	908	989	918
3A	808	846	785	791	828	834
MAV	4,695	5,777	5,909	4,465	4,866	4,891
Total	**10,756**	**12,029**	**11,783**	**10,620**	**11,563**	**11,331**
PCU	**25,612**	**29,455**	**29,151**	**24,923**	**27,082**	**26,720**

Source: Steer analysis

Table 6.4 Monthly MADT and Adopted AADT for FY22 – TP2 Gazole

Vehicle category	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted (FY22*)
CJV	4,999	5,177	4,792	5,229	5,661	5,466
LCV	290	316	295	325	371	321
Bus	672	676	619	637	674	656
2A	993	1,157	1,109	1,121	1,269	1,130
3A	851	887	815	830	884	877
MAV	3,298	4,045	4,171	3,534	3,555	3,531
Total	**11,102**	**12,258**	**11,801**	**11,674**	**12,413**	**11,981**
PCU	**23,533**	**26,755**	**26,210**	**24,784**	**26,071**	**25,235**

Source: Steer analysis

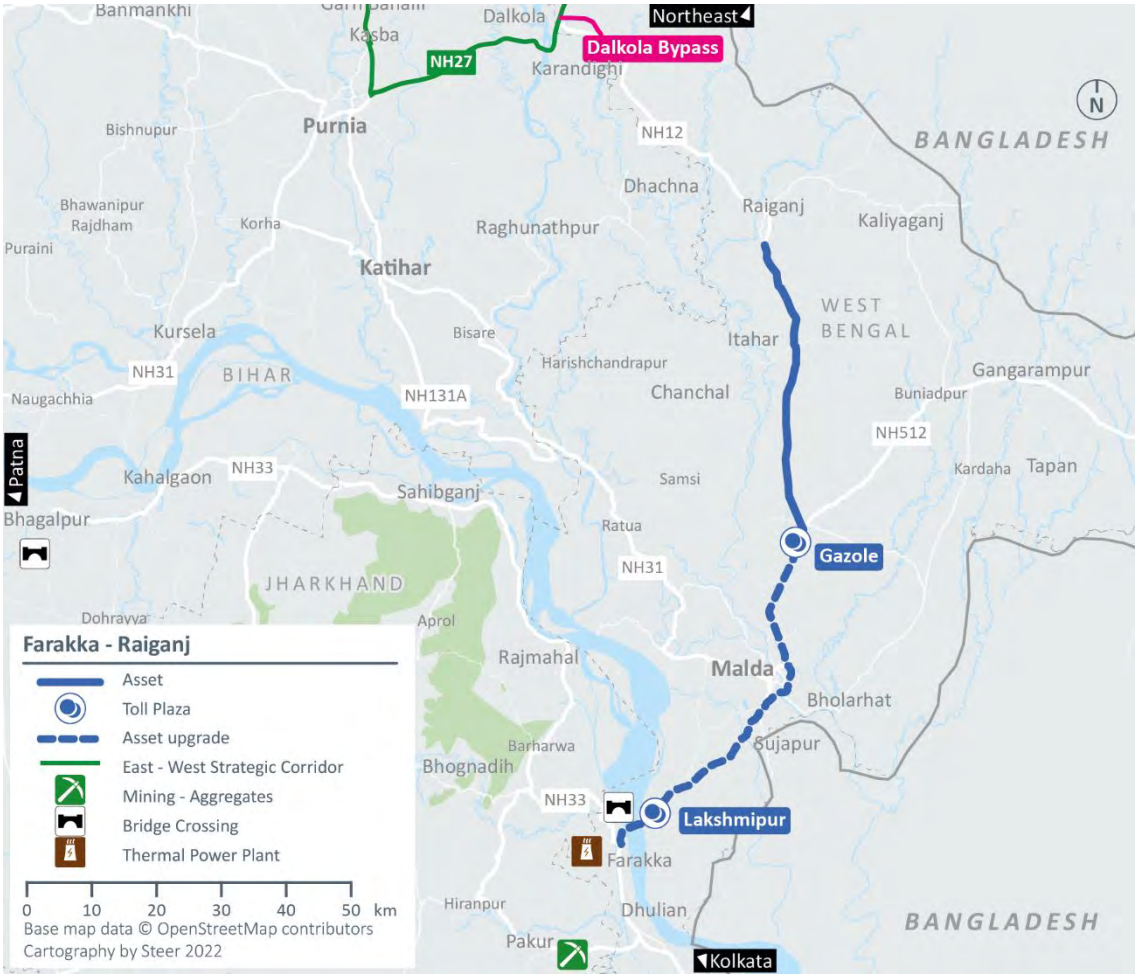
Analysis of potential impacts

Alternate routes and improvements

6.9 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in Chapter 2, in order to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.10 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context



Source: Steer analysis and cartography

6.11 The following table presents the upcoming network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6-5: List of network/other developments

S. No.	Development	Route affected	Year of completion	Impact (+/-)
1.	Completion of pending road stretches on NH12 between Farakka and Dalkhola bypass (including Raiganj-Dalkhola and Dalkhola bypass itself), and the completion of the new Farakka Barrage	Trips with one end north of Malda district and south of Murshidabad district	FY22	+ve
2	Completion of Sahibganj Bridge	Trips between south of Farakka and North of Raiganj.	FY27-28	-ve

Source: Steer analysis

Impact assessment for network/other developments

6.12 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated to each of these. Please note that all traffic volumes for impacts were estimated as impact rates applied on FY20 AADT. The discussion on impacts primarily includes continuance of FY20 impact, and improvement of level of service due to completion of construction on sections on the corridor.

Completion of construction on Asset and other stretches

6.13 As discussed in Chapter 2, construction on the Asset is complete. Improvement of 20-km section between Farakka and Dalkhola bypass, including Malda bypass and Raiganj-Dalkhola four laning, would improve LOS levels significantly for medium- to long-distance traffic. Furthermore, there is also the completion of a new bridge, Farakka Barrage, a 2.2 km two-laned bridge that connects Bengal on either side of the Ganges planned.

6.14 This would in turn improve the level of service especially for the commercial vehicles plying on the Asset. This is assumed to have a small positive impact on the Asset, considered from FY23 the impact of which is presented in the table below.

Table 6-6: Impact of completion of construction on Asset for TP1 and TP2

Vehicle type	FY23
CJV	2.5%
LCV	2.9%
2A	0.4%
3A	1.8%
MAV	2.5%

Source: Steer analysis

Completion of Sahibganj Bridge

6.15 As discussed in Chapter 2, the completion of Sahibganj bridge between Sahibganj and Manihari is expected to be completed by FY27-28. A minor shift of traffic is expected, the traffic plying between south of Farakka and going to north of Raiganj (including Purnia, Katihar), once the bridge comes into operation serving as an alternative to the Asset for short to medium distance trips. Impact estimated is applied over 2 years, 50% in the first year and 100% in the second year. The table below presents the impacts estimated for both the toll plazas.

Table 6-7: Impact of completion of construction on Asset

Vehicle type	FY27	FY28
TP1 Lakshmipur		
CJV	-0.9%	-1.8%
LCV	-0.9%	-1.8%
2A	-0.9%	-1.8%
3A	-1.8%	-3.5%
MAV	-1.3%	-2.7%
TP2 Gazole		
CJV	-0.3%	-0.5%

Vehicle type	FY27	FY28
LCV	-1.2%	-2.4%
2A	-1.2%	-2.5%
3A	-1.8%	-3.6%
MAV	-1.5%	-3.0%

Source: Steer analysis

Overloading

6.16 Overloading contributes to a significant share of both traffic and revenue at both toll plazas. Over the past three years since commencement of tolling, the proportion of overloading has varied significantly, mainly due to the decisions taken by the local administration to either ban or lift the ban on overloading at various times. Since overloading proportions are already at historic lows, as discussed in chapter 3, no further reduction in overloading shares has been assumed in the forecasts.

6.17 As discussed in the previous sections the overloading is charged under staggered penalty system in slabs, for incorporating this into analysis for overloading revenue estimation, we have calculated penalty factors to find out under which slab majority of vehicles paying the toll. The table below presents the penalty factors for both TP1 and TP2.

Table 6-8: FY22 average overloading penalty factors

Vehicle category	TP1	TP2
LCV	3.32	3.50
Bus	2.70	2.68
2A	3.10	2.81
3A	2.81	2.89
MAV	2.48	2.66

Source: Steer analysis

Revenue forecasting assumptions

6.18 To forecast the revenues for a forecast year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate. While toll segmentation provides the breakup of trips paying each ticket type, trip factors provide the conversion factor to convert from traffic (trips) to tickets sold. This section discusses assumptions related to toll segmentation, trip factors and toll rates for the forecast period.

Toll segmentation

6.19 As discussed in Chapter 3, segmentation trends have largely been stabilising over the years, with FY21 (shown in the following tables) indicating a significant reduction in the share of exemptions and violations due to better toll plaza management and FASTag implementation and increased penetration of FASTag. This has also led to an increase in the share of Single tickets compared to FY19 levels. We expect that once FASTag penetration increases particularly for CJV category, there will be further small reduction in exemption/violations. For 3A/MAV category we believe higher level of penetration levels have been achieved and therefore no significant change in segmentation is expected. This is discussed in detail in the sections following the tables below.

Table 6-9: Toll segmentation for the forecast years, TP1 Lakshmipur

Forecast	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	26.9%	32.6%	20.7%	74.65%	79.7%	38.6%
Return	59.5%	63.1%	78.7%	23.51%	20.2%	61.3%
Local personal	7.3%	-	-	-	-	-
Exemptions	6.4%	4.2%	0.6%	1.51%	0.2%	0.2%

Source: Steer analysis of Client TMS data

Table 6-10: Toll segmentation for the forecast years, TP2 Gazole

Forecast	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	24.1%	40.5%	14.2%	60.3%	75.8%	53.0%
Return	62.7%	58.4%	84.9%	38.1%	22.3%	46.5%
Local personal	5.9%	-	-	-	-	-
Exemptions	7.3%	1.1%	1.9%	1.6%	1.9%	0.5%

Source: Steer analysis of Client TMS data

Trip factors

Table 6-11: Trip factors for the forecast years, TP1 Lakshmipur

Forecast	CJV/Mini-LCV	LCV	Bus/2A	3A	MAV
Single	1.00	1.00	1.00	1.00	1.00
Return	2.00	2.00	2.00	2.00	2.00
Monthly	45.00	47.86	45.48	48.95	45.00
Local commercial	1.00	1.00	1.00	1.00	1.00
Local personal	48.39	1.00	1.00	1.00	1.00
Exemptions	1.00	1.00	1.00	1.00	1.00
Violations	1.00	1.00	1.00	1.00	1.00

Source: Steer analysis of Client TMS data

Table 6-12: Trip factors for the forecast years, TP2 Gazole

Forecast	CJV/Mini-LCV	LCV	Bus/2A	3A	MAV
Single	1.00	1.00	1.00	1.00	1.00
Return	2.00	2.00	2.00	2.00	2.00
Monthly	45.00	45.00	45.00	45.00	45.00
Local commercial	1.00	1.00	1.00	1.00	1.00
Local personal	29.60	1.00	1.00	1.00	1.00
Exemptions	1.00	1.00	1.00	1.00	1.00
Violations	1.00	1.00	1.00	1.00	1.00

Source: Steer analysis of Client TMS data

Toll evolution

6.20 Based on the concession agreement and the gazetted toll notification, we see that base toll rates increase every year based on WPI-linked inflation to provide us unrounded toll rates. These are rounded up to the nearest five to estimate the rounded toll rates charged to the road user. We have used actual toll rates from FY19 and FY20 toll notifications to validate the modelling of the toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6-13: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23	14.3%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: Shared by Client

6.21 The table below gives an overview of toll estimation.

Table 6-14: Toll estimation overview

Toll fee escalation	Revision date	Nearest rounding
Linked to an incremental 3% every year and 40% of WPI-linked increase	April	5

Source: Concession agreement and toll notification

Revenue reconciliation

6.22 As part of the validation process to test our model, we have carried out a revenue reconciliation exercise where we compare actual reported revenue for FY21 against the modelled revenue estimated based on forecast traffic and forecast assumptions on toll segmentation, trip factors and toll rates. The comparison, as shown in the table below, shows that modelled revenue overall is within a maximum variation of 0.9% from the reported revenue.

6.23 As we can see from the table below, the overall revenue difference between the Client and the revenue build-up from traffic is well within the acceptable differences and we have assumed the trip segmentation and trip factors to remain the same for the forecast years. The results are presented in the table below:

Table 6.15: Revenue reconciliation summary for March 2022

TP#	Steer modelled revenue (INR lakhs)	Reported revenue (INR lakhs)	Difference (%)
TP1 Lakshmipur	37.98	37.62	(0.9%)
TP2 Gazole	16.71	16.66	(0.3%)

Source: Steer comparison between modelled and reported revenue

6.24 As mentioned earlier, the year saw significant variances in segmentation on month on month basis in the various ticket categories, e.g. increase in single shares and reduction in return shares for a few months. There were penalties being collected from cash users who were entering in FASTag lanes until February and all cash payments were charged double tolls in February due to mandatory implementation.

6.25 All these factors resulted in significant monthly variations which meant that reconciling revenues was not feasible. As mentioned earlier, we have utilised the latest of data for February 2021 for ticket segmentation in our forecast as it reflects the most recent trends post significant increase in FASTag penetration.

Traffic and Revenue forecasts

6.26 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU forecast growth rates and CAGRs on this Asset. Further, Appendix A presents the AADT and revenues for the forecast period.

6.27 As discussed earlier in the chapter, we have considered the potential impact in a scenario where overloading is clamped down through either stricter implementation of NHAI overloading penalties, or tougher and more permanent bans on overloading by the local administration. This section presents the traffic and revenue forecasts after incorporating all the impacts and the overloading assumptions.

6.28 The tables below present the forecasts by including assumptions as discussed above, including impacts and with clampdown on overloading over the years FY22 through FY24. As explained in the presentation of impact estimates, this could result in positive impacts of additional truck volumes caused by commodities carried in overloaded trucks moving to non-overloaded trucks.

Table 6-16: Final (background plus impacts) traffic forecast for TP1 Lakshmipur

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	2,207	2,428	3,233	4,534	6,287	8,101
Mini LCV	1,622	1,730	2,227	3,004	4,047	5,099
LCV	396	421	476	552	642	722
Bus	725	737	788	852	920	976

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
2A	657	683	778	909	1,062	1,198
3A	834	867	927	1,006	1,105	1,188
MAV	4,891	5,330	6,746	8,908	11,760	14,553
AADT	**11,331**	**12,196**	**15,176**	**19,764**	**25,823**	**31,836**
PCU	**26,720**	**28,707**	**35,243**	**45,171**	**58,192**	**70,937**

Source: Steer analysis

Table 6-17: Final (background plus impacts) traffic CAGR (%) for TP1 Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	10.0%	7.4%	7.0%	6.8%	6.92%
Mini LCV	6.7%	6.5%	6.2%	6.1%	6.19%
LCV	6.3%	3.1%	3.0%	3.1%	3.04%
Bus	1.7%	1.7%	1.6%	1.5%	1.57%
2A	3.9%	3.3%	3.1%	3.2%	3.17%
3A	4.0%	1.7%	1.6%	1.9%	1.76%
MAV	9.0%	6.1%	5.7%	5.7%	5.74%
AADT	**7.6%**	**5.6%**	**5.4%**	**5.5%**	**5.48%**
PCU	**7.4%**	**5.3%**	**5.1%**	**5.2%**	**5.15%**

Source: Steer analysis

Table 6-18: Final (background plus impacts) Revenue forecast (INR Crores) for TP1 Lakshmipur

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	6.6	8.3	13.7	24.3	41.9	64.6
Mini LCV	5.7	7.0	11.1	19.0	31.8	48.0
LCV	3.0	3.7	5.2	7.6	10.9	14.7
Bus	7.7	9.0	11.8	16.2	21.8	27.5
2A	8.3	9.9	13.9	20.5	29.9	40.2
3A	16.3	19.5	25.8	35.2	48.1	61.9
MAV	89.5	112.2	175.0	291.8	478.6	708.3
Total	**137.2**	**169.5**	**256.5**	**414.6**	**663.0**	**965**

Source: Steer analysis

Table 6-19: Final (background plus impacts) Revenue CAGR (%) for TP1 Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	25.5%	13.5%	12.1%	11.5%	12.09%
Mini LCV	21.5%	12.5%	11.3%	10.8%	11.32%
LCV	21.5%	8.8%	7.9%	7.6%	7.96%
Bus	16.6%	7.1%	6.4%	6.1%	6.41%
2A	19.5%	8.8%	8.1%	7.9%	8.08%
3A	19.7%	7.1%	6.5%	6.4%	6.61%
MAV	25.4%	11.8%	10.8%	10.4%	10.78%
Total	**23.6%**	**10.9%**	**10.1%**	**9.8%**	**10.14%**

Source: Steer analysis

Table 6-20: Final (background plus impacts) traffic forecast for TP2 Gazole

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	3,626	3,988	5,312	7,449	10,329	13,310
Mini LCV	1,840	1,963	2,542	3,451	4,649	5,858
LCV	321	339	373	418	472	518
Bus	998	1,014	1,085	1,174	1,267	1,344
2A	788	819	930	1,082	1,265	1,426
3A	877	912	975	1,057	1,161	1,248
MAV	3,531	3,849	4,864	6,413	8,467	10,477
AADT	11,981	12,884	16,080	21,044	27,610	34,182
PCU	26,399	28,279	34,550	44,101	56,650	68,981

Source: Steer analysis

Table 6-21: Final (background plus impacts) traffic CAGR (%) for TP2 Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23- FY41
CJV	10.0%	7.4%	7.0%	6.8%	6.92%
Mini LCV	6.7%	6.7%	6.3%	6.1%	6.26%
LCV	5.6%	2.4%	2.3%	2.5%	2.39%
Bus	1.7%	1.7%	1.6%	1.5%	1.57%
2A	3.9%	3.2%	3.1%	3.2%	3.13%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23- FY41
3A	4.0%	1.7%	1.6%	1.9%	1.76%
MAV	9.0%	6.0%	5.7%	5.7%	5.72%
AADT	**7.5%**	**5.7%**	**5.5%**	**5.6%**	**5.57%**
PCU	**7.1%**	**5.1%**	**5.0%**	**5.1%**	**5.08%**

Source: Steer analysis

Table 6-22: Final (background plus impacts) Revenue forecast (INR Crores) for TP2 Gazole

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	5.1	6.3	10.3	18.1	31.0	47.7
Mini LCV	2.8	3.4	5.4	9.1	15.1	22.8
LCV	1.1	1.4	1.9	2.6	3.6	4.8
Bus	5.1	5.8	7.6	10.4	13.9	17.7
2A	4.7	5.4	7.6	11.2	16.2	22.0
3A	8.5	9.8	12.8	17.6	24.2	31.0
MAV	33.6	40.5	62.8	104.6	172.7	254.7
Total	**61.1**	**108.4**	**173.6**	**229.2**	**276.8**	**401**

Source: Steer analysis

Table 6-23: Final (background plus impacts) Revenue CAGR (%) for TP2 Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	22.4%	13.2%	11.9%	11.3%	11.90%
Mini LCV	18.5%	12.4%	11.1%	10.7%	11.21%
LCV	18.0%	8.1%	7.1%	6.9%	7.24%
Bus	13.0%	7.1%	6.4%	6.0%	6.43%
2A	15.5%	8.7%	8.1%	7.7%	8.07%
3A	14.9%	7.0%	6.5%	6.6%	6.59%
MAV	20.5%	11.6%	10.7%	10.5%	10.75%
Total	**18.7%**	**10.6%**	**9.9%**	**9.8%**	**9.96%**

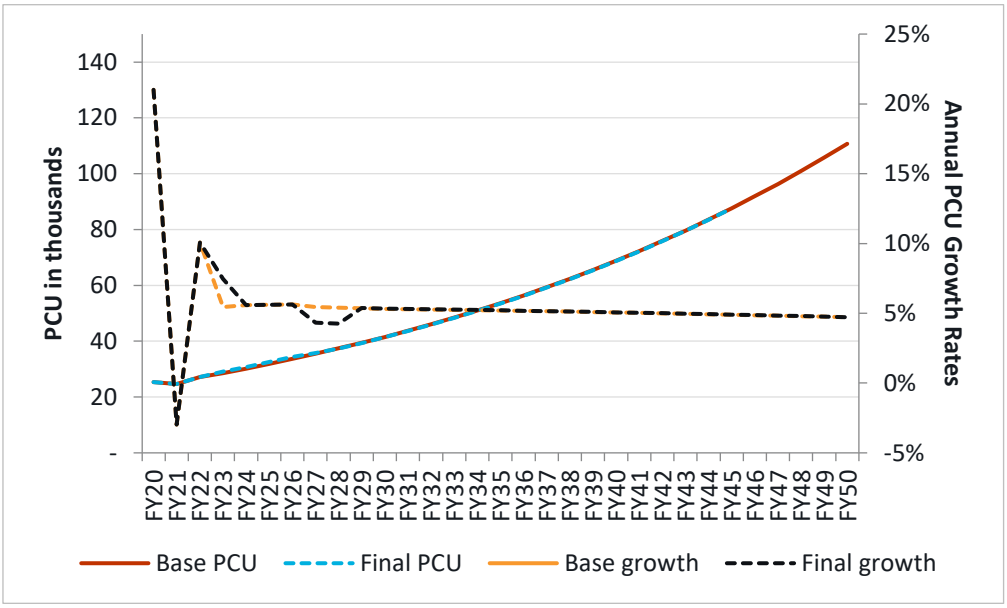
Source: Steer analysis

6.29 As presented in the table above, CAGRs (FY22-FY42) in terms of PCUs for the final (background plus impacts) growth rates is 5.4% respectively at TP1 Lakshmipur, and 5.2% at TP2 Gazole. While the background growth is primarily driven by car growth followed by MAV growth, the

minimal uplift in final growth rates (as also seen in the chart below) is due to only two minor impacts expected i.e. the completion of the pending construction on the Asset and the Dalkhola bypass further north.

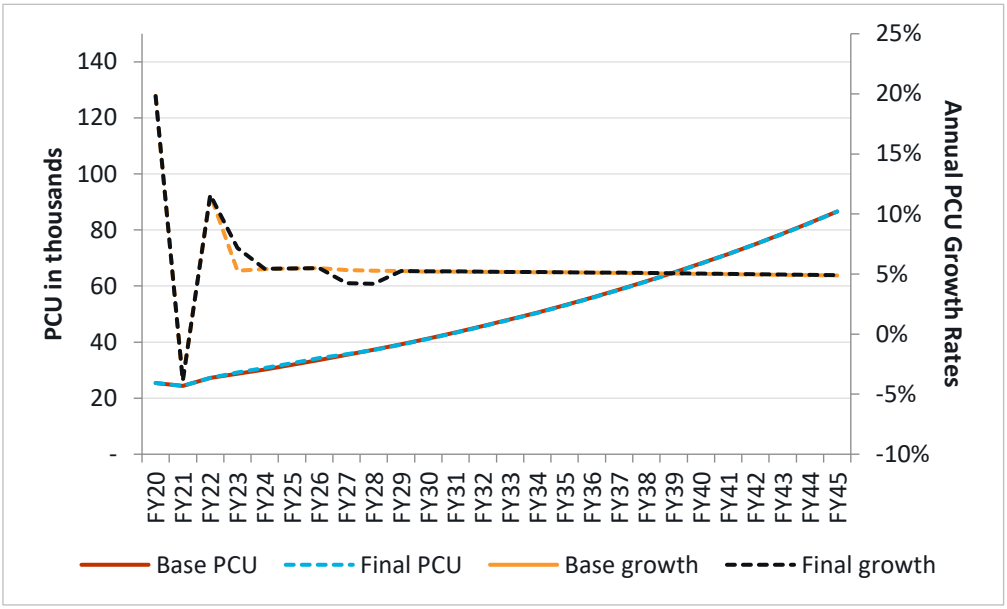
6.30 The charts below present the PCU volumes and growth rates during the forecast years.

Figure 6.2: Forecast traffic and growth rates in PCUs - Background and final, TP1



Source: Steer analysis

Figure 6.3: Forecast traffic and growth rates in PCUs - Background and final, TP2



Source: Steer analysis

Upside and Downside Cases

6.31 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken

due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.32 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.33 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.24: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
FRHL	GDP/GSDP	+1% every year	-1% every year
FRHL	WPI	+1% every year	-1% every year
FRHL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.34 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.35 The upside case impacts included in forecasts are summarised in below:

Table 6.25: Summary of impacts on the Assets

Impact	Completion of construction on the Asset	Sahibganj Bridge
Year	**FY23 onwards**	**FY27 onwards**
TP-1	CJV: 3.1% LCV: 7.2% 2A: 0.9% 3A: 4.5% MAV: 6.2%	Mini LCV: -1.34% LCV: -1.37% 2A: -1.35% 3A: -2.66% MAV: -2.0%:
TP-2	CJV: 3.1% LCV: 3.6% 2A: 0.5% 3A: 2.3% MAV: 3.1%	Mini LCV: -0.41% LCV: -1.78% 2A: -1.86% 3A: -2.68% MAV: -2.22%:

Source: Steer analysis of OD data, and publicly available information

6.36 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.37 The downside case impacts included in forecasts are summarised in below:

Table 6.26: Summary of impacts on the Assets

Impact	Completion of construction on the Asset	Sahibganj Bridge
Year	**FY23 onwards**	**FY27 onwards**
TP-1	CJV: 1.9% LCV: 4.3% 2A: 0.5% 3A: 2.7% MAV: 3.7%	Mini LCV: -2.24% LCV: -2.29% 2A: -2.24% 3A: -4.43% MAV: -3.33%
TP-2	CJV: 1.9% LCV: 2.2% 2A: 0.3% 3A: 1.4% MAV: 1.9%	Mini LCV: -0.68% LCV: -2.97% 2A: -3.10% 3A: -4.47% MAV: -3.70%

Source: Steer analysis of OD data, and publicly available information

6.38 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.39 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case. Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.27: Traffic forecast (With Upside Impacts) for TP1: Lakshmipur

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	2,207	2,487	3,559	5,453	8,253	11,398
Mini LCV	1,622	1,759	2,424	3,553	5,186	6,963
Bus	396	442	519	629	763	886
LCV	725	740	805	890	981	1,058
2A	657	693	819	1,000	1,220	1,421
3A	834	895	982	1,099	1,239	1,358
MAV	4,891	5,608	7,571	10,809	15,355	20,134
AADT	**11,331**	**12,623**	**16,679**	**23,433**	**32,995**	**43,218**
PCU's	**26,720**	**29,838**	**38,807**	**53,505**	**74,037**	**95,631**

Source: Steer analysis

Table 6.28: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	12.7%	9.4%	8.9%	8.6%	8.83%
Mini LCV	8.4%	8.3%	8.0%	7.9%	7.94%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
Bus	11.7%	4.1%	3.9%	3.9%	3.94%
LCV	2.1%	2.1%	2.0%	2.0%	2.01%
2A	5.4%	4.3%	4.1%	4.0%	4.07%
3A	7.3%	2.4%	2.3%	2.4%	2.34%
MAV	14.7%	7.8%	7.4%	7.3%	7.36%
AADT	**11.4%**	**7.2%**	**7.0%**	**7.1%**	**7.08%**
PCU's	**11.7%**	**6.8%**	**6.6%**	**6.7%**	**6.68%**

Source: Steer analysis

Table 6.29: Revenue forecast (With Upside Impacts) for TP1: Lakshmipur (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	6.6	8.5	15.5	31.0	60.6	103.4
Mini LCV	5.7	7.1	12.4	23.8	44.9	74.5
Bus	3.0	3.9	5.8	9.1	14.3	20.5
LCV	7.7	9.0	12.4	17.9	25.6	34.1
2A	8.3	10.1	15.0	23.9	37.7	54.5
3A	16.3	20.2	27.8	40.8	59.5	80.7
MAV	89.5	118.0	200.7	375.3	690.1	1,118.0
Total Revenue	**137.2**	**176.7**	**289.7**	**521.8**	**932.8**	**1,486**

Source: Steer analysis

Table 6.30: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	28.5%	16.3%	14.9%	14.4%	14.91%
Mini LCV	23.5%	15.1%	13.9%	13.6%	13.97%
Bus	27.7%	10.4%	9.6%	9.5%	9.68%
LCV	17.1%	8.2%	7.6%	7.4%	7.65%
2A	21.2%	10.5%	9.8%	9.5%	9.84%
3A	23.6%	8.4%	8.0%	7.8%	8.01%
MAV	31.9%	14.2%	13.3%	13.0%	13.31%
Total Revenue	**28.8%**	**13.2%**	**12.5%**	**12.3%**	**12.56%**

Source: Steer analysis

Table 6.31: Traffic forecast (With Upside Impacts) for TP2: Gazole

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	3,626	4,085	5,847	8,959	13,559	18,727
Mini LCV	1,840	1,995	2,762	4,069	5,938	7,973
Bus	321	344	390	453	529	597

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
LCV	998	1,019	1,109	1,225	1,351	1,457
2A	788	827	976	1,188	1,448	1,687
3A	877	921	1,010	1,129	1,273	1,396
MAV	3,531	3,931	5,300	7,556	10,734	14,075
AADT	**11,981**	**13,122**	**17,393**	**24,579**	**34,832**	**45,912**
PCU's	**26,399**	**28,770**	**37,182**	**51,005**	**70,394**	**90,895**

Source: Steer analysis

Table 6.32: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	12.7%	9.4%	8.9%	8.6%	8.83%
Mini LCV	8.4%	8.5%	8.1%	7.9%	8.00%
Bus	7.1%	3.2%	3.1%	3.1%	3.11%
LCV	2.1%	2.1%	2.0%	2.0%	2.01%
2A	4.9%	4.2%	4.0%	4.0%	4.04%
3A	5.0%	2.3%	2.3%	2.4%	2.34%
MAV	11.3%	7.8%	7.4%	7.3%	7.34%
AADT	**9.5%**	**7.3%**	**7.2%**	**7.2%**	**7.21%**
PCU's	**9.0%**	**6.6%**	**6.5%**	**6.7%**	**6.60%**

Source: Steer analysis

Table 6.33: Revenue forecast (With Upside Impacts) for TP2: Gazole (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	5.1	6.5	11.4	22.8	45.1	77.0
Mini LCV	2.8	3.4	5.8	11.2	21.4	35.6
Bus	1.1	1.4	2.0	3.0	4.5	6.3
LCV	5.1	5.8	8.0	11.5	16.4	21.8
2A	4.7	5.5	8.1	13.0	20.4	29.6
3A	8.5	9.9	13.7	19.9	29.2	39.6
MAV	33.6	41.4	70.2	130.9	241.0	390.8
Total Revenue	**61.1**	**73.8**	**119.2**	**212.3**	**377.9**	**601**

Source: Steer analysis

Table 6.34: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	25.4%	15.2%	14.9%	14.6%	14.77%
Mini LCV	20.5%	14.3%	13.9%	13.8%	13.89%
Bus	19.6%	9.2%	8.6%	8.9%	8.80%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
LCV	13.4%	8.3%	7.7%	7.3%	7.65%
2A	16.6%	10.3%	9.9%	9.4%	9.82%
3A	16.0%	8.3%	7.9%	7.9%	8.00%
MAV	23.1%	14.1%	13.3%	13.0%	13.28%
Total Revenue	**20.8%**	**12.7%**	**12.2%**	**12.2%**	**12.35%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.40 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.41 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.35: Traffic forecast (With Downside Impacts) for TP1: Lakshmipur

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	2,207	2,374	2,963	3,837	4,918	5,955
Mini LCV	1,622	1,705	2,063	2,581	3,237	3,853
Bus	396	423	464	517	579	633
LCV	725	734	773	820	869	908
2A	657	679	748	839	945	1,034
3A	834	871	910	960	1,031	1,089
MAV	4,891	5,322	6,355	7,823	9,671	11,363
AADT	**11,331**	**12,107**	**14,275**	**17,377**	**21,250**	**24,835**
PCU's	**26,720**	**28,593**	**33,350**	**40,085**	**48,506**	**56,214**

Source: Steer analysis

Table 6.36: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	7.6%	5.7%	5.3%	5.1%	5.24%
Mini LCV	5.1%	4.9%	4.6%	4.6%	4.63%
Bus	7.0%	2.3%	2.2%	2.3%	2.26%
LCV	1.3%	1.3%	1.2%	1.2%	1.19%
2A	3.3%	2.5%	2.3%	2.4%	2.37%
3A	4.4%	1.1%	1.1%	1.4%	1.25%
MAV	8.8%	4.5%	4.2%	4.3%	4.30%
AADT	**6.8%**	**4.2%**	**4.0%**	**4.1%**	**4.07%**
PCU's	**7.0%**	**3.9%**	**3.7%**	**3.9%**	**3.83%**

Table 6.37: Revenue forecast (With Downside Impacts) for TP1: Lakshmipur

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	6.6	8.1	12.3	19.6	29.7	41.8
Mini LCV	5.7	6.9	10.1	15.6	23.0	32.0
Bus	3.0	3.7	4.9	6.6	8.9	11.4
LCV	7.7	9.0	11.3	14.7	18.7	22.6
2A	8.3	9.9	13.1	17.9	24.2	30.6
3A	16.3	19.6	24.6	31.8	40.9	49.9
MAV	89.5	112.0	160.7	241.9	358.3	486.2
Total Revenue	**137.2**	**169.1**	**237.0**	**348.0**	**503.7**	**674**

Source: Steer analysis

Table 6.38: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Lakshmipur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	22.7%	11.0%	9.8%	8.7%	9.56%
Mini LCV	19.7%	10.2%	9.0%	8.2%	8.93%
Bus	22.3%	7.0%	6.4%	6.1%	6.39%
LCV	16.1%	6.0%	5.3%	5.0%	5.26%
2A	18.8%	7.3%	6.5%	6.2%	6.49%
3A	20.2%	5.9%	5.2%	5.2%	5.32%
MAV	**25.2%**	**9.5%**	**8.5%**	**8.2%**	**8.50%**
Total Revenue	**23.3%**	**8.8%**	**8.0%**	**7.7%**	**7.99%**

Source: Steer analysis

Table 6.39: Traffic forecast (With Downside Impacts) for TP2: Gazole

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	3,626	3,900	4,867	6,304	8,080	9,784
Mini LCV	1,840	1,934	2,358	2,975	3,730	4,440
Bus	321	335	358	388	425	456
LCV	998	1,011	1,064	1,130	1,197	1,251
2A	788	812	891	995	1,120	1,226
3A	877	903	943	995	1,069	1,128
MAV	3,531	3,773	4,497	5,524	6,828	8,023
AADT	**11,981**	**12,668**	**14,979**	**18,309**	**22,449**	**26,309**
PCU's	**26,399**	**27,832**	**32,330**	**38,714**	**46,705**	**54,044**

Source: Steer analysis

Table 6.40: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	7.6%	5.7%	5.3%	5.1%	5.24%
Mini LCV	5.1%	5.1%	4.8%	4.6%	4.73%
Bus	4.2%	1.7%	1.6%	1.9%	1.74%
LCV	1.3%	1.3%	1.2%	1.2%	1.19%
2A	3.0%	2.4%	2.2%	2.4%	2.32%
3A	3.0%	1.1%	1.1%	1.4%	1.24%
MAV	6.9%	4.5%	4.2%	4.3%	4.28%
AADT	**5.7%**	**4.3%**	**4.1%**	**4.2%**	**4.14%**
PCU's	**5.4%**	**3.8%**	**3.7%**	**3.8%**	**3.76%**

Source: Steer analysis

Table 6.41: Revenue forecast (With Downside Impacts) for TP2: Gazole (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY37	FY41
CJV	5.1	6.2	9.0	14.3	22.1	30.9
Mini LCV	2.8	3.3	4.7	7.3	11.1	15.2
Bus	1.1	1.3	1.7	2.3	3.0	3.7
LCV	5.1	5.7	7.3	9.5	12.0	14.5
2A	4.7	5.4	7.1	9.7	13.0	16.5
3A	8.5	9.7	12.1	15.7	20.1	24.7
MAV	33.6	39.7	56.6	85.4	126.1	172.0
Total Revenue	**61.1**	**71.4**	**98.5**	**144.2**	**207.5**	**278**

Source: Steer analysis

Table 6.42: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Gazole

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY37	FY23-FY41
CJV	19.7%	9.9%	9.8%	9.1%	9.38%
Mini LCV	16.8%	9.2%	9.2%	8.6%	8.84%
Bus	16.4%	6.3%	5.9%	5.7%	5.83%
LCV	12.5%	6.0%	5.4%	4.9%	5.26%
2A	14.5%	7.1%	6.6%	6.0%	6.42%
3A	13.9%	5.6%	5.3%	5.1%	5.32%
MAV	18.1%	9.2%	8.6%	8.1%	8.48%
Total Revenue	**16.8%**	**8.4%**	**7.9%**	**7.5%**	**7.83%**

Source: Steer analysis

Concession agreement: effect of variations in target traffic growth

6.42 As per the concession agreement, the level of target traffic estimated for October 1, 2020 is 22,666 PCUs per day. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual traffic.' If the target traffic for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6-43: Target Traffic: Concession agreement vs the forecast traffic

TP#	Date	CA target traffic (PCUs)	Steer forecasts (PCUs)				Variation (%)
			Sept FY19	Sept FY20	Sept FY21	'Actual traffic'	
TP1	01-Oct-2020	22,666	24,552	27,533	25,291	**25,792**	13.8%

Source: CA and Steer analysis.

6.43 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have forecast seasonality of September month to adjust for seasonal trends and arrive at September traffic from AADT traffic on both the toll plazas. We have taken average of both the toll plazas for this analysis.

6.44 As seen from the table above, the target traffic forecast for the total Asset is 13.8% higher than the concession agreement target. As the difference lies above the permitted 2.5% excess, a renegotiation of the length of the concession agreement is expected. As per the concession agreement, for every 1% excess target traffic, the concession period shall be decreased by 1.5%, with a capping at 10%. Therefore, for 14% excess traffic, the concession period, originally 30 years, is expected to be decreased by 3 years from FY41, potentially reducing the last date of concession to FY38.

Summary outlook

6.45 Overall, the passenger traffic is primarily driven by leisure travel between large urban centres like Kolkata, and other towns like Farakka, Malda, Gazole and Raiganj lying on the Asset. Goods traffic are largely driven by movement of stone aggregate from the Pakur region to Malda, Bangladesh and other regions, apart from agricultural produce like rice and jute. The aggregate-carrying 3A and MAV vehicles typically overload heavily and are therefore penalised by the toll operators. We expect that this share of overloading traffic will normalise to lower levels in the next 3-4 years and lead to an healthy conversion to further 3A/MAV traffic to accommodate the tonnage demand on the corridor.

6.46 Network developments include progress on construction both on the Asset (about 20 km pending) and the sections located further north and south on the north-south corridor between Kolkata and Dalkhola. These upgrades are expected to improve the level of service on the whole corridor and result not only in a healthy growth on the Asset but also some induced traffic demand. Both passenger and goods traffic have seen good growth in the historical period from FY17 to FY20, though traffic was temporarily affected in late FY19 due to closure of Farakka Barrage.

6.47 The Asset is the primary route connecting Kolkata and southern West Bengal with the norther parts of the state and Northeast India. Therefore, improvements in level of service due to completion of construction in various planned and ongoing sections is expected to encourage more passenger movement and induce additional traffic. The advantage of being in a unique location strategically and geographically works in favour for the asset and results in absence of any other viable alternate routes for users currently on the road.

Risks

6.48 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be risks associated with assumptions and the forecasts using them as summarised below.

6.49 As per our evaluation of the target traffic for the Asset, the traffic is excess of the target traffic by 35% from the target traffic PCU volumes. Therefore, we estimate a decrease of 3 years from the concession period, moving from FY41 to FY38.

6.50 Overall, we see a positive outlook for the region and the Asset, given that serves as the primary connection to north eastern India and Bangladesh from the state of West Bengal and further south. It is also the primary route on the tourism corridor with both state and national governments focussing on developing north eastern states as tourism hubs in the near future. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Top 10 OD pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Lakshmipur

Table A.1: CJV top 10 OD pair shares at TP1 Lakshmipur

	OD Pair	Share
1.	Farakka Area-Rest of Maldah	39.0%
2.	Rest of Murshidabad-Rest of Maldah	8.7%
3.	Farakka Area-Raiganj Area	6.3%
4.	Farakka Area-Sujapur Area	5.6%
5.	Kolkata-Rest of Maldah	5.1%
6.	Dhuliyan Area-Rest of Maldah	4.5%
7.	Barddhaman-Rest of Maldah	3.5%
8.	Barddhaman-Raiganj Area	3.2%
9.	Darjiling-Kolkata	3.0%
10.	Kolkata-Raiganj Area	2.8%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Lakshmipur

	OD Pair	Share
1.	Farakka Area-Raiganj Area	11.1%
2.	Rest of Pakur-Rest of Maldah	6.6%
3.	Farakka Area-Rest of Maldah	5.1%
4.	Suri Area-Rest of Maldah	4.7%
5.	Darjiling-Kolkata	4.3%
6.	Rest of Pakur-Raiganj Area	4.1%
7.	Assam-Kolkata	3.5%
8.	Kolkata-Raiganj Area	3.3%
9.	Kolkata-Rest of Maldah	3.1%
10.	Rest of Pakur-Gazole Area	2.5%

Source: Steer analysis of OD data

TP2 Gazole

Table A.3:

CJV top 10 OD pair shares at TP2 Gazole

	OD Pair	Share
1.	Rest of Maldah-Gazole Area	36.1%
2.	Rest of Maldah-Raiganj Area	13.3%
3.	Rest of Maldah-Chanchal Area	5.6%
4.	Rest of Maldah-Balurghat Area	5.2%
5.	Dakshin Dinajpur-Rest of Maldah	4.8%
6.	Samsi Area-Rest of Maldah	3.7%
7.	Gangarampur Area-Rest of Maldah	3.5%
8.	Farakka Area-Raiganj Area	2.7%
9.	Rest of Maldah-Itahar Area	2.4%
10.	Darjiling-Rest of Maldah	2.2%

Source: Steer analysis of OD data

Table A.4: MAV top 10 OD pair shares at TP2 Gazole

	OD Pair	Share
1.	Farakka Area-Raiganj Area	13.1%
2.	Assam-Kolkata	3.6%
3.	Darjiling-Kolkata	3.4%
4.	Rest of Maldah-Gazole Area	2.5%
5.	Rest of Maldah-Raiganj Area	2.4%
6.	Rest of Pakur-Raiganj Area	2.4%
7.	Farakka Area-Balurghat Area	2.2%
8.	Farakka Area-Bamangola Area	2.0%
9.	Assam-Purba Medinipur	1.8%
10.	Rest of Pakur-Rest of Uttar Dinajpur	1.8%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY42. The following two tables show the traffic growth rates and AADT, respectively, in the scenario without overloading clampdown.

Table B.1: Forecasts for final (background + impacts) traffic forecasts (%), TP1 Lakshmipur

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY22	2,207	1,622	396	725	657	834	4,891	11,331	26,720
FY23	2,428	1,730	421	737	683	867	5,330	12,196	28,707
FY24	2,609	1,848	435	749	707	886	5,676	12,911	30,300
FY25	2,805	1,974	450	762	733	905	6,044	13,672	31,993
FY26	3,015	2,108	465	775	759	925	6,434	14,482	33,787
FY27	3,233	2,227	476	788	778	927	6,746	15,176	35,243
FY28	3,464	2,350	487	801	798	930	7,066	15,895	36,740
FY29	3,708	2,501	503	813	825	948	7,494	16,792	38,704
FY30	3,967	2,659	519	826	852	967	7,943	17,733	40,757
FY31	4,242	2,827	535	839	880	986	8,413	18,723	42,911
FY32	4,534	3,004	552	852	909	1,006	8,908	19,764	45,171
FY33	4,844	3,191	569	866	938	1,025	9,426	20,859	47,540
FY34	5,174	3,388	587	879	968	1,045	9,970	22,010	50,022
FY35	5,523	3,596	605	893	999	1,065	10,539	23,220	52,622
FY36	5,894	3,816	623	906	1,030	1,085	11,136	24,490	55,344
FY37	6,287	4,047	642	920	1,062	1,105	11,760	25,823	58,192
FY38	6,703	4,290	661	934	1,095	1,126	12,413	27,223	61,171
FY39	7,144	4,547	681	948	1,129	1,146	13,096	28,690	64,287
FY40	7,609	4,816	701	962	1,163	1,167	13,809	30,227	67,540
FY41	8,101	5,099	722	976	1,198	1,188	14,553	31,836	70,937
FY42	8,621	5,396	743	990	1,233	1,209	15,329	33,522	74,483
FY43	9,169	5,709	764	1,004	1,269	1,231	16,139	35,285	78,183
FY44	9,748	6,036	786	1,019	1,306	1,252	16,983	37,130	82,041

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY45	10,358	6,380	809	1,033	1,344	1,274	17,862	39,059	86,062
FY46	11,002	6,740	831	1,048	1,382	1,295	18,777	41,075	90,251
FY47	11,680	7,118	855	1,063	1,421	1,317	19,728	43,181	94,612
FY48	12,394	7,513	878	1,077	1,460	1,339	20,718	45,380	99,152
FY49	13,145	7,927	903	1,092	1,501	1,361	21,745	47,674	1,03,873
FY50	13,933	8,359	927	1,107	1,542	1,384	22,812	50,064	1,08,779

Source: Steer analysis

Table B.2: Forecasts for final (background + impacts) growth rates (%) for TP1 Lakshmipur

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY22	4.6%	4.6%	(46.6%)	4.0%	4.0%	(13.2%)	20.5%	**5.4%**	**8.5%**
FY23	10.0%	6.7%	6.3%	1.7%	3.9%	4.0%	9.0%	**7.6%**	**7.4%**
FY24	7.5%	6.8%	3.4%	1.7%	3.6%	2.2%	6.5%	**5.9%**	**5.6%**
FY25	7.5%	6.8%	3.4%	1.7%	3.6%	2.2%	6.5%	**5.9%**	**5.6%**
FY26	7.5%	6.8%	3.4%	1.7%	3.6%	2.2%	6.5%	**5.9%**	**5.6%**
FY27	7.2%	5.6%	2.4%	1.6%	2.5%	0.3%	4.8%	**4.8%**	**4.3%**
FY28	7.1%	5.5%	2.3%	1.6%	2.5%	0.2%	4.7%	**4.7%**	**4.2%**
FY29	7.1%	6.4%	3.2%	1.6%	3.4%	2.0%	6.1%	**5.6%**	**5.3%**
FY30	7.0%	6.3%	3.2%	1.6%	3.3%	2.0%	6.0%	**5.6%**	**5.3%**
FY31	6.9%	6.3%	3.2%	1.6%	3.3%	2.0%	5.9%	**5.6%**	**5.3%**
FY32	6.9%	6.3%	3.1%	1.6%	3.3%	2.0%	5.9%	**5.6%**	**5.3%**
FY33	6.8%	6.2%	3.1%	1.6%	3.2%	1.9%	5.8%	**5.5%**	**5.2%**
FY34	6.8%	6.2%	3.1%	1.5%	3.2%	1.9%	5.8%	**5.5%**	**5.2%**
FY35	6.8%	6.1%	3.1%	1.5%	3.2%	1.9%	5.7%	**5.5%**	**5.2%**
FY36	6.7%	6.1%	3.1%	1.5%	3.1%	1.9%	5.7%	**5.5%**	**5.2%**
FY37	6.7%	6.1%	3.0%	1.5%	3.1%	1.9%	5.6%	**5.4%**	**5.1%**
FY38	6.6%	6.0%	3.0%	1.5%	3.1%	1.9%	5.6%	**5.4%**	**5.1%**
FY39	6.6%	6.0%	3.0%	1.5%	3.1%	1.8%	5.5%	**5.4%**	**5.1%**
FY40	6.5%	5.9%	3.0%	1.5%	3.0%	1.8%	5.4%	**5.4%**	**5.1%**
FY41	6.5%	5.9%	2.9%	1.5%	3.0%	1.8%	5.4%	**5.3%**	**5.0%**
FY42	6.4%	5.8%	2.9%	1.5%	3.0%	1.8%	5.3%	**5.3%**	**5.0%**
FY43	6.4%	5.8%	2.9%	1.4%	2.9%	1.8%	5.3%	**5.3%**	**5.0%**
FY44	6.3%	5.7%	2.9%	1.4%	2.9%	1.7%	5.2%	**5.2%**	**4.9%**
FY45	6.3%	5.7%	2.8%	1.4%	2.9%	1.7%	5.2%	**5.2%**	**4.9%**
FY46	6.2%	5.6%	2.8%	1.4%	2.8%	1.7%	5.1%	**5.2%**	**4.9%**
FY47	6.2%	5.6%	2.8%	1.4%	2.8%	1.7%	5.1%	**5.1%**	**4.8%**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY48	6.1%	5.6%	2.8%	1.4%	2.8%	1.7%	5.0%	**5.1%**	**4.8%**
FY49	6.1%	5.5%	2.8%	1.4%	2.8%	1.7%	5.0%	**5.1%**	**4.8%**
FY50	6.0%	5.5%	2.7%	1.4%	2.7%	1.6%	4.9%	**5.0%**	**4.7%**

Source: Steer analysis

Table B.3: Forecasts for final (background + impacts) traffic forecasts, TP2 Gazole

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY22	3,626	1,840	321	998	788	877	3,531	**11,981**	**26,399**
FY23	3,988	1,963	339	1,014	819	912	3,849	**12,884**	**28,279**
FY24	4,287	2,096	348	1,032	848	931	4,098	**13,641**	**29,804**
FY25	4,608	2,239	358	1,049	879	951	4,364	**14,448**	**31,425**
FY26	4,954	2,392	368	1,067	910	972	4,646	**15,308**	**33,143**
FY27	5,312	2,542	373	1,085	930	975	4,864	**16,080**	**34,550**
FY28	5,691	2,700	378	1,102	950	977	5,087	**16,885**	**36,001**
FY29	6,092	2,873	388	1,120	982	997	5,396	**17,847**	**37,886**
FY30	6,517	3,055	398	1,138	1,015	1,016	5,718	**18,856**	**39,858**
FY31	6,969	3,247	408	1,156	1,048	1,037	6,057	**19,921**	**41,928**
FY32	7,449	3,451	418	1,174	1,082	1,057	6,413	**21,044**	**44,101**
FY33	7,959	3,665	428	1,192	1,117	1,077	6,786	**22,226**	**46,380**
FY34	8,500	3,892	439	1,210	1,153	1,098	7,178	**23,470**	**48,770**
FY35	9,075	4,131	450	1,229	1,190	1,119	7,588	**24,781**	**51,275**
FY36	9,684	4,383	461	1,248	1,227	1,140	8,017	**26,160**	**53,900**
FY37	10,329	4,649	472	1,267	1,265	1,161	8,467	**27,610**	**56,650**
FY38	11,013	4,929	483	1,286	1,304	1,183	8,937	**29,135**	**59,528**
FY39	11,738	5,224	495	1,305	1,344	1,205	9,428	**30,738**	**62,541**
FY40	12,502	5,533	506	1,324	1,385	1,226	9,941	**32,418**	**65,690**
FY41	13,310	5,858	518	1,344	1,426	1,248	10,477	**34,182**	**68,981**
FY42	14,164	6,199	530	1,363	1,468	1,271	11,036	**36,032**	**72,420**
FY43	15,065	6,558	543	1,383	1,512	1,293	11,619	**37,972**	**76,011**
FY44	16,016	6,934	555	1,403	1,555	1,316	12,227	**40,006**	**79,760**
FY45	17,019	7,329	568	1,423	1,600	1,338	12,860	**42,136**	**83,673**
FY46	18,076	7,743	581	1,443	1,646	1,361	13,518	**44,367**	**87,753**
FY47	19,190	8,177	594	1,463	1,692	1,384	14,203	**46,702**	**92,007**
FY48	20,363	8,631	607	1,483	1,739	1,407	14,915	**49,146**	**96,439**
FY49	21,597	9,107	620	1,504	1,787	1,431	15,655	**51,700**	**1,01,055**
FY50	22,892	9,603	634	1,524	1,836	1,454	16,423	**54,366**	**1,05,855**

Source: Steer analysis

Table B.4: Forecasts for final (background + impacts) growth rates (%) for TP2 Gazole

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total	PCU
FY22	13.8%	13.8%	(40.3%)	14.0%	14.0%	(4.0%)	9.6%	8.5%	8.1%
FY23	10.0%	6.7%	5.6%	1.7%	3.9%	4.0%	9.0%	7.5%	7.1%
FY24	7.5%	6.8%	2.7%	1.7%	3.6%	2.2%	6.5%	5.9%	5.4%
FY25	7.5%	6.8%	2.7%	1.7%	3.6%	2.2%	6.5%	5.9%	5.4%
FY26	7.5%	6.8%	2.7%	1.7%	3.6%	2.2%	6.5%	6.0%	5.5%
FY27	7.2%	6.3%	1.4%	1.6%	2.2%	0.3%	4.7%	5.0%	4.2%
FY28	7.1%	6.2%	1.4%	1.6%	2.1%	0.2%	4.6%	5.0%	4.2%
FY29	7.1%	6.4%	2.6%	1.6%	3.4%	2.0%	6.1%	5.7%	5.2%
FY30	7.0%	6.3%	2.5%	1.6%	3.3%	2.0%	6.0%	5.7%	5.2%
FY31	6.9%	6.3%	2.5%	1.6%	3.3%	2.0%	5.9%	5.6%	5.2%
FY32	6.9%	6.3%	2.5%	1.6%	3.3%	2.0%	5.9%	5.6%	5.2%
FY33	6.8%	6.2%	2.5%	1.6%	3.2%	1.9%	5.8%	5.6%	5.2%
FY34	6.8%	6.2%	2.5%	1.5%	3.2%	1.9%	5.8%	5.6%	5.2%
FY35	6.8%	6.1%	2.5%	1.5%	3.2%	1.9%	5.7%	5.6%	5.1%
FY36	6.7%	6.1%	2.4%	1.5%	3.1%	1.9%	5.7%	5.6%	5.1%
FY37	6.7%	6.1%	2.4%	1.5%	3.1%	1.9%	5.6%	5.5%	5.1%
FY38	6.6%	6.0%	2.4%	1.5%	3.1%	1.9%	5.6%	5.5%	5.1%
FY39	6.6%	6.0%	2.4%	1.5%	3.1%	1.8%	5.5%	5.5%	5.1%
FY40	6.5%	5.9%	2.4%	1.5%	3.0%	1.8%	5.4%	5.5%	5.0%
FY41	6.5%	5.9%	2.3%	1.5%	3.0%	1.8%	5.4%	5.4%	5.0%
FY42	6.4%	5.8%	2.3%	1.5%	3.0%	1.8%	5.3%	5.4%	5.0%
FY43	6.4%	5.8%	2.3%	1.4%	2.9%	1.8%	5.3%	5.4%	5.0%
FY44	6.3%	5.7%	2.3%	1.4%	2.9%	1.7%	5.2%	5.4%	4.9%
FY45	6.3%	5.7%	2.3%	1.4%	2.9%	1.7%	5.2%	5.3%	4.9%
FY46	6.2%	5.6%	2.3%	1.4%	2.8%	1.7%	5.1%	5.3%	4.9%
FY47	6.2%	5.6%	2.2%	1.4%	2.8%	1.7%	5.1%	5.3%	4.8%
FY48	6.1%	5.6%	2.2%	1.4%	2.8%	1.7%	5.0%	5.2%	4.8%
FY49	6.1%	5.5%	2.2%	1.4%	2.8%	1.7%	5.0%	5.2%	4.8%
FY50	6.0%	5.5%	2.2%	1.4%	2.7%	1.6%	4.9%	5.2%	4.8%

Source: Steer analysis

Revenue forecasts

B.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY45.

Table B.5: Forecasts for final (background + impacts) revenue forecasts, TP1 Lakshmipur

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
FY22	660	573	304	772	830	1,632	8,946	**13,718**
FY23	828	696	370	900	991	1,954	11,216	**16,955**
FY24	960	803	402	967	1,080	2,110	12,610	**18,932**
FY25	1,074	891	439	1,034	1,179	2,261	14,098	**20,976**
FY26	1,217	1,006	477	1,105	1,286	2,439	15,850	**23,380**
FY27	1,374	1,115	517	1,183	1,387	2,576	17,500	**25,652**
FY28	1,548	1,240	555	1,267	1,495	2,719	19,306	**28,130**
FY29	1,730	1,379	602	1,349	1,625	2,899	21,399	**30,983**
FY30	1,935	1,530	643	1,433	1,753	3,092	23,717	**34,103**
FY31	2,180	1,714	696	1,520	1,888	3,293	26,269	**37,560**
FY32	2,432	1,903	757	1,617	2,047	3,524	29,177	**41,456**
FY33	2,718	2,114	813	1,713	2,205	3,743	32,150	**45,456**
FY34	3,039	2,350	874	1,816	2,376	3,980	35,497	**49,932**
FY35	3,389	2,606	941	1,932	2,571	4,242	39,247	**54,927**
FY36	3,781	2,891	1,014	2,052	2,769	4,542	43,556	**60,606**
FY37	4,187	3,183	1,093	2,178	2,992	4,810	47,859	**66,301**
FY38	4,676	3,530	1,174	2,309	3,218	5,132	52,879	**72,920**
FY39	5,246	3,940	1,264	2,447	3,470	5,467	58,353	**80,187**
FY40	5,803	4,334	1,365	2,609	3,748	5,827	64,412	**88,099**
FY41	6,458	4,799	1,467	2,754	4,016	6,186	70,829	**96,509**
FY42	7,187	5,315	1,573	2,920	4,325	6,590	78,029	**1,05,939**
FY43	8,030	5,903	1,698	3,098	4,651	7,009	85,931	**1,16,320**
FY44	8,918	6,523	1,834	3,299	5,025	7,479	94,797	**1,27,875**
FY45	9,886	7,189	1,969	3,487	5,388	7,922	1,03,856	**1,39,698**
FY46	10,963	7,926	2,111	3,689	5,780	8,417	1,13,977	**1,52,864**
FY47	12,130	8,720	2,259	3,903	6,192	8,908	1,24,751	**1,66,863**
FY48	13,429	9,600	2,425	4,137	6,658	9,479	1,37,074	**1,82,804**
FY49	14,822	10,549	2,584	4,353	7,107	9,993	1,49,284	**1,98,693**
FY50	16,298	11,535	2,768	4,594	7,595	10,589	1,63,187	**2,16,566**

Source: Steer analysis

Table B.6: Forecasts for final (background + impacts) revenue forecasts, TP2 Gazole

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
FY22	515	284	115	511	470	854	3,364	**6,112**
FY23	630	337	136	577	543	981	4,054	**7,257**
FY24	704	373	146	618	592	1,054	4,543	**8,031**
FY25	803	422	158	665	644	1,137	5,098	**8,927**

FY	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
FY26	914	478	169	709	708	1,214	5,691	**9,883**
FY27	1,034	537	185	760	757	1,284	6,284	**10,842**
FY28	1,144	588	197	817	821	1,357	6,933	**11,858**
FY29	1,284	657	211	860	879	1,449	7,694	**13,034**
FY30	1,441	733	226	918	957	1,546	8,513	**14,333**
FY31	1,612	816	239	974	1,027	1,649	9,449	**15,767**
FY32	1,815	910	261	1,038	1,115	1,759	10,463	**17,360**
FY33	2,015	1,006	276	1,097	1,202	1,879	11,596	**19,071**
FY34	2,240	1,112	296	1,170	1,300	1,992	12,776	**20,887**
FY35	2,484	1,228	320	1,236	1,398	2,125	14,125	**22,916**
FY36	2,814	1,382	339	1,317	1,509	2,267	15,622	**25,250**
FY37	3,100	1,515	364	1,392	1,617	2,420	17,267	**27,675**
FY38	3,482	1,690	393	1,486	1,754	2,570	19,031	**30,406**
FY39	3,900	1,881	416	1,572	1,892	2,738	20,985	**33,384**
FY40	4,294	2,061	446	1,675	2,046	2,921	23,190	**36,635**
FY41	4,774	2,277	477	1,772	2,197	3,096	25,471	**40,064**
FY42	5,370	2,551	510	1,875	2,359	3,302	28,101	**44,068**
FY43	5,954	2,811	545	1,992	2,534	3,514	30,924	**48,272**
FY44	6,605	3,100	592	2,120	2,741	3,744	34,093	**52,997**
FY45	7,349	3,435	628	2,240	2,942	3,978	37,429	**58,001**
FY46	8,097	3,762	669	2,365	3,141	4,213	41,017	**63,264**
FY47	8,990	4,159	709	2,508	3,372	4,471	44,938	**69,147**
FY48	10,012	4,601	763	2,650	3,617	4,751	49,325	**75,719**
FY49	11,033	5,048	807	2,795	3,878	5,012	53,728	**82,303**
FY50	12,065	5,489	860	2,948	4,139	5,296	58,635	**89,432**

Source: Steer analysis

C Data Collection Exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1 Lakshmipur

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
9-12-20	2,576	1,929	866	526	572	961	4,501	2	11,933
10-12-20	2,528	1,927	883	636	524	944	4,441	2	11,885
11-12-20	2,482	1,842	963	628	596	1,225	4,555	1	12,292
12-12-20	2,381	1,816	943	613	559	1,140	4,960	4	12,416
13-12-20	2,519	1,714	915	638	578	1,194	4,672	2	12,232
14-12-20	2,190	1,576	861	603	473	969	4,269	1	10,942
15-12-20	2,030	1,478	857	547	498	1,048	4,202	3	10,663

Source: Steer analysis

Table C.2: 7-day TVC counts at TP2 Gazole

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
9-12-20	4,344	2,034	774	727	675	856	3,483	-	12,893
10-12-20	3,770	2,070	863	801	579	821	3,477	4	12,385
11-12-20	3,894	2,003	837	779	587	983	3,663	-	12,746
12-12-20	3,526	1,970	839	795	574	991	4,079	3	12,777
13-12-20	3,787	1,692	791	749	578	1,103	3,633	1	12,334
14-12-20	3,629	1,809	779	803	578	891	3,568	1	12,058
15-12-20	3,608	1,903	778	784	723	954	3,232	1	11,983

Source: Steer analysis

Table C.3: Weekly average daily traffic of TVC vs TMS

Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
TP1 Lakshmipur	TVC	2,387	1,755	898	599	543	1,069	4,514	2	11,766

Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
	TMS	4,146		505		1,488	1,152	4,554		11,845
TP2 Gazole	TVC	3,794	1,926	809	777	613	943	3,591	1	12,454
	TMS	5,518		356		1,717	988	3,618		12,198

Source: Steer analysis, TMS Traffic data shared by Client

Zone list

Table C.4: Zone list used for OD analysis

Zone No	Zone Name	State
1	Rest of India	Andaman & Nicobar Island
2	Andhra Pradesh	Andhra Pradesh
3	Arunanchal Pradesh	Arunanchal Pradesh
4	Assam	Assam
5	Bangladesh	Bangladesh
6	Bhutan	Bhutan
7	Araria	Bihar
8	Aurangabad	Bihar
9	Banka	Bihar
10	Begusarai	Bihar
11	Bihpur Naugachhia Area	Bihar
12	Bhojpur	Bihar
13	Buxar	Bihar
14	Darbhanga	Bihar
15	Gaya	Bihar
16	Gopalganj	Bihar
17	Jamui	Bihar
18	Kaimur (bhabua)	Bihar
19	Rest of Katihar	Bihar
20	Khagaria	Bihar
21	Kishanganj	Bihar
22	Lakhisarai	Bihar
23	Madhepura	Bihar
24	Madhubani	Bihar
25	Munger	Bihar
26	Muzaffarpur	Bihar
27	Nalanda	Bihar
28	Nawada	Bihar
29	Pashchim Champaran	Bihar
30	Patna	Bihar
31	Purba Champaran	Bihar
32	Purnia	Bihar
33	Rohtas	Bihar
34	Saharsa	Bihar
35	Samastipur	Bihar
36	Saran (chhapra)	Bihar
37	Sheikhpura	Bihar
38	Sheohar	Bihar
39	Sitamarhi	Bihar

Zone No	Zone Name	State
40	Siwan	Bihar
41	Supaul	Bihar
42	Vaishali	Bihar
43	Arwal	Bihar
44	Jehanabad	Bihar
45	Barsoi Area	Bihar
46	Sultanganj Area	Bihar
47	Bhagalpur Area	Bihar
48	Kahalgaon Area	Bihar
49	Chandigarh	Chandigarh
50	Rest of Chhattisgarh	Chhattisgarh
51	Bailadilla City	Chhattisgarh
52	Bilaspur City	Chhattisgarh
53	Bhilai City	Chhattisgarh
54	Dadara & Nagar Havelli	Dadara & Nagar Havelli
55	Daman & Diu	Daman & Diu
56	Goa	Goa
57	Pipavav Port	Gujarat
58	Rest of Gujarat	Gujarat
59	Jamnagar Port	Gujarat
60	Mundra Port	Gujarat
61	Surat Port	Gujarat
62	Kandla Port	Gujarat
63	Rest of Haryana	Haryana
64	Gurgaon City	Haryana
65	Panipat City	Haryana
66	North India	Himachal Pradesh
67	Bokaro City	Jharkhand
68	Rest of Bokaro	Jharkhand
69	Chatra	Jharkhand
70	Deoghar	Jharkhand
71	Dhanbad	Jharkhand
72	Dumka	Jharkhand
73	Garhwa	Jharkhand
74	Giridih	Jharkhand
75	Godda	Jharkhand
76	Gumla	Jharkhand
77	Hazaribagh City	Jharkhand
78	Rest of Hazaribagh	Jharkhand
79	Jamtara	Jharkhand
80	Khunti	Jharkhand
81	Kodarma	Jharkhand
82	Latehar	Jharkhand
83	Lohardaga	Jharkhand
84	Rest of Pakur	Jharkhand
85	Palamu	Jharkhand
86	Pashchimi Singhbhum	Jharkhand
87	Jamshedpur City	Jharkhand
88	Rest of Purbi Singhbhum	Jharkhand

Zone No	Zone Name	State
89	Ramgarh	Jharkhand
90	Ranchi	Jharkhand
91	Rest of Sahibganj	Jharkhand
92	Saraikela-kharsawan	Jharkhand
93	Simdega	Jharkhand
94	Sahibganj Area	Jharkhand
95	Pakur Area	Jharkhand
96	Karnataka	Karnataka
97	Kerala	Kerala
98	Rest of West Madhya Pradesh	Madhya Pradesh
99	Rest of East Madhya Pradesh	Madhya Pradesh
100	Rest of Central Madhya Pradesh	Madhya Pradesh
101	Balaghat City	Madhya Pradesh
102	Bhopal	Madhya Pradesh
103	Indore City	Madhya Pradesh
104	Rest of Maharashtra	Maharashtra
105	Mumbai City	Maharashtra
106	Pune	Maharashtra
107	Nagpur City	Maharashtra
108	Manipur	Manipur
109	Meghalaya	Meghalaya
110	Mizoram	Mizoram
111	Myanmar	Myanmar
112	Nagaland	Nagaland
113	NCT of Delhi	NCT of Delhi
114	Nepal	Nepal
115	Rest of Odisha	Odisha
116	Rayagada City	Odisha
117	Paradip Port	Odisha
118	Rourkela City	Odisha
119	Pakistan	Pakistan
120	Puducherry	Puducherry
121	Punjab	Punjab
122	Rajasthan	Rajasthan
123	Sikkim	Sikkim
124	Tamil Nadu	Tamil Nadu
125	Telangana	Telangana
126	Tripura	Tripura
127	Agra	Uttar Pradesh
128	Rest of West Uttar Pradesh	Uttar Pradesh
129	Allahabad	Uttar Pradesh
130	Rest of East Uttar Pradesh	Uttar Pradesh
131	Kanpur Nagar	Uttar Pradesh
132	Lucknow	Uttar Pradesh
133	Mathura	Uttar Pradesh
134	Moradabad	Uttar Pradesh
135	Varanasi	Uttar Pradesh
136	West Uttar Pradesh	Uttar Pradesh
137	Uttarakhand	Uttarakhand

Zone No	Zone Name	State
138	Bankura	West Bengal
139	Barddhaman	West Bengal
140	Suri Area	West Bengal
141	Dakshin Dinajpur	West Bengal
142	Darjiling	West Bengal
143	Haora	West Bengal
144	Hugli	West Bengal
145	Jalpaiguri	West Bengal
146	Koch Bihar	West Bengal
147	Kolkata	West Bengal
148	Bhaluka Area	West Bengal
149	Dhuliyan Area	West Bengal
150	Nadia	West Bengal
151	North 24 Parganas	West Bengal
152	Pashchim Medinipur	West Bengal
153	Purba Medinipur	West Bengal
154	Puruliya	West Bengal
155	South 24 Parganas	West Bengal
156	Stalkuri Area	West Bengal
157	Gangarampur Area	West Bengal
158	Rest of Murshidabad	West Bengal
159	Rest of Uttar Dinajpur	West Bengal
160	Samsi Area	West Bengal
161	Farakka Area	West Bengal
162	Aurangabad Area	West Bengal
163	Rest of Maldah	West Bengal
164	Manikchak Area	West Bengal
165	Baishnabnagar Area	West Bengal
166	Kachu Pukur Area	West Bengal
167	Malda Area	West Bengal
168	Ratua Area	West Bengal
169	Adina Jadupur Area	West Bengal
170	Bamangola Area	West Bengal
171	Dahil Area	West Bengal
172	Gazole Area	West Bengal
173	Makdampur Area	West Bengal
174	Makra Area	West Bengal
175	Khasra Area	West Bengal
176	Gosaipur Area	West Bengal
177	Khatil Area	West Bengal
178	Balurghat Area	West Bengal
179	Kaliyaganj Area	West Bengal
180	Mirual Area	West Bengal
181	Gulandar Area	West Bengal
182	Khail Area	West Bengal
183	Kamalabari Area	West Bengal
184	Lahanda Area	West Bengal
185	Gunarajpur Area	West Bengal
186	Bankur Area	West Bengal

Zone No	Zone Name	State
187	Raiganj Area	West Bengal
188	Bhadratha Area	West Bengal
189	Itahar Area	West Bengal
190	Chanchal Area	West Bengal
191	Eklakhi Area	West Bengal
192	Harishchandrapur Area	West Bengal
193	Baliadanga Area	West Bengal
194	Sujapur Area	West Bengal
195	Rampurhat Area	West Bengal
196	Nalhati Area	West Bengal
197	Barharwa Area	West Bengal
198	Farakka NTPC Plant	West Bengal
199	NTPC	West Bengal

Source: Steer Analysis

Direction-wise commodity distribution

Table C.5: Commodity distribution towards Farakka for TP1 Lakshmipur

Commodity code	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	13%	11%	22%	7%
Construction	0%	0%	1%	0%
Stone	0%	-	0%	1%
Groceries	2%	1%	1%	-
Manufacturing	5%	3%	1%	1%
Petroleum	0%	3%	1%	0%
Miscellaneous	1%	2%	2%	0%
Container	-	1%	1%	0%
Empty	78%	78%	71%	90%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.6: Commodity distribution towards Raiganj for TP1 Lakshmipur

Commodity code	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	34%	11%	35%	19%
Construction	1%	3%	5%	3%
Stone	0%	4%	6%	44%
Groceries	4%	26%	9%	1%
Minerals	-	-	0%	1%
Manufacturing	7%	17%	11%	8%
Petroleum	1%	4%	9%	7%
Miscellaneous	1%	14%	9%	2%
Machinery	0%	-	0%	1%
Container	-	3%	1%	0%

Commodity code	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Empty	52%	15%	11%	3%
Sand	0%	3%	4%	11%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.7: Commodity distribution towards Farakka for TP2 Gazole

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	11%	11%	30%	12%
Construction	0%	0%	0%	1%
Stone	0%	0%	1%	1%
Groceries	2%	2%	2%	1%
Minerals	0%	0%	0%	1%
Manufacturing	6%	10%	6%	3%
Petroleum	1%	4%	3%	3%
Miscellaneous	3%	8%	8%	2%
Machinery	0%	0%	-	0%
Container	-	0%	0%	1%
Empty	76%	63%	49%	75%
Sand	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.8: Commodity distribution towards Raiganj for TP2 Gazole

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	22%	19%	32%	23%
Construction	1%	3%	8%	4%
Stone	5%	4%	5%	42%
Groceries	9%	13%	6%	2%
Minerals	-	0%	1%	1%
Manufacturing	16%	25%	14%	11%
Petroleum	3%	6%	10%	9%
Miscellaneous	4%	7%	6%	2%
Machinery	2%	1%	0%	0%
Container	-	0%	0%	0%
Empty	37%	20%	17%	4%
Sand	1%	-	1%	3%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Trip length distribution

Table C.9: Trip length frequency for TP1 Lakshmipur

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
0-65 km	7%	12%	10%	11%	11%	7%
65-300 km	87%	55%	74%	56%	55%	68%
300-500 km	6%	33%	13%	17%	14%	10%
500-1000 km	0%	-	2%	11%	13%	7%
>1000 km	-	0%	2%	6%	6%	7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Table C.10: Trip length frequency for TP2 Gazole

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
0-65 km	17%	21%	9%	10%	5%	5%
65-300 km	76%	66%	69%	51%	48%	61%
300-500 km	6%	12%	16%	23%	20%	14%
500-1000 km	0%	0%	4%	11%	16%	9%
>1000 km	0%	0%	2%	6%	11%	12%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

D Impact analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the asset.

D.2 Please find below the table for improvement in overall level of service of the corridor

Table D.1: GJC comparison for level of service improvement

	Asset		
	CJV	2A	MAV
Existing Toll rates	145	410	640
Length	162	162	162
Existing GJC	1,543	4,339	9,463
GJC post improvement	1,388	4,001	8,254

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre, Vatika Triangle, MG Road, Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741302

Client contract/project number

Transit

Author/originator

Prashanth Udayakumar
Vaibhav Gupta
Ojaswi Gupta

Reviewer/approver

Nandini Ravindranath
Serbjeet Kohli

Other contributors

Shipra Bhatia, Bianca Cosentino

Distribution

Client: Steer:

Version control/issue number

1.0

Date

26 March 2020

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Ghaziabad Aligarh Expressway Private Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Ghaziabad Aligarh Expressway Private Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited . This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer ..... **i**

Glossary Items ..... **iii**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Key economic activities 9

Alternate Routes 9

3 Traffic Description **11**

Introduction 11

Historical Trends 12

Conclusions 33

4 Socio Economic Context **34**

Population growth 34

Economic growth 35

5 Traffic growth analysis **38**

Introduction 38

Estimation of background elasticities 38

Forecasts for background elasticities 44

Forecasts for growth drivers 45

6 Forecasts: Base year AADT and Impacts **47**

Introduction 47

Seasonality Correction factors 48

Base year FY22 AADT estimates 48

Analysis of potential impacts 50

Revenue forecasting assumptions 54
Traffic and Revenue forecasts 56
Upside and Downside Cases 60
Traffic and Revenue Forecasts-Upside case 62
Traffic and Revenue Forecasts-Downside case 65
Summary outlook 67

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4
Figure 2.1: Asset Location 6
Figure 2.2: Asset context 7
Figure 2.3: Typical cross section of the Asset and toll plazas 8
Figure 2.4: Alternate routes 10
Figure 5: Month on Month traffic recovery vs FY20, TP1 15
Figure 6: Month on Month traffic recovery vs FY20, TP2 15
Figure 3.7: Ticket segmentation for CJV at TP1 (Luharli) 18
Figure 3.8: Ticket segmentation for MAV at TP1 (Luharli) 19
Figure 3.9: Ticket segmentation for CJV at TP2 (Somna) 19
Figure 3.10: Ticket segmentation for MAV at TP2 (Somna) 20
Figure 3.11: WADT at Asset 21
Figure 3.12: Comparison between TVC and TMS daily traffic data, TP1 Luharli 22
Figure 3.13: Comparison between TVC and TMS daily traffic data, TP2 Somna 22
Figure 3.14: Comparison between vehicle shares from TVC and TMS WADTs 23
Figure 3.15: Zonal influence, TP1 Luharli 26
Figure 3.16: Zonal influence at TP2, Somna 27
Figure 3.17: Internal-external distribution, TP1 Luharli 28
Figure 3.18: Internal-external distribution, TP2 Somna 28
Figure 3.19: Commodity distribution, TP1 Luharli 29
Figure 3.20: Commodity distribution, TP2 Somna 29
Figure 3.21: Commodity distribution, TP1 Luharli towards Dadri 30
Figure 3.22: Commodity distribution, TP1 Luharli towards Khurja 30
Figure 3.23: Commodity distribution, TP2 Somma towards Aligarh 31

Figure 3.24: Commodity distribution, TP2 Somma towards Khurja 31
Figure 3.25: Trip length distribution TP1 32
Figure 3.26: Trip length distribution TP2 32
Figure 4.1: Evolution of Delhi's and Uttar Pradesh's state GDP and national GDP 35
Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP 36
Figure 4.3: Sectoral contribution to Delhi's GSDP 37
Figure 5.1: Relationship between CJV traffic and Uttar Pradesh GSDP, TP1 Luharli 40
Figure 5.2: Relationship between CJV traffic and Uttar Pradesh GSDP, TP2 Somna 40
Figure 5.3: Relationship between LCV+2A combined traffic and Uttar Pradesh, TP1 Luharli 41
Figure 5.4: Relationship between LCV+2A combined traffic and Uttar Pradesh, TP2 Somna 42
Figure 5.5: Relationship between 3A+MAV traffic and Uttar Pradesh GSDP, TP1 Luharli 43
Figure 5.6: Relationship between 3A+MAV traffic and Uttar Pradesh GSDP, TP2 Somna 43
Figure 5.7: GDP-GSDP forecast 46
Figure 6.1: Alternate routes and Asset shown against the regional network context 50
Figure 6.2: Traffic and growth rates for forecast PCUs - Background and final, TP1 60
Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP2 60
Figure 4: 77

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Concession details 8
Table 2.2: Vehicle wise toll rates on GAEPL (INR), FY22 9
Table 3.1: PCU factors 11
Table 3.2: Historical evolution in AADT by vehicle class at TP1 – Luharli 12
Table 3.3: Historical YoY growth rates and CAGR by vehicle class at TP1 – Luharli 12
Table 3.4: Historical evolution in AADT by vehicle class at TP2 – Somna 13
Table 3.5: Historical YoY growth rates and CAGR by vehicle class at TP2 – Somna 13
Table 3.6: Historical revenue evolution (in INR Crore) 14
Table 3.7: Typical ticket types sold at NHAI plazas 16
Table 3.8: Timeline of national ETC implementation. 17
Table 3.9: Percentage of Traffic via FASTag, March 2022 17
Table 3.10: Data collection schedule 21

Table 3.11: Difference in TVC and TMS in combined categories 23
Table 3.12: Sample rates for OD data 24
Table 3.13: Aggregate commodity categories 24
Table 3.14: Zone aggregations for zonal influence analysis 25
Table 4.1: CAGR of population in India 34
Table 4.2: Population Growth in India (2001 – 2011) 35
Table 5.1: Vehicle-wise growth and CAGR (%), TP1 Luharli 38
Table 5.2: Vehicle-wise growth and CAGR (%), TP2 Somna 39
Table 5.3: Identified growth drivers to model traffic growth 39
Table 5.4: Impacts in FY19/FY20 and expected play-out in the immediate forecast period 44
Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 45
Table 6.1: Key intermediate and final outputs in the forecast 47
Table 6.2: Seasonality correction factors for TP1-Luharli 48
Table 6.3: Seasonality correction factors for TP2-Somna 48
Table 6.4: Monthly MADT and base year FY22 AADT estimation for TP1 Luharli 49
Table 6.5: Monthly MADT and base year FY22 AADT estimation for TP2 Somna plaza 49
Table 6.6: List of network/other developments 51
Table 6.7: Impact of six-laning of asset and four laning of Aligarh-Kannauj 51
Table 6.8: Impact of THDC Khurja super thermal power project 52
Table 6.9: Impact of Pahasu alternate on TP2 Somna 52
Table 6.10: Impact of Ganga Expressway 53
Table 6.11: Summary of impact assessments 53
Table 6.12: Trip factors for the forecast years for TP1 Luharli 54
Table 6.13: Trip factors for the forecast years for TP2 Somna 54
Table 6.14: Toll segmentation for FY22, TP1 Luharli 55
Table 6.15: Toll segmentation for FY22, TP2 Somna 55
Table 6.16: WPI growth forecast assumptions 55
Table 6.17: Revenue reconciliation summary (INR Lakhs) 56
Table 6.18: Traffic forecast (With Impacts) for TP1 Luharli 56
Table 6.19: Traffic growth CAGR (%) for TP1 Luharli 57
Table 6.20: Revenue forecast (With Impacts) for TP1 Luharli (INR Crores) 57
Table 6.21: Revenue growth CAGR (%) for TP1 Luharli 57

Table 6.22: Traffic forecast (With Impacts) for TP2 Somna 58
Table 6.23: Traffic growth CAGR (%) for TP2 Somna 58
Table 6.24: Revenue forecast (With Impacts) for TP2 Somna (INR Crores) 58
Table 6.25: Revenue growth CAGR (%) for TP2 Somna 59
Table 6.26: Summary of Macro Assumptions for upside and downside cases 61
Table 6.27: Summary of impacts on the Assets 61
Table 6.28: Summary of impacts on the Assets 62
Table 6.29: Traffic forecast (With Upside Impacts) for TP1 Luharli 62
Table 6.30: Traffic growth (With upside Impacts) CAGR (%) for TP1 Luharli 62
Table 6.31: Revenue forecast (With Upside Impacts) for TP1 Luharli (INR Crores) 63
Table 6.32: Revenue growth (With upside Impacts) CAGR (%) for TP1 Luharli 63
Table 6.33: Traffic forecast (With Upside Impacts) for TP2 Somna 63
Table 6.34: Traffic growth (With upside Impacts) CAGR (%) for TP2 Somna 64
Table 6.35: Revenue forecast (With upside Impacts) for TP2 Somna (INR Crores) 64
Table 6.36: Revenue growth (With upside Impacts) CAGR (%) for TP2 Somna 64
Table 6.37: Traffic forecast (With Downside Impacts) for TP1 Luharli 65
Table 6.38: Traffic growth (With Downside Impacts) CAGR (%) for TP1 Luharli 65
Table 6.39: Revenue forecast (With Downside Impacts) for TP1 Luharli (INR Crores) 65
Table 6.40: Revenue growth (With Downside Impacts) CAGR (%) for TP1 Luharli 66
Table 6.41: Traffic forecast (With Downside Impacts) for TP2 Somna 66
Table 6.42: Traffic growth (With Downside Impacts) CAGR (%) for TP2 Somna 66
Table 6.43: Revenue forecast (With Downside Impacts) for TP2 Somna (INR Crores) 67
Table 6.44: Revenue growth (With Downside Impacts) CAGR (%) for TP2 Somna 67

Appendices

A Detailed Forecasts

B Top OD Pair

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Fund Advisors Private Limited. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19and post- COVID-19views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the

Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Oversized vehicles
PCU	Passenger Car Unit: it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (referred to as 'Client' hereafter) has commissioned Steer Davies Gleave India Private Limited (hereafter called 'Steer') for a traffic due diligence to be carried out on Ghaziabad Aligarh Expressway Private Limited (hereafter called 'Asset').

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by the Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset

Scope of work	Data source
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI, and WPI line based on forecasts provided by the client

1.3 This report presents the draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on existing/brownfield Assets.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - Traffic management system (TMS) data pertaining to FY16-FY22) up to March FY22.
  - OD data from surveys conducted in December 2020
  - Concession agreement and toll notifications
  - Previous studies
- TVC counts from 03 to 09 September 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza

1.7 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.

- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the asset against our Steer knowledge base (e.g., similar asset types in the same state or on the same corridor), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes major network and other impacts including change in toll rates and more. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.8 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until May 3rd 2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March and 20th April. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

1.9 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

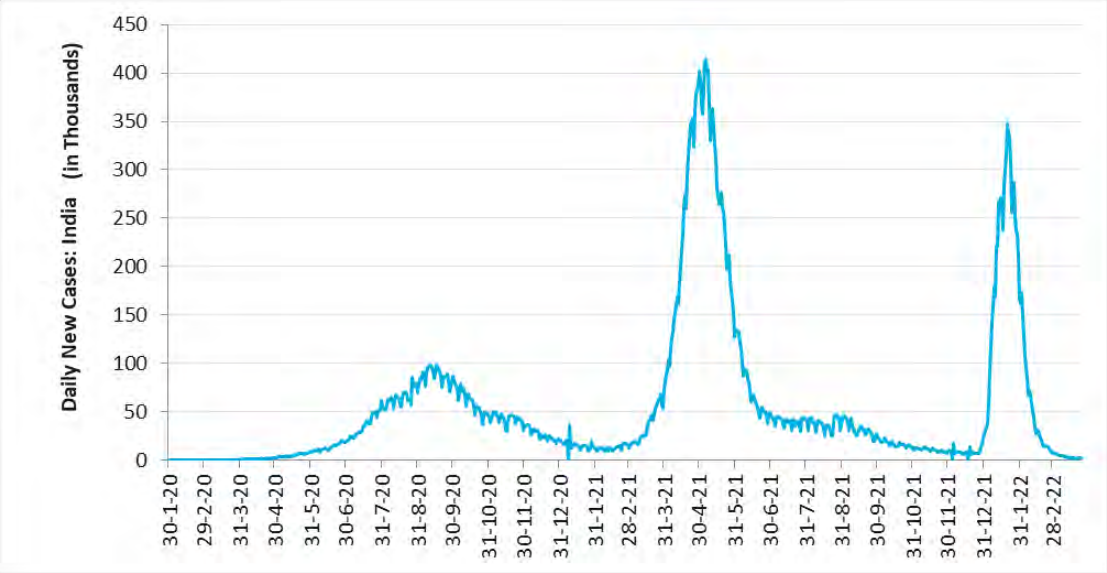
1.10 Data from various roads across the country indicates that the largest impact on MAV traffic was experienced between the months of March 2020 to May 2020, with rest of the FY21 showing MAV volumes par FY20 levels. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, and as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic

recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 14th October 2021.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.13 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for one quarter. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe in comparison to fatality rate, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave.

1.15 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network,

especially in inter-state bus service. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.16 The report has been divided into six chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

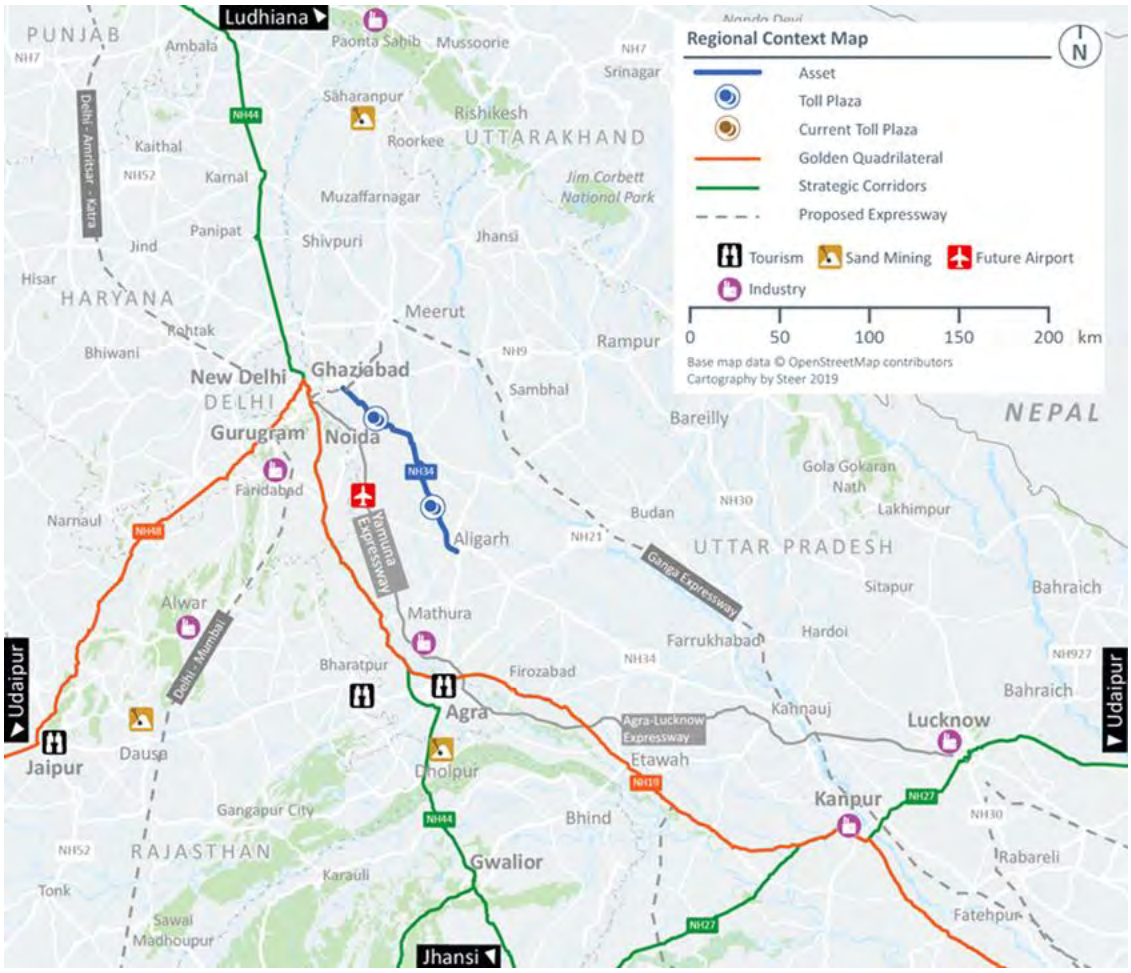
Introduction

2.1 This chapter provides a description of the Asset, primarily based on both primary (site visits) data and our understanding of the regional and network context of the Asset. Starting with the strategic network context, the chapter discusses the asset-level context, followed by economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in western Uttar Pradesh (UP), connecting the cities of Ghaziabad and Aligarh via Khurja and Bulandshahr. The figure below shows the regional and wider road network in which the Asset is located.

Figure 2.1: Asset Location



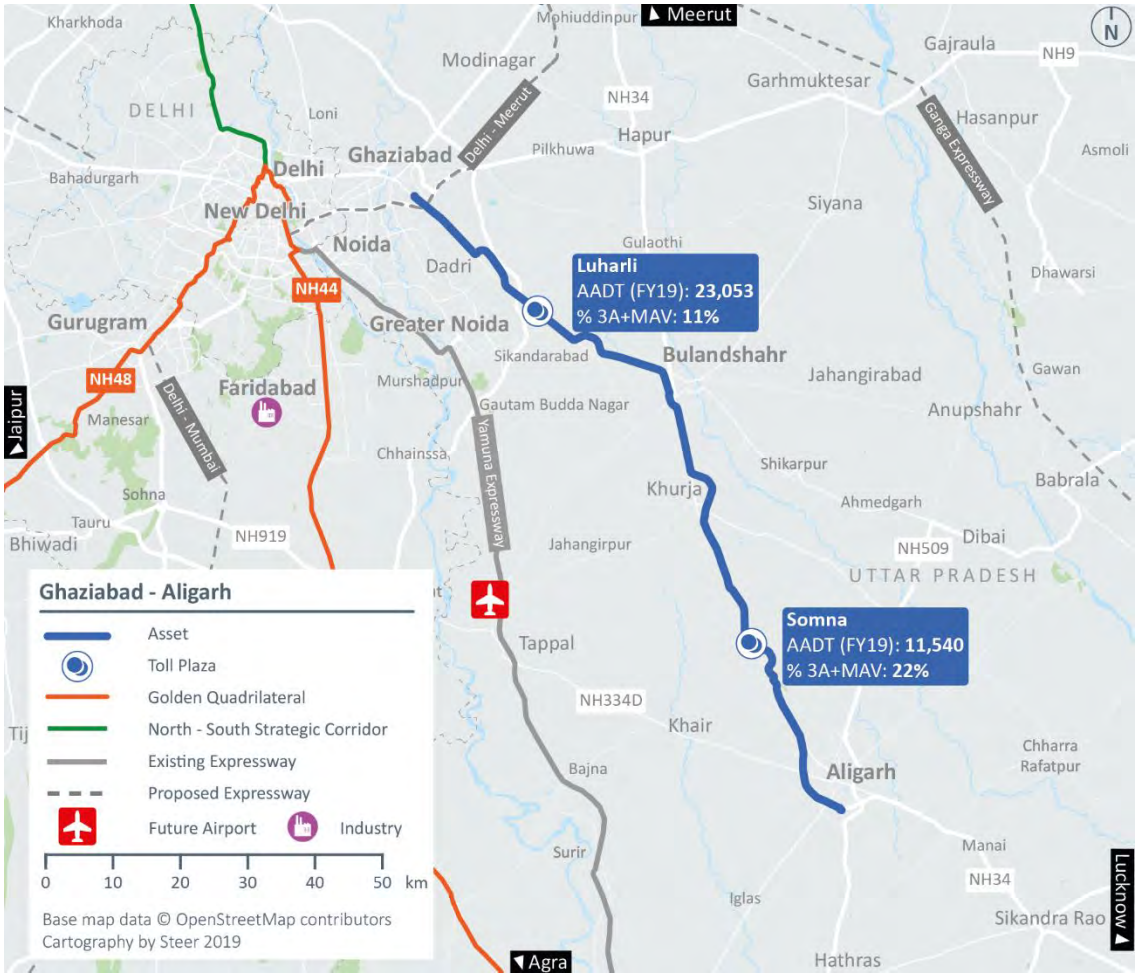
Source: Steer cartography using OpenStreetMap data

2.3 The Asset is a 125.175-km toll road which forms a part of NH 91 in Uttar Pradesh. This is a four-lane road with two toll plazas, namely, Luharli (TP1 closer to Ghaziabad) and Somna (TP2 closer to Aligarh). The following figure provides a closer view of the Asset in the context of its immediate surroundings.

2.4 The asset primarily caters to two different types of movements, by virtue of its strategic location on various corridors:

- Local traffic between cities in western UP, Delhi Central NCR (consisting of Delhi state) and Ghaziabad.
- Trips to the industrial area of Sikandrabad which is located on the Asset and serves as a major attractor/generator of traffic.
- Heavy vehicle traffic originating from the states of Haryana, Punjab and Jammu and Kashmir in the north travelling to states in the east of India including West Bengal, Orissa and the north-eastern states. The asset is part of strategic north – east movement and majority of this traffic appears on Somna toll plaza.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling

2.5 The toll plazas on the Asset have been operational since June 2015. As per the original concession agreement the concession period was of 24 years including the construction

period, which was ending in 2035. But as per the settlement agreement dated 08th April 2022 an extension of 4.32 years has been granted and agreed upon by National highways Authority of India (NHAI) based on the clause 29 of the concession agreement and now the end of concession has been extended to FY40.

Table 2.1: Concession details

Item	Description
State	Uttar Pradesh
Highway and lane configuration	NH 91 four-lane
Toll plazas	• TP1: Luharli • TP2: Somna
Length (km) as per concession agreement, applicable	• TP1: 62.175 Km • TP2: 63.00 Km
Commencement of operations*	• TP1: June 2015 • TP2: June 2015
Concession period	24 years
Last year of concession	FY40

Source: Concession agreement

2.6 The following pictures indicate a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross section of the Asset and toll plazas

Source: Steer photos from site visit

2.7 Tolls are collected for Car/Jeep/Van (CJV), LCV/Minibus, Bus/Truck, 3A/MAV/HCH/EME/OSV categories. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling, apart from

hybrid lanes. The toll rates for FY23, effective from 1 April 2022 are as shown in the table below.

Table 2.2: Vehicle wise toll rates on GAEPL (INR), FY22

Type of Vehicle	Single Journey Fee	
	TP1 Luharli	TP2 Somna
CJV	120	160
LCV	190	245
Bus/Truck	385	490
3A/MAV	590	740
OSV	755	970

Source: Toll notification

Key economic activities

2.8 UP is the most populous state in India and is largely an agrarian economy with agriculture being a major source of employment and livelihood. With several urban centres located on the Asset, including Ghaziabad, the toll plazas, especially TP1 Luharli, serve large volumes of local and regional light vehicular traffic.

2.9 The part of the state, where the Asset is located, is an industrial region with towns like Sikandrabad, Khurja and Aligarh that serve as a hub of medium and large scale industries specializing in manufacturing services, ceramics, and hardware. This was also observed from the traffic seen during the site visits. The influence of these economic drivers on the Asset's performance is discussed in more detail in Chapter 5.

Alternate Routes

2.10 The traffic movements on the Asset can be categorised into three kinds. This section discusses alternate route options available for each of these.

2.11 The Asset lies on the strategically important east-west movement between Delhi and west, and Lucknow and beyond. The figure below illustrates other alternate routes available to long-distance users while travelling between Delhi and Lucknow.

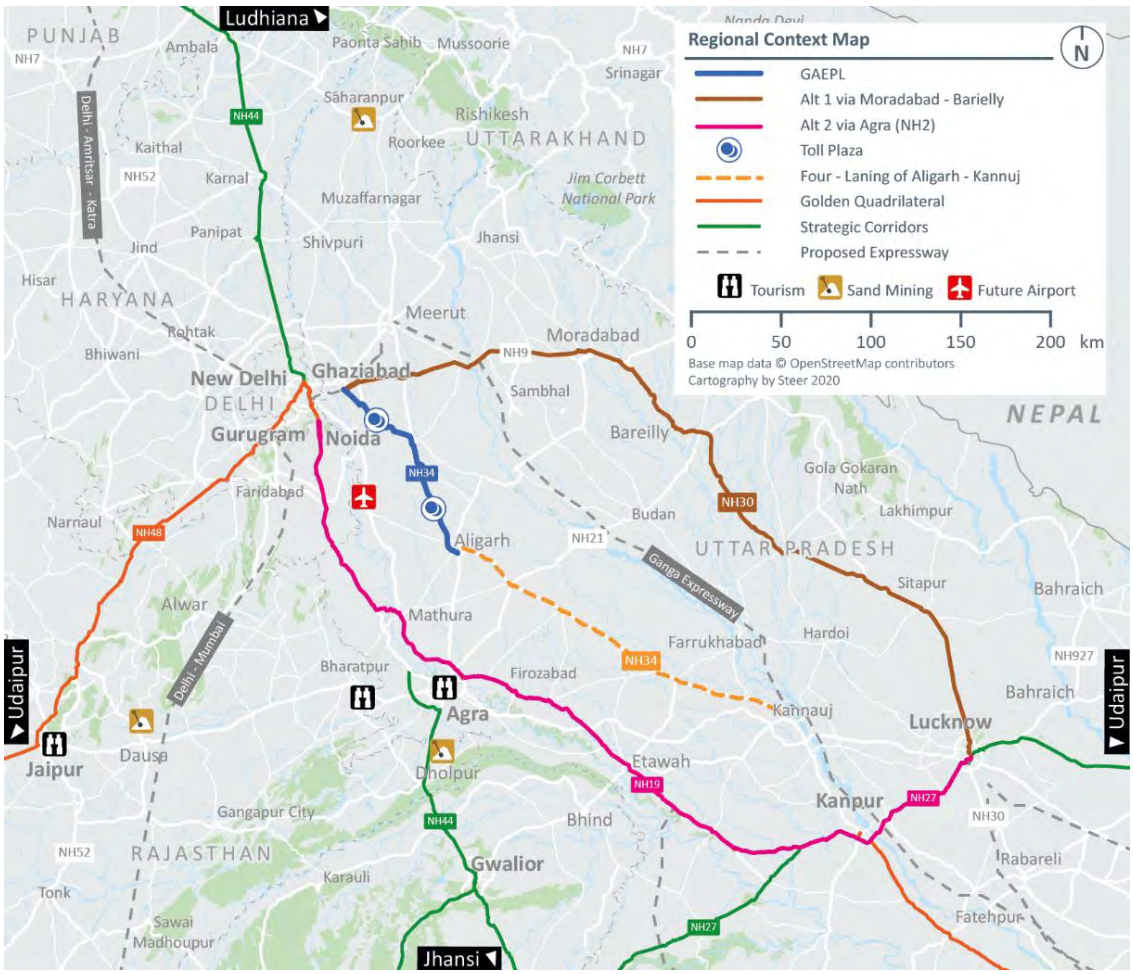
- Asset: Delhi-Ghaziabad-Aligarh-Kannauj-Lucknow via NH91
- Alternate 1: Delhi-Moradabad-Bareilly-Sitapur-Lucknow via NH 24
- Alternate 2: Delhi-Faridabad-Agra-Kanpur-Lucknow via NH2 (NH19).
- Alternate 3: Delhi-Agra (via Yamuna Expressway)-Lucknow (via Agra-Lucknow expressway).

2.12 For medium-distance traffic especially traversing the region southwest of the Asset, there are several state highways which have been recently upgraded, thereby improving the overall quality of local network. These have provided cheaper, often free, routes to access industrial cities like Sikandrabad and Ghaziabad.

2.13 In terms of very local movement, there is a diversion road at TP1 Luharli that can allow CJV and LCV traffic to pass and is a leakage point. While there is a local diversion road at TP2 Somna as well, the road is a kuccha (not well paved) road and local villagers show resistance against vehicles using this road.

2.14 Chapter 6 provides a discussion and estimation of potential impacts due to these alternate routes.

Figure 2.4: Alternate routes



Source: Steer Cartography

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data, including that which was collected as a part of this study, and data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year Monthly Average Daily Traffic (MADT) is established. This data is typically provided by the Client and independently analysed and validated by us using Traffic Volume Count (TVC) information.

PCU Factor assumption

3.4 The PCU values have been taken from '*IRC 64:1990- Guidelines for Capacity of Roads in Rural Areas'.* For MAV, based on the discussion with the Client, we have referred to the rigid and trailer splits in the TVC counts for calculating the effective PCU for MAVs. For rigid trailer trucks we have assumed a PCU factor of 3, whereas for trailer trucks we have assumed a PCU factor of 4.5.

3.5 In addition, please see the PCU factors considered in the table below.

Table 3.1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV*	3.6
OSV	4.5

Source: Steer analysis, * Rigid-Trailer PCU

Historical Trends

3.6 The following table indicate the historical variation in traffic volume at the Luharli toll plaza, in terms of vehicle shares and total AADT.

Table 3.2: Historical evolution in AADT by vehicle class at TP1 – Luharli

AADT	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	8,898	10,531	12,283	17,294	16,663	15,519	17,516
LCV	1,881	2,003	2,156	2,433	2,283	1,905	1,672
2A/Bus	2,241	2,248	2,728	2,572	2,770	2,304	2,667
3A/MAV	2,123	2,073	2,125	2,551	2,584	2,456	2,694
OSV	0	0	0	2	2	4	3
Total	**15,143**	**16,855**	**19,292**	**24,852**	**24,303**	**22,187**	**24,551**
PCU*	**26,026**	**27,686**	**31,292**	**36,888**	**36,819**	**33,565**	**37,184**

Source: Steer analysis based on data provided by the Client. *3.6 used for 3A/MAV PCU

Table 3.3: Historical YoY growth rates and CAGR by vehicle class at TP1 – Luharli

Total	FY17	FY18	FY19	FY20	FY21	FY22	CAGR 16-20	CAGR 20-22
CJV	18.3%	16.6%	40.8%	(3.6%)	(6.9%)	12.9%	17.0%	2.5%
LCV	6.5%	7.6%	12.8%	(6.2%)	(16.6%)	(12.2%)	5.0%	(14.4%)
2A/Bus	0.3%	21.3%	(5.7%)	7.7%	(16.8%)	15.7%	5.4%	(1.9%)
3A/MAV	(2.3%)	2.5%	20.0%	1.3%	(5.0%)	9.7%	5.0%	2.1%
Total	11.3%	14.5%	28.8%	(2.2%)	(8.7%)	10.7%	12.6%	0.5%
PCU	6.4%	13.0%	17.9%	(0.2%)	(8.8%)	10.8%	9.1%	0.5%

Source: Steer analysis of TMS data provided by client

3.7 Luharli toll plaza lies very close to large urban centres and caters to significant of movement between Ghaziabad, Delhi and areas near Sikandrabad. From the table above, it is observed that CJVs have the dominant share of traffic, comprising of around 70% of the traffic since 2019. This can be attributed to the presence of large urban settlements on and in the vicinity of the Asset like Ghaziabad, Aligarh, Khurja, Bulandshahr, and trips generated from Kanpur and some parts of Delhi. Around 50% of the CJV trips are generated from/to the settlements present on the Asset. CJV volumes have increased significantly starting FY19 primarily due to improved recording of these vehicles.

3.8 The LCV- 2A category has historically been affected by classification issues because of similar size and look of the vehicle. Additionally, there has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag.

3.9 3A/MAV volumes have remained in the 2500-2700 range since FY19. It has registered a volume CAGR of 2% between FY20 and FY22. Overall the PCU growth has been flat on the Asset in the last two years, this can be attributed to pandemic related restrictions impacting volumes on the Asset for a large part of FY21 and FY22.

3.10 The following table indicate the historical variation in traffic volume at the Somna toll plaza, in terms of vehicle shares and total AADT.

Table 3.4: Historical evolution in AADT by vehicle class at TP2 – Somna

AADT	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	4,034	4,650	4,814	6,250	6,482	6,013	6,206
LCV	1,364	1,451	1,601	1,574	1,329	1,002	824
2A/Bus	1,590	1,770	2,076	1,859	2,000	1,817	2,037
3A/MAV	2,080	2,268	2,902	2,536	2,168	1,997	1,940
OSV	0	0	1	1	0	1	1
Total	**9,070**	**10,140**	**11,394**	**12,221**	**11,979**	**10,831**	**11,008**
PCU*	**18,283**	**20,240**	**23,813**	**22,411**	**21,518**	**19,583**	**20,069**

Source: Steer analysis of Client data, *3.6 used for 3A/MAV PCU

3.11 This toll plaza follows the similar trends of traffic shares that is CJVs being the major contributor to the overall traffic, but the CJV volumes are much lower than the TP-1 and are getting reported in the range >6,000 vehicles after FY19. The AADT levels are less, pertaining to the regional passenger traffic moving at this Asset and confirmed by the OD analysis, that only 30% of the traffic is generated from/to the areas present on the Asset and rest 70% lies in the further influence area.

3.12 It can be noted from the OD analysis (discussed in subsequent sections), this Asset serves long-distance traffic connecting north-west Uttar Pradesh, Punjab etc. to cities like Lucknow, Kanpur, Patna, Kolkata, and the predominant commodity moving on this Asset is agro-related. 3A+MAVs are in the range of 2000 AADT and have dropped from a high of 2900 AADT observed in FY18. Network changes such as commissioning of EPE/KMP, construction on the Aligarh – Kanpur Road are some of the reasons for the decline in traffic.

Table 3.5: Historical YoY growth rates and CAGR by vehicle class at TP2 – Somna

Total	FY17	FY18	FY19	FY20	FY21	FY22	CAGR 16-20	CAGR 20-22
CJV	15.3%	3.5%	29.8%	3.7%	(7.2%)	3.2%	12.6%	(2.1%)
LCV	6.4%	10.3%	(1.7%)	(15.6%)	(24.6%)	(17.8%)	(0.7%)	(21.3%)
2A/Bus	11.3%	17.2%	(10.4%)	7.6%	(9.1%)	12.1%	5.9%	0.9%
3A/MAV	9.0%	28.0%	(12.6%)	(14.5%)	(7.9%)	(2.8%)	1.0%	(5.4%)
Total	11.8%	12.4%	7.3%	(2.0%)	(9.6%)	1.6%	7.2%	(4.1%)
PCU	10.7%	17.7%	(5.9%)	(4.0%)	(9.0%)	2.5%	4.2%	(3.4%)

Source: Steer analysis of Client data.

3.13 The toll plaza has showed muted traffic growth over the years. In the FY20-22 period the PCU growth stands at a negative 4%, with drop in almost categories including CJV's and 3A+MAV (combined), whose volumes have dropped from 2100 levels to 1900 levels in FY22. However, such drops are visible on an annual basis when the pandemic related restrictions impacted the traffic volumes in Q1FY22. The monthly level volumes as compared to FY20 are discussed in the following section.

Historical Revenue

3.14 The following table shows the historical reported revenue on the Asset.

Table 3.6: Historical revenue evolution (in INR Crore)

Toll Plaza	FY17	FY18	FY19	FY20	FY21	FY22
Annual Revenue (INR Crore)	139.50	193.42	210.38	209.41	201.68	225.45

Source: Steer analysis based on data provided by the Client.

3.15 TP1 observes higher AADT than TP2, still TP2 generates more revenue than TP1. This can be attributed to the following factors— difference in the toll rates between the toll plazas, significantly higher exemptions of CJV on TP1, higher Return trips which are discounted after the implementation of FASTag, while the traffic crossing TP-2 is regional in nature that is long haul passenger and goods movement is encountered at the Somna toll plaza, hence, very lower proportion of return trips are present at this toll Plaza which in turn leads to more revenue.

3.16 Looking at the FY20-22 TP-1 has seen a higher growth of around 9% in comparison to TP-2 which has not seen much growth (around 1%) because of the regional nature of the traffic passing through the TP-2 as the long-haul passenger movements were affected during the strict lockdowns in FY21 and FY22.

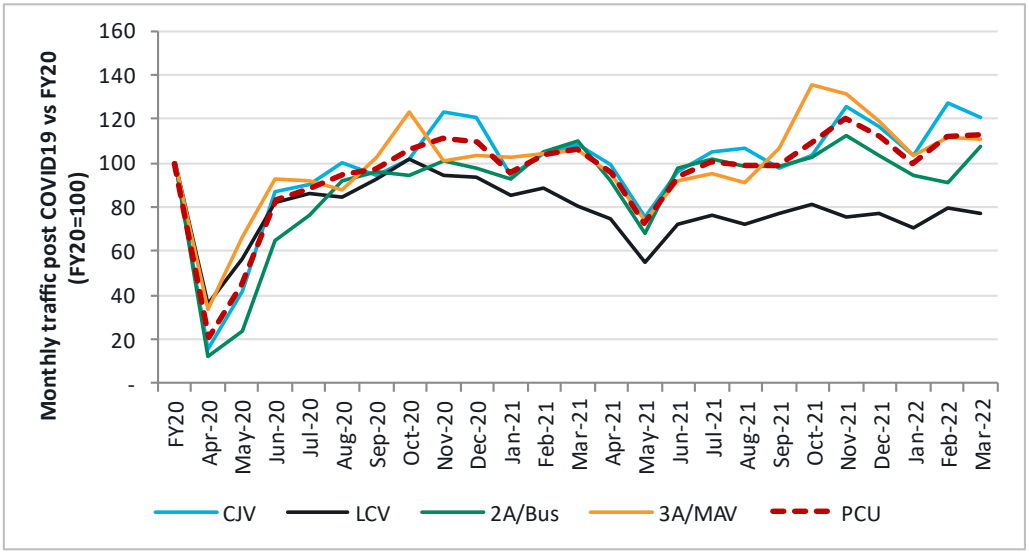
Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.17 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. Further extensions until May 17 and again until May 31 featured relaxations in 'green' and 'orange' zones. Starting 8 June 2020, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States.

3.18 In direct relation to these 'Lockdown' and 'Unlock' phases, traffic on roads across the country dropped significantly in the last week of March 2020 continuing into April and May 2020. While traffic for MAVs had a quick recovery in June back to FY20 AADT levels, the other vehicle classes have seen longer recovery trends. However, as we can see Q3 and Q4FY21 levels have been higher as compared to FY20, a pattern that has been witnessed on other Assets as well. The onset of the second wave of Covid19 infections has impacted traffic in April and May 2021 where CJV's have seen larger impacts as compared to 3A+ MAV traffic

3.19 The evolution of traffic since FY20 is presented below for Luharli toll plaza.

Figure 5: Month on Month traffic recovery vs FY20, TP1

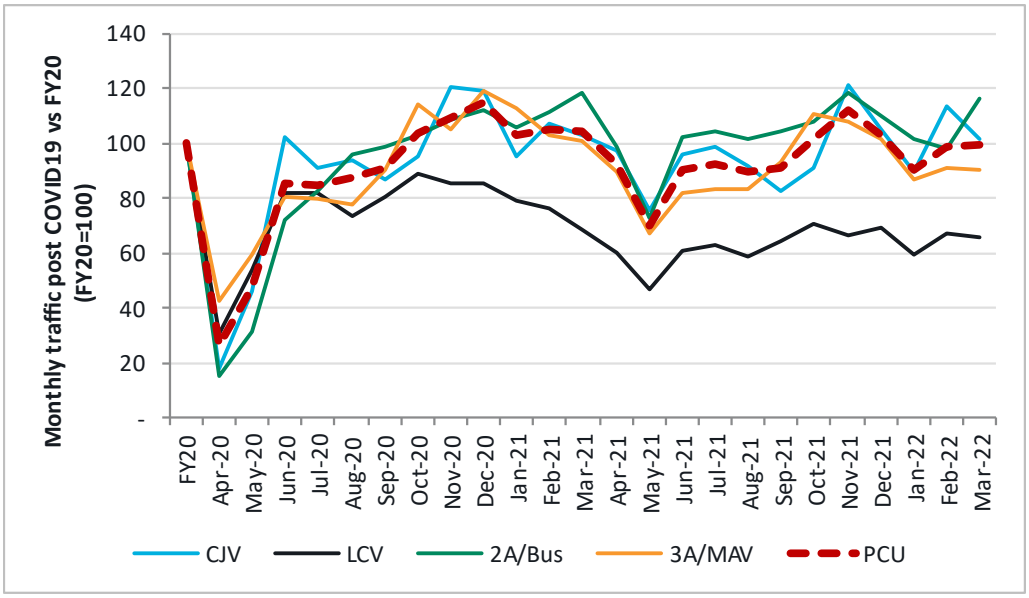


Source: Steer analysis of Client TMS data

3.20 As we can see from the table above, by Q4FY21 the Asset reached the FY20 traffic levels, with the full FY21 being impacted by Covid19 related restrictions in Q1FY21. The impact of 2nd wave of Covid19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to goods traffic. Similar impact on traffic volumes was visible in Jan FY22 due to the third wave of COVID-19 related restrictions.

3.21 The evolution of traffic since FY20 is presented below for Somna toll plaza

Figure 6: Month on Month traffic recovery vs FY20, TP2



Source: Steer analysis of Client TMS data

3.22 As seen in the graph above, the traffic levels observed on the Asset have witnessed significant recovery to pre COVID-19 levels in a short period of time. CJVs and MAV traffic volumes are seen to have recovered the traffic by the month of June-2020, while the bus traffic has recovered by the month of July-2020. CJVs and Buses follow almost similar trends in recovery,

while the MAVs have sustained higher recovery rates. This recovery can be attributed to both normal economic growth of the region. The peaks in the graph for the CJVs and Buses depict the increased travel demand during the festive season (Oct-Nov), while the MAVs have also seen increased levels due to increased consumption demand and the movement of agro-related products on the corridor during this time.

Toll Frequencies

3.23 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in table below.

3.24 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this varies from asset to asset or even toll plaza to toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.25 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.7: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows for a return journey within a day with a 50% discount on the return trip.
Monthly	Discounted single entry ticket for users who undertake multiple trips within a month can buy the monthly pass.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.26 Further, the toll plazas also record violations which are non-paying users, who are not officially allowed under exemptions category but are forced exemptions. For the Asset, the segmentation discussed below reports Exemption and violations together.

3.27 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

FASTag implementation

3.28 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.8: Timeline of national ETC implementation.

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: Source: NHAI.gov.in and Wikipedia

3.29 With the FASTag implementation in December 2019, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls.

3.30 Following table depicts the ETC penetration for both the Assets for the month of March 2022. It is observed that for TP-1 the shares for heavy goods vehicles have reached 85% mark. The FASTag share for the CJVs is at 49% level because of the local nature of the traffic. At the Somna toll plaza these percentages at a considerably higher levels, because of the regional character of the traffic passing through this toll plaza. The FASTag penetration for the goods vehicles have almost reached 100% mark for the Somna toll plaza while for the CJV traffic this share is around 73% because of the local mix in the CJV traffic volumes.

Table 3.9: Percentage of Traffic via FASTag, March 2022

Toll Plaza	CJV	LCV	Bus	2A	3A	MAV
Luharli	49%	70%	96%	90%	85%	92%
Somna	73%	97%	99%	99%	99%	100%

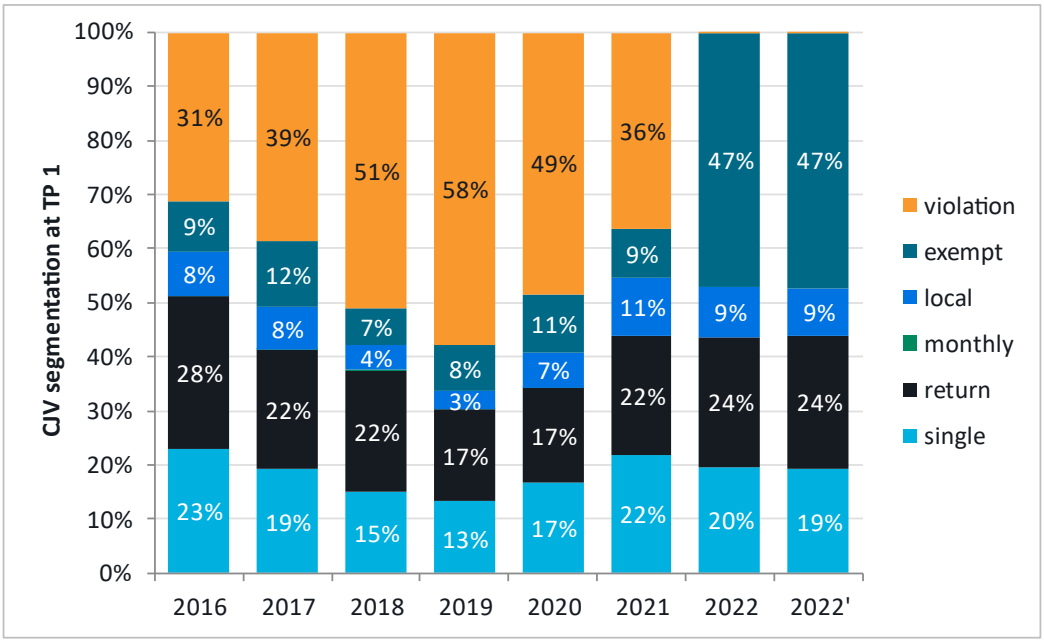
Source: Steer Analysis of Client Data

Share of traffic by payment type

3.31 FY21 was a partial year in terms of operation of the toll plazas. Further, there was a change in ticket patterns due to the mandatory implementation of FASTag as a mode of payment (share of single tickets increased in FY21). FY22 was also impacted by 2nd wave of COVID-19 in Q1 and Q2 of FY22. Hence during this period travel patterns were also disrupted, with more shorter trips being undertaken since several states implemented state entry barriers, resulting in an increase in the proportion of short distance trips. By Q3FY22 travel patterns returned to normal levels and hence, it is assumed that segmentation from Oct-21 onwards can be following normal travel behaviour on the Assets.

3.32 Following figure depicts the ticket segmentation for CJV category at the Luharli toll plaza.

Figure 3.7: Ticket segmentation for CJV at TP1 (Luharli)



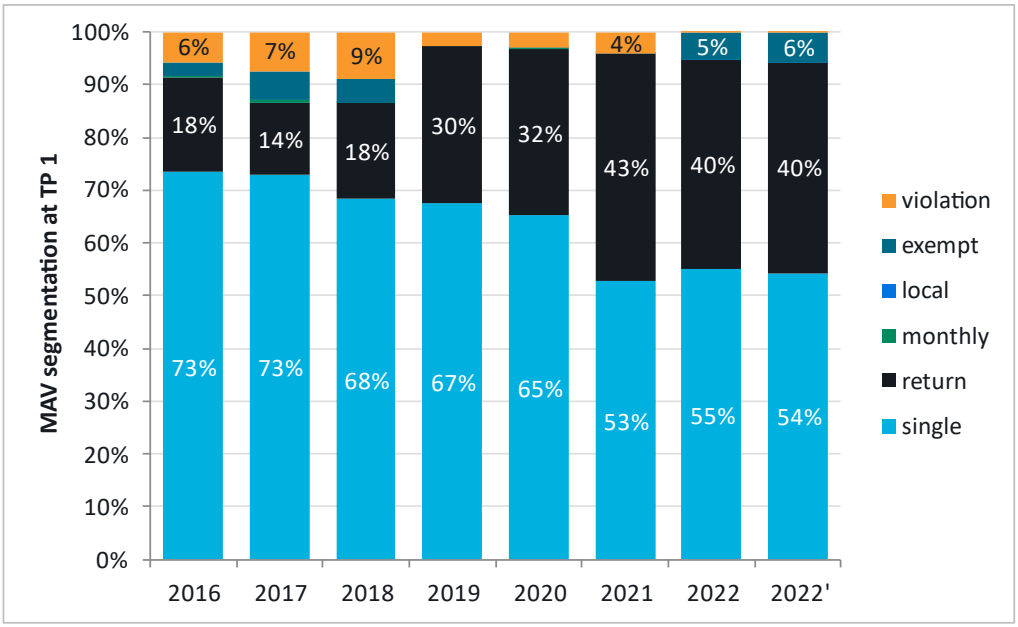
Steer Analysis, FY22' is an average from Oct-21 to Mar-22

3.33 As observed from the chart above, the major share of the CJV traffic is under the Exemption + Violation category ranging from 40% to 64% over the years. This share has now stabilised at 47% in the year FY22. The magnitude of the share of exemptions observed on this Asset is much higher than our observations on similar assets across the country. As per our observation due to site visits and our understanding of the region, local political influences and aggressive attitudes of road users play a role in this high share.

3.34 We observe the increase in share of return trips at this Asset, this is because of the implementation of FASTag all over the country which allows for a return journey within a day with a 50% discount on the return trip. The higher share of the return trips can also be inferred by the OD analysis, more than 45% of the trips have an average trip length in the range of 0-65kms, showing that majority of the traffic has a local characteristic, hence, the increase in return share.

3.35 Following figure depicts the ticket segmentation for MAV category at the Luharli toll plaza.

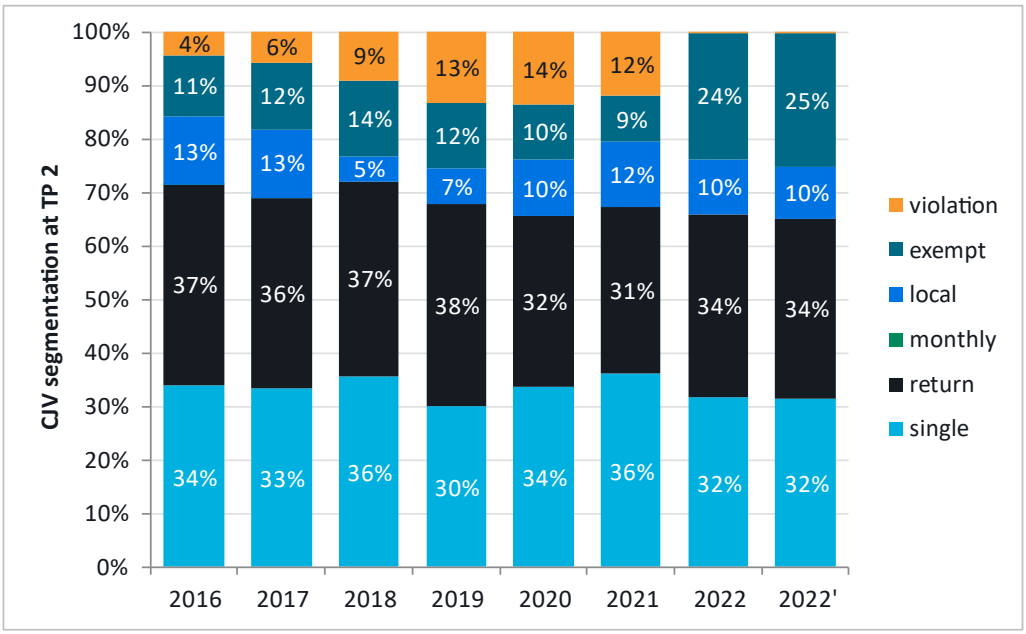
Figure 3.8: Ticket segmentation for MAV at TP1 (Luharli)



Steer Analysis, FY22' is an average from Oct-21 to Mar-22

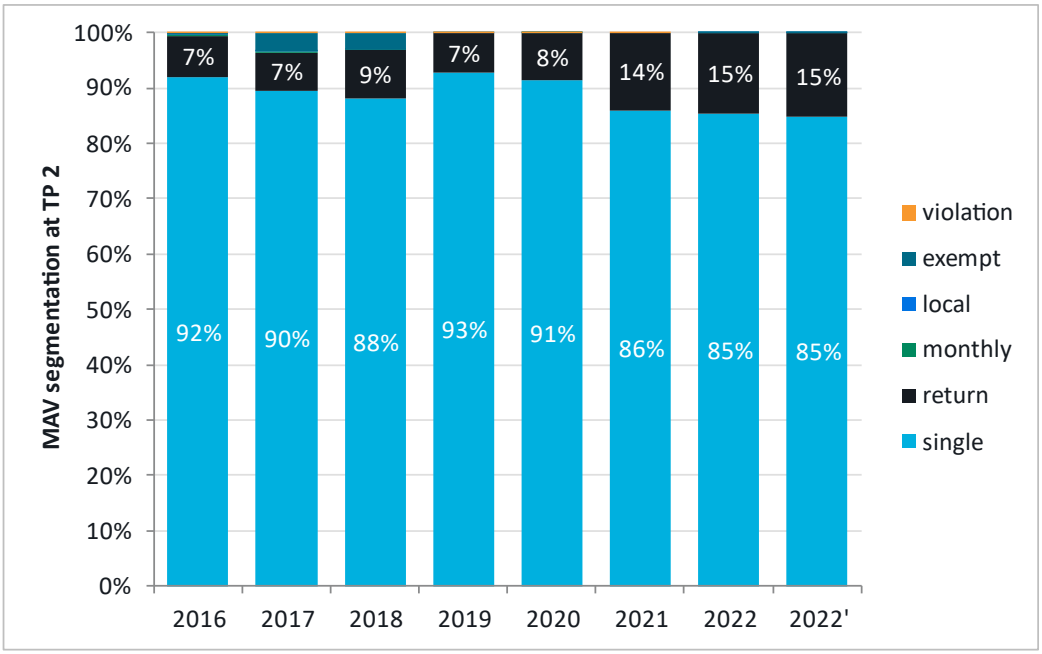
3.36 Following figure depicts the ticket segmentation for CJV and MAV category at the Somna toll plaza.

Figure 3.9: Ticket segmentation for CJV at TP2 (Somna)



Steer Analysis, FY22' is an average from Oct-21 to Mar-22

Figure 3.10: Ticket segmentation for MAV at TP2 (Somna)



Steer Analysis, FY22' is an average from Oct-21 to Mar-22

3.37 For the CJV traffic, the single journey ticket share is around 32% and has remained consistent over the period from FY16 to FY22, which is because of the stable travel patterns on this Asset. The even shares of single and return ticket types is because of the nature of the traffic crossing the toll plaza. Around 65% of the traffic using the Asset have an average trip length ranging from 65-300 Kms, which means that majority of CJV traffic is regional in nature. The exemption on this Asset is less than the TP-1 and is in the range of 20-25% over the history of the Asset, which means less local influence on the toll paying traffic. MAV traffic has a high share of single journey tickets and has stabilised to 85% over the period of Oct-21 to Mar-22. (FY22'). This high share of single tickets can be explained by the OD analysis— more than 60% of the traffic have an average trip length >300 kms, which means the MAV traffic using this Asset have a high trip length, hence, the single trip tickets have a high share.

3.38 The segmentation shows us that both the plazas on the Asset have very distinct characteristics. TP1 has a high share of local traffic catering to the travel demand generated by the regions of Dadri, Sikandrabad and Ghaziabad whereas TP2 serves long haul trips connecting north-west Uttar Pradesh, Punjab etc. to cities like Kanpur, Lucknow, Patna, Kolkata.

Data collection exercise

3.39 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset comprising the surveys listed in the table below. While TVC survey data were provided by the Client, OD surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.10: Data collection schedule

TP1#	7-day videography based TVC		
	Start date	**End date**	**Time (hrs)**
TP1 Luharli	03 Sept 2019	09 Sept 2019	0000-2359
TP2 Somna	03 Sept 2019	09 Sept 2019	0000-2359

Source: Data collection plan as followed for collecting independent survey data, 2019

3.40 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, the Client had provided Steer with seven-day counts at each toll plaza.

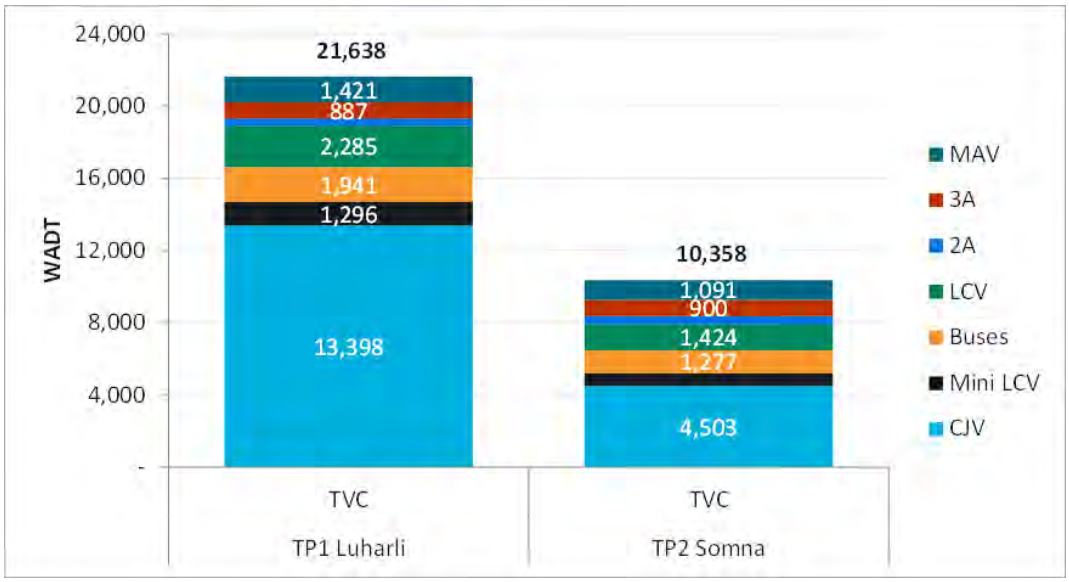
Key findings of the TVC data analysis

WADT estimates

3.41 Taking a simple average of the seven-day TVC counts, we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicle such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicle, government vehicle and other vehicle types officially allowed as 'exempted' under the concession agreement.

3.42 As seen earlier, CJVs are the largest vehicle category (13,398 at TP1 Luharli and 4,503 at TP2 Somna), followed by LCVs (2,285 at TP1 and 1,424 at TP2).

Figure 3.11: WADT at Asset

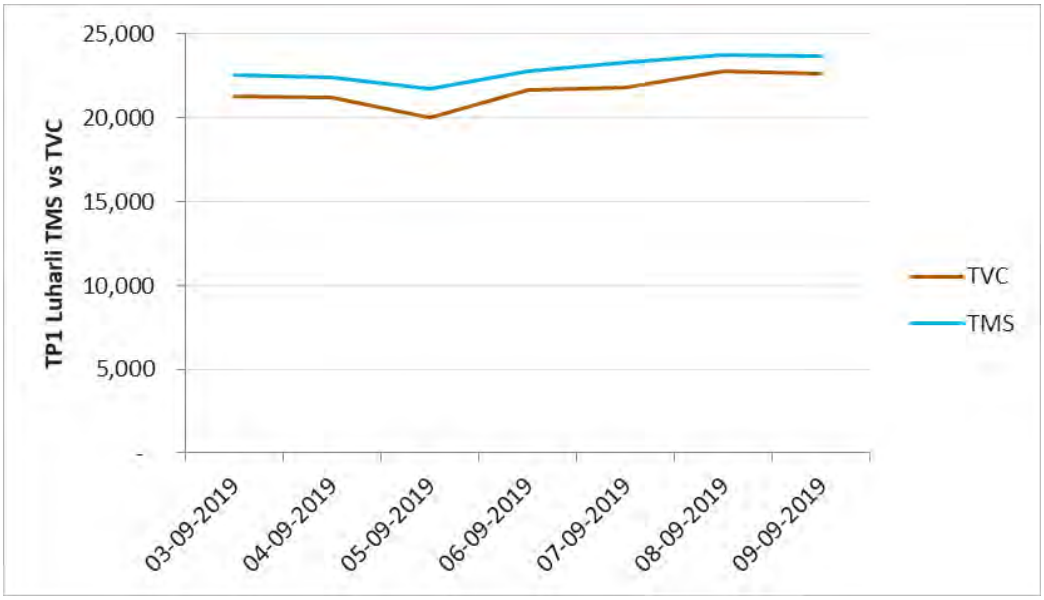


Source: Steer analysis of TVC data TVC v/s TMS analysis

3.43 We used the TVC data shared by Client to validate the toll plaza data for the same days, as supplied by the Client via their toll management system (TMS). This TMS data was then used as the base data, for our forecasting model.

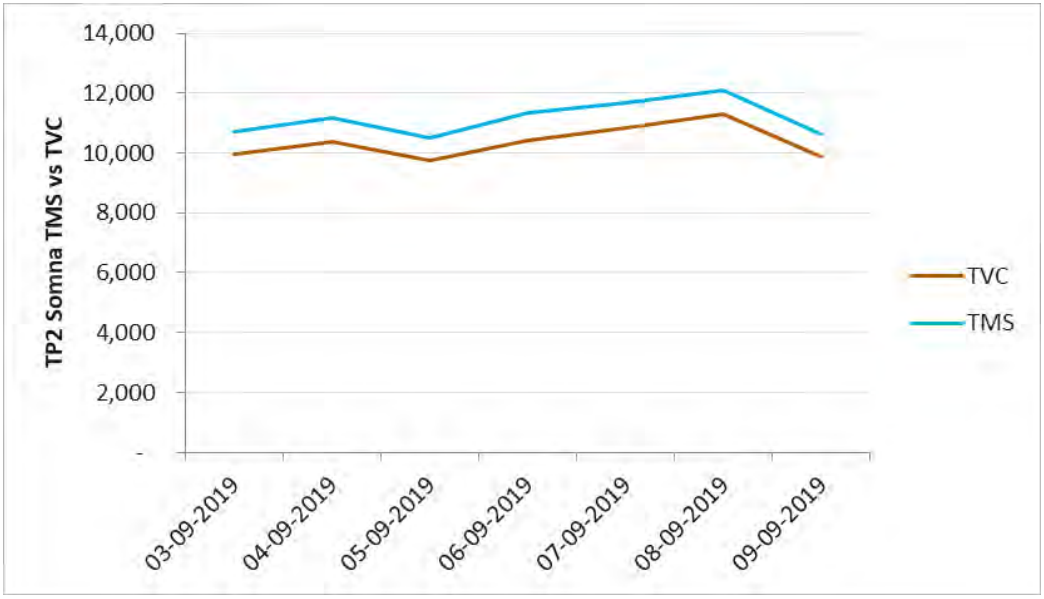
3.44 The figures below show the comparison between daily traffic data and shares of vehicle categories in TVC and TMS for the two toll plazas. As can be seen, the difference between daily traffic at TP1 and TP2 is of the range of 5% to 8% respectively with TMS giving a higher volume count. The difference can be attributed to technical differences between the two mechanisms used to obtain the volumes.

Figure 3.12: Comparison between TVC and TMS daily traffic data, TP1 Luharli



Source: Steer analysis of TVC and Client TMS data

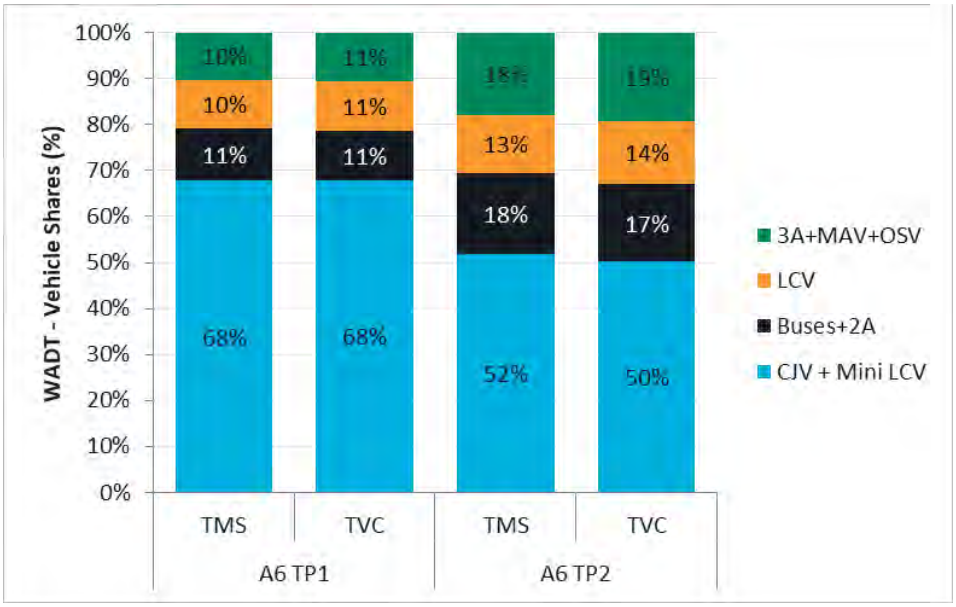
Figure 3.13: Comparison between TVC and TMS daily traffic data, TP2 Somna



Source: Steer analysis of TVC and Client TMS data

3.45 The figure below compares the shares of vehicle types at both plazas, between TVC and TMS data. As can be seen, the shares are very comparable between the TVC and TMS data.

Figure 3.14: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.46 Due to certain vehicle types like LCV and Mini LCV, and LCV and 2A often showing issues in classification at various toll roads across the country, we combine the light vehicle categories (CJV/Mini LCV, LCV, Bus, 2A) and heavy vehicles (3A, MAV) as we compare TMS versus TVC. Upon combining these two vehicle categories, as shows in the table below, we see that the difference comes down for heavy vehicles, while light vehicles still show 6% and 10% at TP1 and TP2, respectively.

Table 3.11: Difference in TVC and TMS in combined categories

Vehicle type	TP1 Luharli			TP2 Somna		
	TVC	TMS	TMS vs TVC (%)	TVC	TMS	TMS vs TVC (%)
CJV+LCV+2A+Bus	19,327	20,549	6.3%	8,364	9,162	9.5%
3A+MAV+OSV	2,312	2,341	1.3%	1,994	1,997	0.2%
Total	**21,638**	**22,890**	**5.8%**	**10,358**	**11,159**	**7.7%**

Source: Steer analysis of TVC and Client TMS data

3.47 At an overall level, we see that the difference comes below 8%. Given the overall fit of the data at an WADT level and minimal variation between the TVC and TMS data for the largest revenue generator (3A+MAV combined), we believe that the base year traffic calculated using the Client data forms a reasonably robust base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.48 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. As part of this assignment, we have analysed the regional drivers of demand based on the following OD analyses on the data as provided by the Client:

- Zonal influence
- Internal External analysis

- Commodity distribution
- Trip length distribution

3.49 While zonal analysis and list of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analysis is used to estimate key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.50 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TVC data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at both the toll plazas. We believe that the sample rates of the OD data are reasonable.

Table 3.12: Sample rates for OD data

Vehicle type	TP1 Luharli	TP2 Somna
CJV	23%	54%
Bus	26%	125%
LCV	72%	58%
2A	88%	94%
3A	79%	101%
MAV	84%	84%
Total	**36%**	**71%**

Source: Steer analysis of OD data

Commodity Categories

3.51 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.13: Aggregate commodity categories

Commodity Description	Code	Aggregation code
Agriculture Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Clay	CLY	CLY
Cement	CMT	CMT
Building Material / Construction (Lime, Brick etc)	CNS	CNS
Ceramic	CRM	CRM
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, Bread, Cool Drinks, Beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC

Commodity Description	Code	Aggregation code
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Electrical/Manufacturing items (Electronic items, Medicine, Leather, Wine, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (Steel, Iron)	MET	
Raw Wood, Cork & Wood Products, Furniture	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Rubber	RUB	RUB
Sand	SND	SND
Stone (kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

3.52 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones and influenced by various cities, states and regions in the proximity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind zone aggregation may vary based on the characteristics displayed by each asset.

Table 3.14: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
Immediate area of influence (IAOI)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Uttar Pradesh	Rest of cities/Districts in the state that Asset lies in (other than Local/IAOI)
Central NCR	Delhi, Gurgaon, Noida.
Rest of Haryana	Haryana
North India	Uttarakhand, Jammu & Kashmir, Himachal Pradesh
Madhya Pradesh	Madhya Pradesh
Rajasthan	Rajasthan
Punjab	Punjab
Uttarakhand	Uttarakhand
Gujarat	Gujarat
East & Northeast India	West Bengal, Orissa and Northeast Indian states
South India	Andhra Pradesh, Tamil Nadu, Karnataka, Kerala

Source: Steer analysis

Zonal influence

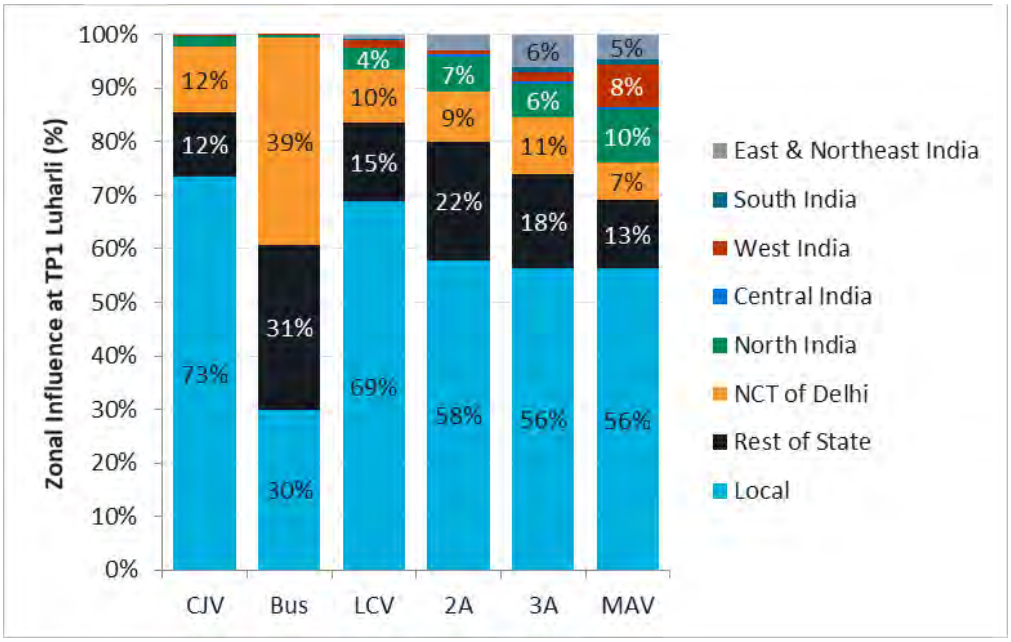
3.53 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[1] at each toll plaza of each Asset, aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed on trip ends and not trips.

3.54 The figures below present the zonal influence on various vehicle types crossing the toll plazas. We can see that 'local' trips make up the largest share for all vehicle types. This decreases as the size of vehicle types, as observed on other Assets across the country, given that heavier vehicles travel longer distances. This can be specifically attributed to the urban nature of the Asset and proximity to several industrial and growing urban centres like Ghaziabad, Sikandrabad, Khurja and Aligarh. The distribution also varies between the toll plazas, with TP2 showing lower 'local' influence.

3.55 We observe the highest share of 'local' influence for CJV's (73%, 54% at TP1, TP2 respectively). MAVs see lower but significant 'local' influence (56%, 22%), which is still much higher than observations made at long-distance corridors across roads in the country. Compared with competing long-distance corridors, this indicates potentially larger share of traffic having one trip end lying on the Asset i.e. dependent on the regional economy. This is further discussed in the sub-sections presenting top OD pairs and trip length analyses.

3.56 Other regions that have a contribution greater than 10% to the zonal influence at TP1 are 'Rest of State', Delhi NCR and other areas in North India like Haryana. In the case of TP2, the contribution of 'Rest of State' trips increase to 27% for CJV and 37% for MAV vehicles.

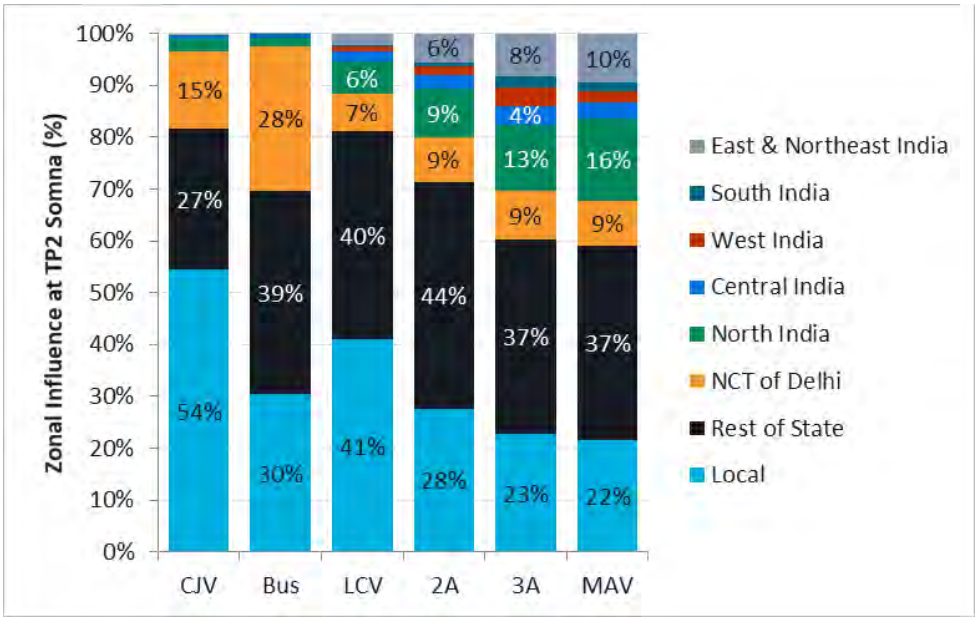
Figure 3.15: Zonal influence, TP1 Luharli



Source: Steer analysis of OD data

[1] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad is 50% since one trip end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.16: Zonal influence at TP2, Somna



Source: Steer analysis of OD data

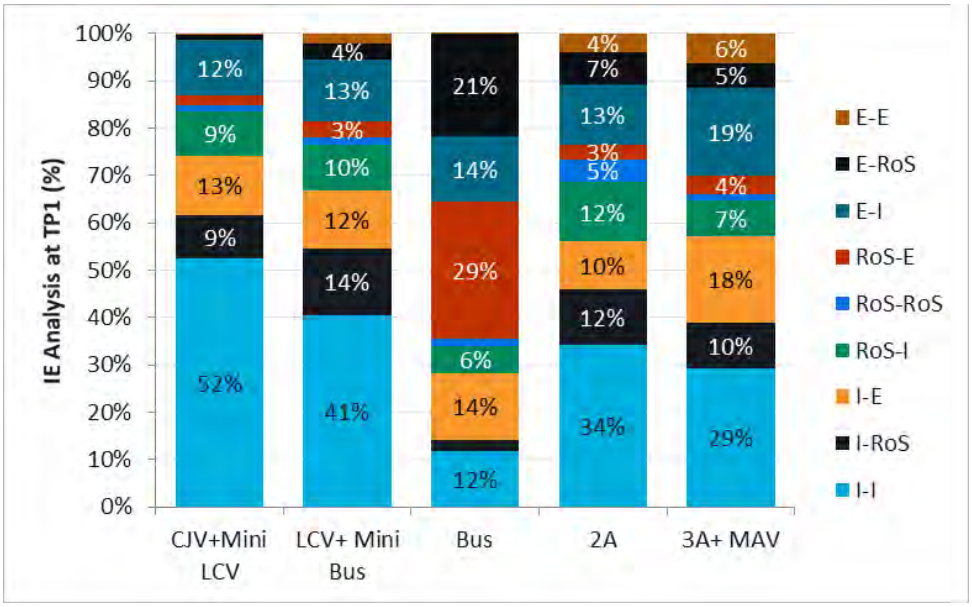
Internal External analysis

3.57 Internal-External analysis helps in identifying the trips which have both the origin and destination on the Asset (Internal-Internal), both trips ends within the state (RoS) or or neither end on the Asset i.e. through trips (External-External). 'Internal' zones are those that were analysed as 'local' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are all other zones.

3.58 The graphs below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation but at a trip level.

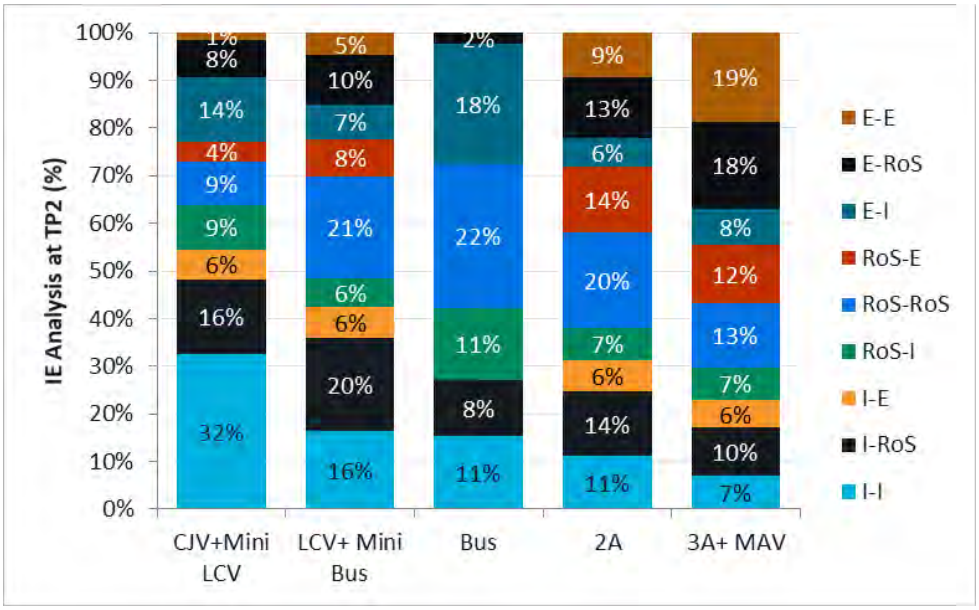
3.59 For CJVs and light vehicles at TP1 Luharli and TP2 Somna, we see that the zonal influence maps to a combination of internal and rest of state trips which means that there are both short-distance and medium-distance trips that contributed to the high 'local' zonal influence. MAVs, on the other hand, show difference between TP1 and TP2, with TP2 showing more long-distance (E-E) movement.

Figure 3.17: Internal-external distribution, TP1 Luharli



Source: Steer analysis of OD data

Figure 3.18: Internal-external distribution, TP2 Somna



Source: Steer analysis of OD data

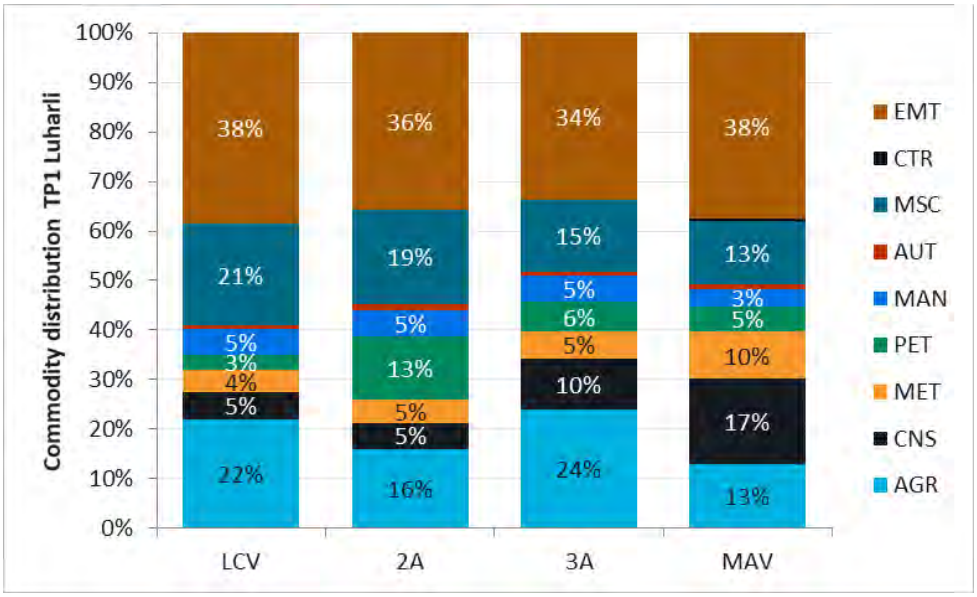
Commodity distribution

3.60 The figures below present the commodity distribution for goods vehicles at this toll plaza. As also observed during our site visits, we see that a significant number of vehicles are 'empty', which resonates with the high 'local' zonal influence and significant shares of 'return' toll type.

3.61 There is a significant volume of construction, manufacturing, metals and petroleum related commodities on the asset along with agricultural materials. Vehicles carrying these products generally have one end of their trips in the industrial areas of Sikandrabad, Ghaziabad, Bulandshahr or Aligarh.

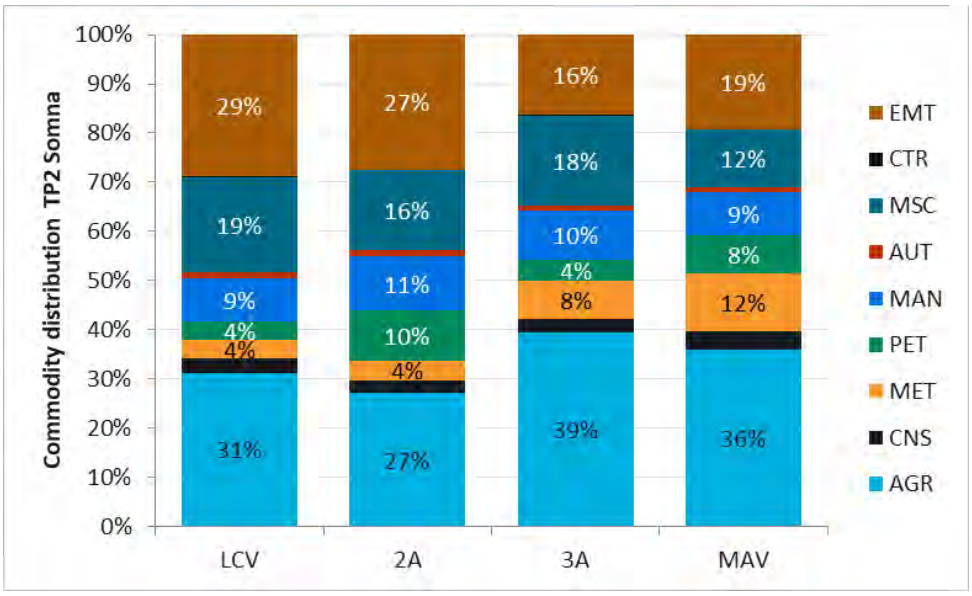
3.62 As seen in the chart below, TP2 Somna has higher shares of agricultural commodities compared to TP1 Luharli due to the more long-distance nature of truck movement at TP2 Somna with trip ends in northern Haryana, Punjab and Jammu & Kashmir.

Figure 3.19: Commodity distribution, TP1 Luharli



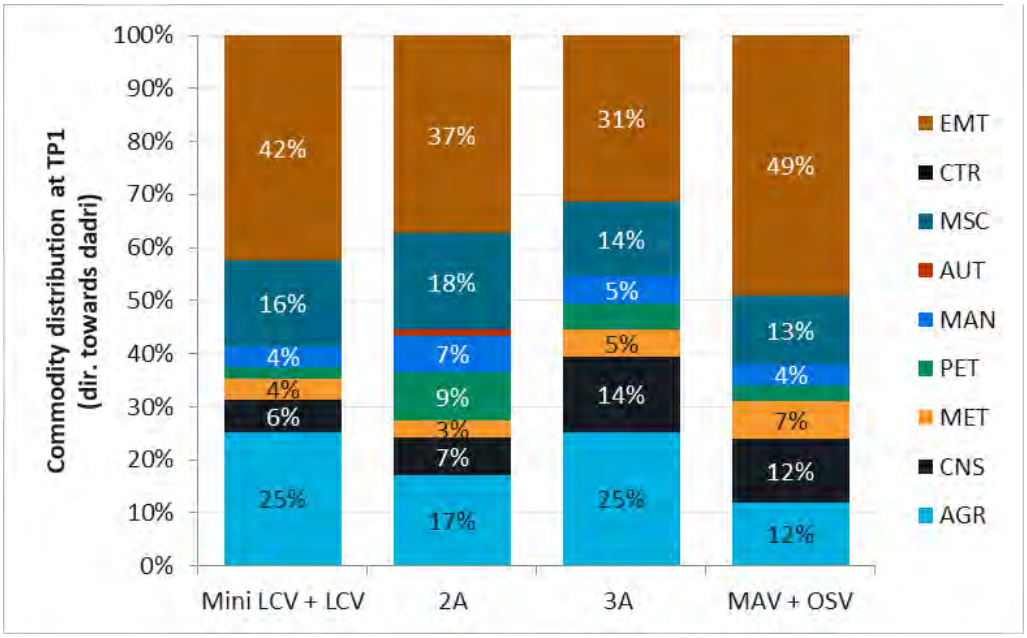
Source: Steer analysis of OD data

Figure 3.20: Commodity distribution, TP2 Somna



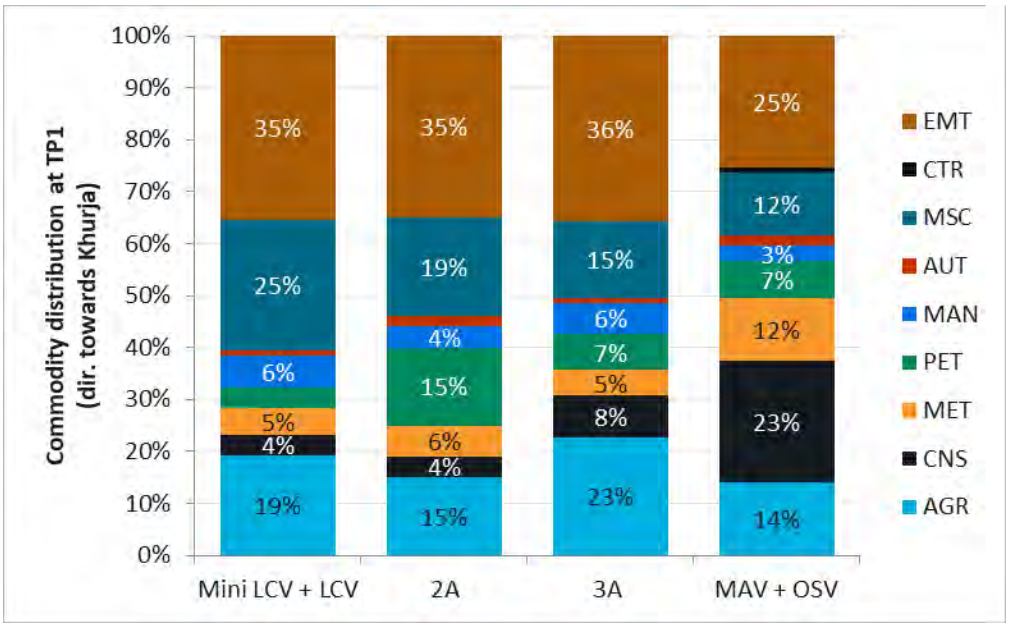
Source: Steer analysis of OD data

Figure 3.21: Commodity distribution, TP1 Luharli towards Dadri



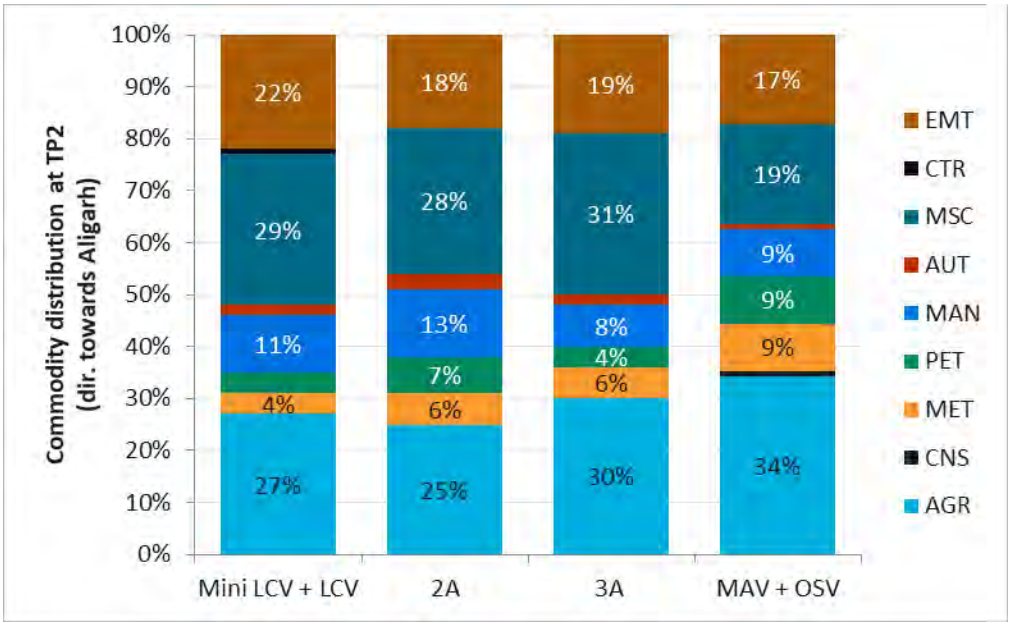
Source: Steer analysis of OD data

Figure 3.22: Commodity distribution, TP1 Luharli towards Khurja



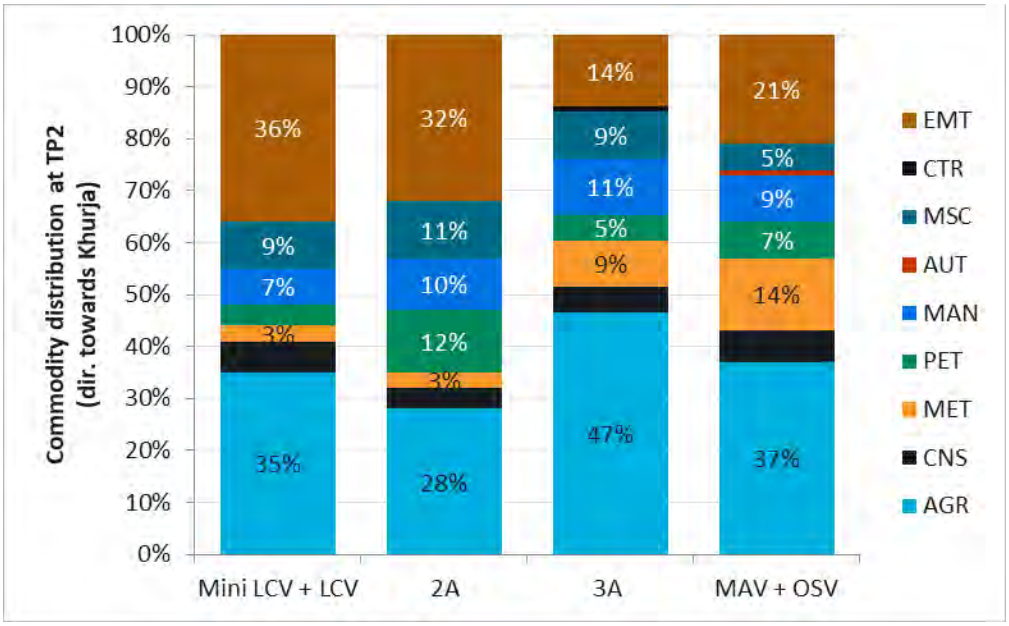
Source: Steer analysis of OD data

Figure 3.23: Commodity distribution, TP2 Somma towards Aligarh



Source: Steer analysis of OD data

Figure 3.24: Commodity distribution, TP2 Somma towards Khurja



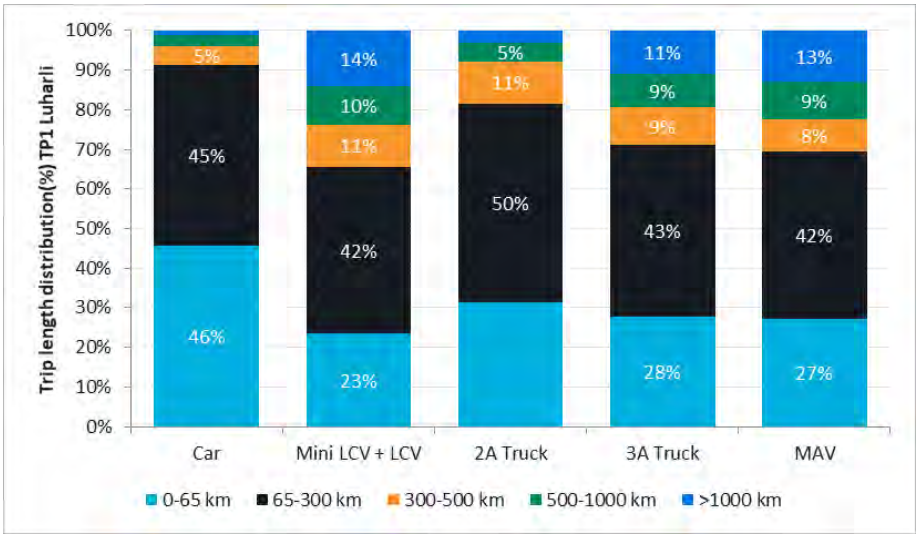
Source: Steer analysis of OD data

Trip length analysis

3.63 Trip-length distribution provides the distance-based profile of various vehicle types. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into groups – 0-65 km, 65-300 km, 300-500 km, and 500-1000 km and >1,000 km. The trip

distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[2]

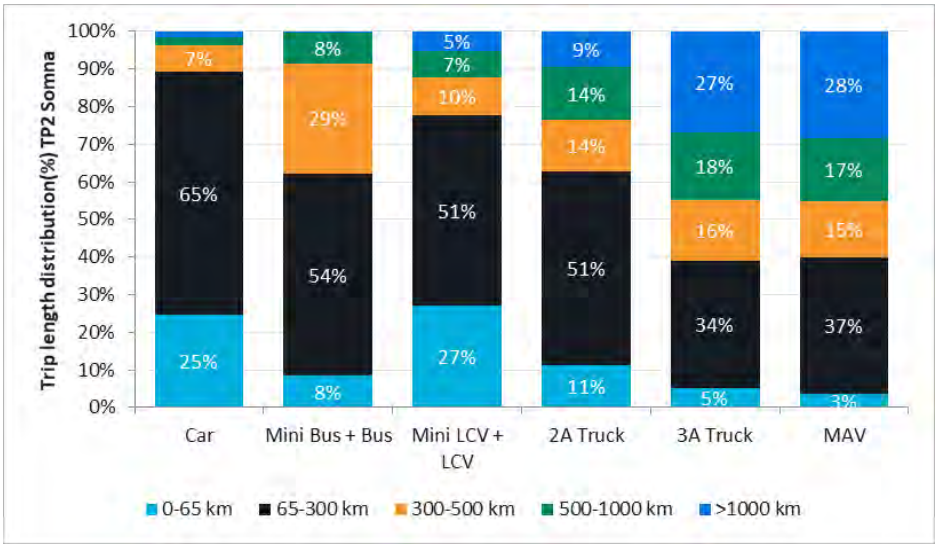
Figure 3.25: Trip length distribution TP1



Source: Steer analysis of OD data

3.64 In keeping with observations in the zonal influence, we see that more than 70% (MAVs) up to 90% (CJVs at TP1) and 40% (CJVs at TP2) make trips that are less than 300 km long. This supports the urban nature of the Asset with relatively shorter trips and a higher percentage of passenger vehicles. We have further analysed the differences between traffic behaviours at the two toll plazas in the historical growth analysis discussed in Chapter 5.

Figure 3.26: Trip length distribution TP2



Source: Steer analysis of OD data Socio Economic Context

[2] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving under various scenarios can be extracted using macro-enabled Excel, R, etc.

Conclusions

3.65 In summary, TP2 has a higher share of MAVs compared to TP1 (11% compared to 8%). The opposite is true for CJVs, which represent 71% of vehicles at TP1, but 56% at TP2. The COVID-19 pandemic impacted traffic on the Asset significantly during all the three waves, but the Asset has recovered strongly with the economic recovery across the Asset corridor as evident from traffic levels observed upto Q4FY22 in CJVs, buses and MAV vehicle categories. TP2 performance however remains lower than expected, whereas TP1 3A+MAV levels are trending higher than historical volumes observed on the plaza.

3.66 The Asset is an outlier in terms of compliance as we have observed unpreceded violations in the past (more than 60% at TP1 and 30% at TP2 for CJVs). During the last two years, especially from February 2021 onwards, with compulsion in use of FASTag by NHAI, a significant increase in compliance is observed with decrease in violations and exemptions (47% at TP1 and 25% at TP2 for CJVs). The buses on the Asset are observed to buy return tickets generally as they traverse return trips between Aligarh - Delhi-NCR region.

3.67 The TVC does show variation on the TMS, at the total level TMS is 5.8% lower than TVC at TP1, and 7.7% lower than TVC at TP2, primarily attributable to local CJV users. However, the differences are smaller for the larger revenue generating categories (3A, MAV and OSV combined), 1.3% and 0.2% at TP1 and TP2 respectively.

3.68 The OD analysis shows us that both the plazas on the Asset have very distinct characteristics. TP1 serves a more local-influence based traffic serving the demands being generated by the industrial regions of Dadri, Sikandrabad and Ghaziabad whereas TP2 serves long-distance traffic connecting north-west Uttar Pradesh, Punjab etc. to cities like Lucknow, Kanpur, Patna, Kolkata. The major commodity observed on TP1 were manufacturing items, metals, and finished products along with agri-related products whereas TP2 is agri-related commodities dominated plaza. TP1 of the Asset observes 3A/MAV trips that re generally internal in nature (56% for MAVs) whereas TP2 observes 3A/MAV trips that are generally external in nature (41% for MAVs).

3.69 The overall characteristic of the Asset is strategic is nature connecting several key urban and economic activity centres of New Delhi, Ghaziabad, Sikandrabad, Khurja, Aligarh in immediate vicinity with wider generators and attractors of Western-Uttar Pradesh, Punjab, Kanpur and Lucknow region, Bihar, and West Bengal also being connected by the Asset. High population density and contiguous development of urban centres are drivers for a healthy CJV and Bus traffic proportion on the Asset.

4 Socio Economic Context

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and,
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Uttar Pradesh and Delhi (containing the Asset), compared to that of the country. Overall, urbanisation is seen at both the state and national levels, as shown by the fact that the rural population is growing slower than the urban population. Overall, Uttar Pradesh and Delhi have grown at a rate which is similar to the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Uttar Pradesh	166	132	35	200	155	44	1.8%	1.7%	2.6%
Delhi	13.8	0.9	12.9	16.8	0.4	16.4	1.9%	(7.8%)	2.4%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of urbanisation, and the dynamic nature of local population migration (both of which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

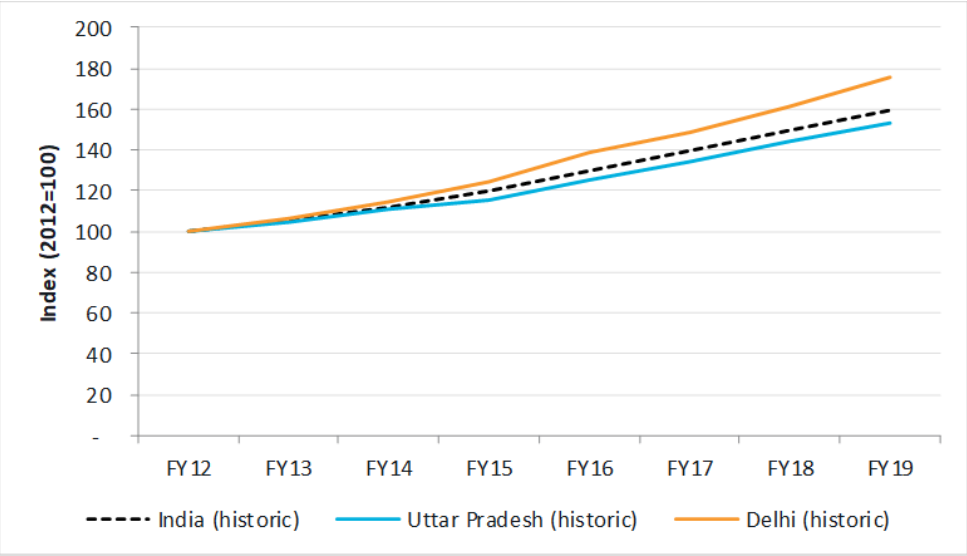
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Uttar Pradesh has been weaker than the country as a whole, whereas Delhi being the capital city has grown at a much faster pace than the national average. Delhi and Uttar Pradesh contribute approximately 4% and 8% respectively to India's GDP. The following figure illustrates the evolution of Delhi and Uttar Pradesh's GSDP.

Figure 4.1: Evolution of Delhi's and Uttar Pradesh's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

Uttar Pradesh

4.9 Uttar Pradesh is the most populous state in India with a population of ~200 million people. The state has a large pool of skilled, semi-skilled and unskilled labour. Uttar Pradesh is also considered the largest consumer base in the country.

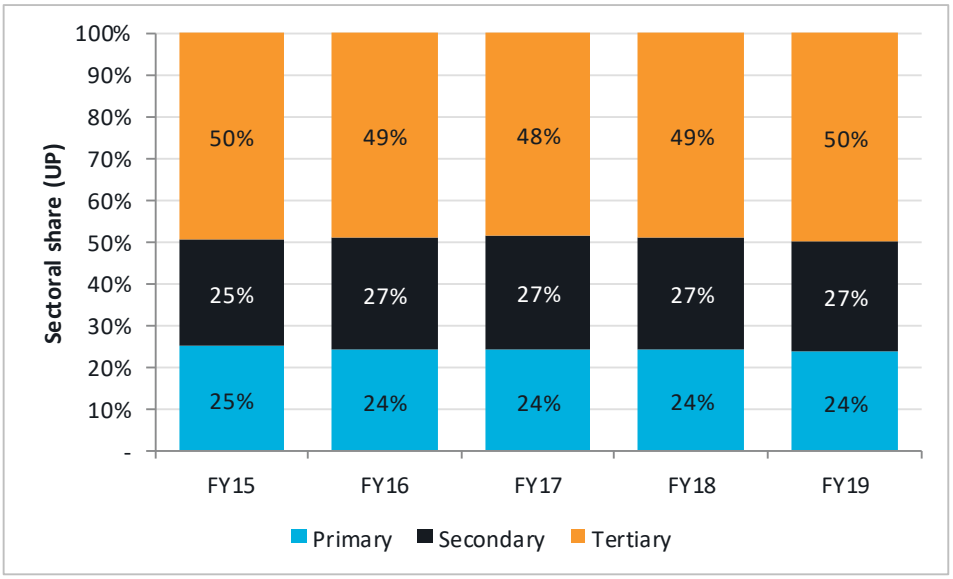
4.10 The tertiary sector has the highest sectoral contribution to the state GDP followed by the secondary and primary sectors, with shares remaining stable during the past five years.

4.11 The tourism and transport sector constitute a majority of the state's tertiary sector. Uttar Pradesh is considered a favoured tourist destination in India, with key tourist attractions being Agra, Varanasi, Mathura and Prayagraj. In 2018, the state attracted the second-highest number of domestic tourist arrivals in the country with 285 million visits. The state also holds the third position in the country in terms of foreign tourist arrivals with over 3.78 million[3] people arriving.

4.12 In terms of the secondary sector, the state has key industrial areas in Khurja (ceramic); Moradabad (metals); Meerut, Bareilly, Mirzapur and Lucknow (handloom and handicrafts); and Kanpur and Noida (leather and tannery). The state also has an oil refinery in Mathura, operated by the Indian Oil Corporation (IOC).

4.13 Uttar Pradesh contains a major part of the fertile Gangetic plains, with a large share of population dependent upon the agriculture sector for the livelihood. The key primary industries in the state include food processing, crop production and horticulture. The state is mainly known for the production of wheat, sugarcane, potato and mango.

Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP



Source: Central Statistics Organisation

[3] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

Delhi

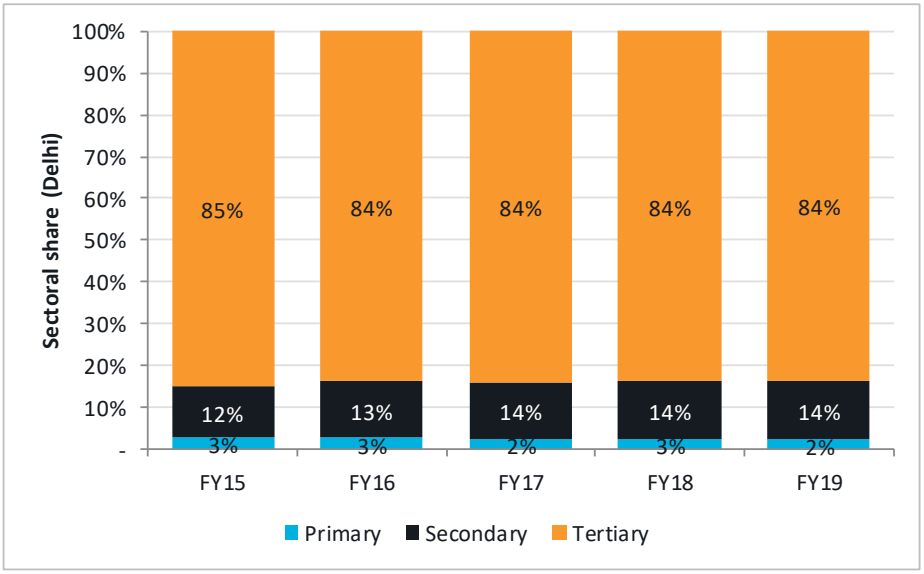
4.14 Delhi, the capital city of India, is one of the largest metropolises in the country.

4.15 In terms of sectoral contribution, the tertiary sector has the highest share followed by the secondary and primary sectors, with shares remaining stable during the past five years.

4.16 The biggest contributors to the tertiary sector in Delhi are tourism, trade, financial services and real estate. Owing to its location, connectivity and rich cultural history, Delhi has always been a prime tourist attraction of the country with key tourist places being India Gate, Lotus Temple, Humayun's Tomb and Akshardham. In 2018, the state attracted the fourth highest foreign tourist arrivals, around 2.7 million. The Indira Gandhi International Airport of Delhi serves both domestic and international passengers. It was the 12th busiest airport in the world in 2018 in terms of traffic volumes. The airport handled around 69.23 million passengers in 2018-19.

4.17 In terms of secondary sector, the state has key industrial clusters at Narela, Naraina, Okhla and Mayapuri. The share of primary/agriculture sector is very miniscule in the state.

Figure 4.3: Sectoral contribution to Delhi's GSDP



Source: Central Statistics Organisation

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'. To understand the historical traffic trends in relation to these growth drivers, we carry out regression analyses to determine the historical relationship between each traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.3 Typically, passenger and light commercial vehicle traffic like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state in which the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because the majority of light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.4 Elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in growth drivers of traffic. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.5 Following the brief note on historical trends shown in Chapter 3, we now delve deeper into results of the historical growth analysis for each major vehicle type. The table below shows the historical CAGRs on the Asset by vehicle type.

Table 5.1: Vehicle-wise growth and CAGR (%), TP1 Luharli

Total	FY17	FY18	FY19	FY20	FY21	FY22	CAGR 16-20	CAGR 20-22
CJV	18.3%	16.6%	40.8%	(3.6%)	(6.9%)	12.9%	17.0%	2.5%
LCV	6.5%	7.6%	12.8%	(6.2%)	(16.6%)	(12.2%)	5.0%	(14.4%)
2A/Bus	0.3%	21.3%	(5.7%)	7.7%	(16.8%)	15.7%	5.4%	(1.9%)
3A/MAV	(2.3%)	2.5%	20.0%	1.3%	(5.0%)	9.7%	5.0%	2.1%
Total	11.3%	14.5%	28.8%	(2.2%)	(8.7%)	10.7%	12.6%	0.5%
PCU	6.4%	13.0%	20.7%	(0.4%)	(9.5%)	10.5%	9.7%	0.0%

Source: Steer analysis of Client TMS data

Table 5.2: Vehicle-wise growth and CAGR (%), TP2 Somna

Total	FY17	FY18	FY19	FY20	FY21	FY22	CAGR 16-20	CAGR 20-22
CJV	15.3%	3.5%	29.8%	3.7%	(7.2%)	3.2%	12.6%	(2.1%)
LCV	6.4%	10.3%	(1.7%)	(15.6%)	(24.6%)	(17.8%)	(0.7%)	(21.3%)
2A/Bus	11.3%	17.2%	(10.4%)	7.6%	(9.1%)	12.1%	5.9%	0.9%
3A/MAV	9.0%	28.0%	(12.6%)	(14.5%)	(7.9%)	(2.8%)	1.0%	(5.4%)
Total	11.8%	12.4%	7.3%	(2.0%)	(9.6%)	1.6%	7.2%	(4.1%)
PCU	10.7%	17.7%	(2.4%)	(4.4%)	(9.5%)	1.9%	5.0%	(4.0%)

Source: Steer analysis of Client TMS data

5.6 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.3: Identified growth drivers to model traffic growth

Vehicle type	TP1 Luharli			TP2 Somna		
	GDP India	GDP Delhi	GSDP UP	GDP India	GDP Delhi	GSDP UP
Car		50%	50%			100%
LCV		20%	80%			100%
Bus		30%	70%			100%
2A	20%	20%	60%	40%		60%
3A	25%	20%	55%	55%		45%
MAV	35%	15%	50%	55%		45%

Source: Steer analysis of Client data

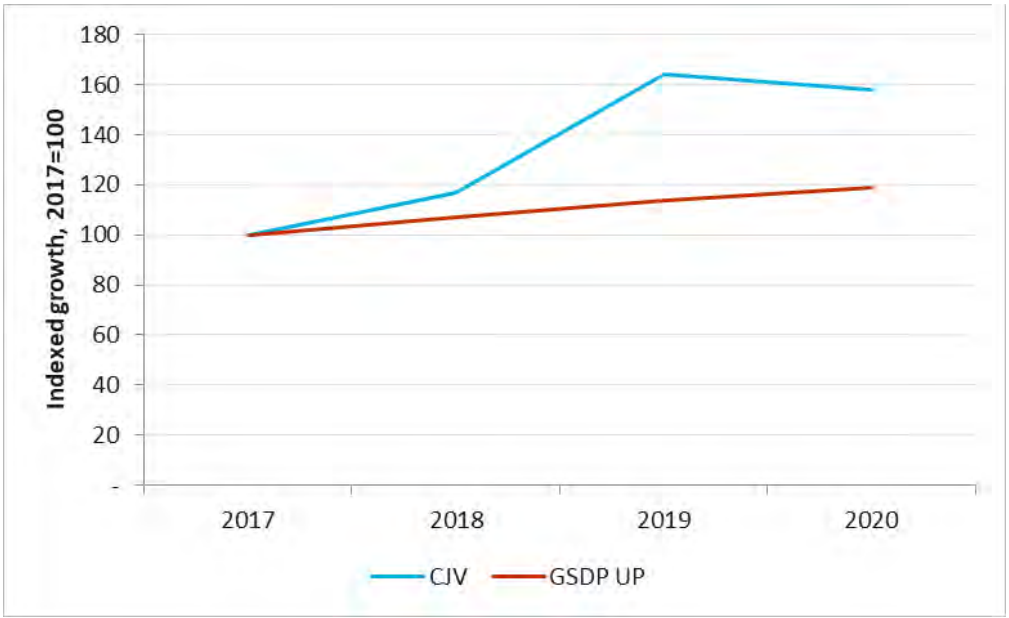
5.7 The recent historical period of tolling is chequered with variations in traffic growth between years for certain vehicle types, due to completion of construction of Western and Eastern Peripheral Expressways around Delhi and the slump in the regional economy. Therefore, certain affected years were not available for the regression analysis. This is one of the reasons for differences between the derived and assumed elasticities as we typically forecast elasticities to reflect the more recently observed relationship between traffic growth and macroeconomic growth either based on recent elasticities or benchmarks.

5.8 Please note that in our regression analysis, we have used the combined traffic for toll categories as data for historical years were available only in combined form.

CJV

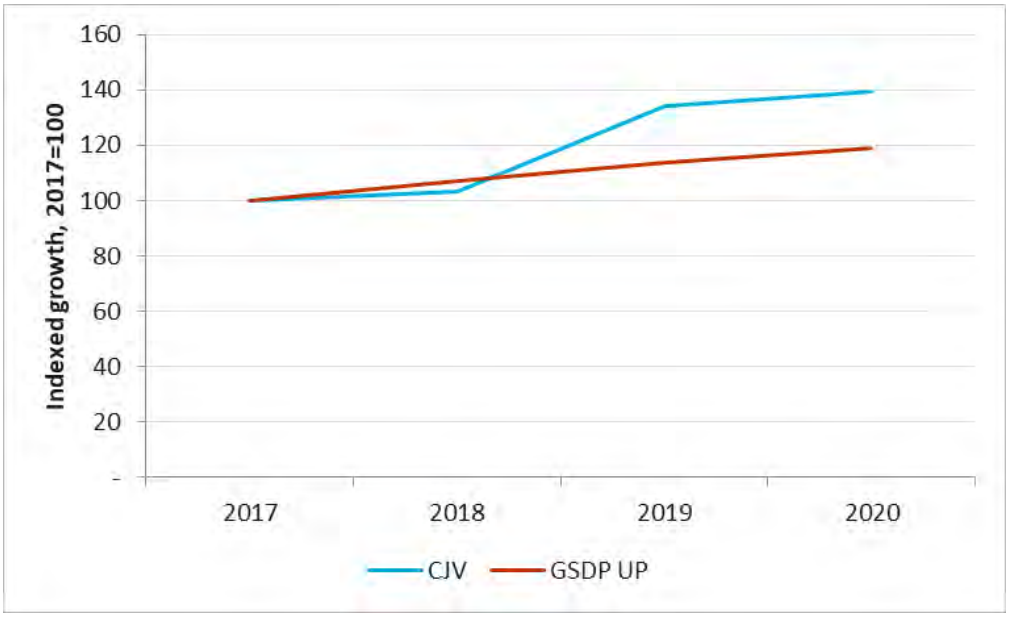
5.9 We see from the OD data that the CJVs primarily cater to regional movements between Ghaziabad, Sikandrabad, Bulandshahr, Khurja, Aligarh and other towns lying on the Asset. We have therefore taken Uttar Pradesh GSDP to be the growth driver to model the growth of CJV traffic. The following figure shows the relationship between indexed values of CJV traffic and Uttar Pradesh GSDP at TP1 Luharli and TP2 Somna.

Figure 5.1: Relationship between CJV traffic and Uttar Pradesh GSDP, TP1 Luharli



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data. CJV traffic includes reported exemptions.

Figure 5.2: Relationship between CJV traffic and Uttar Pradesh GSDP, TP2 Somna



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data. CJV traffic includes reported exemptions.

5.10 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in GSDP/GDP (i.e., suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. This assumption is very contextual and subject to change as there are changes in economic policies of government and overall economic stability nationally and globally.

5.11 Historically, the CJV traffic on the Asset has shown very strong growth apparently in the FY16-FY19 period, with the following year FY20 showing only very small positive or negative growth rates. However, an analysis of only toll paying traffic (excluding reported exemptions and violations) show flat growth for CJVs over the historical period FY17 onwards.

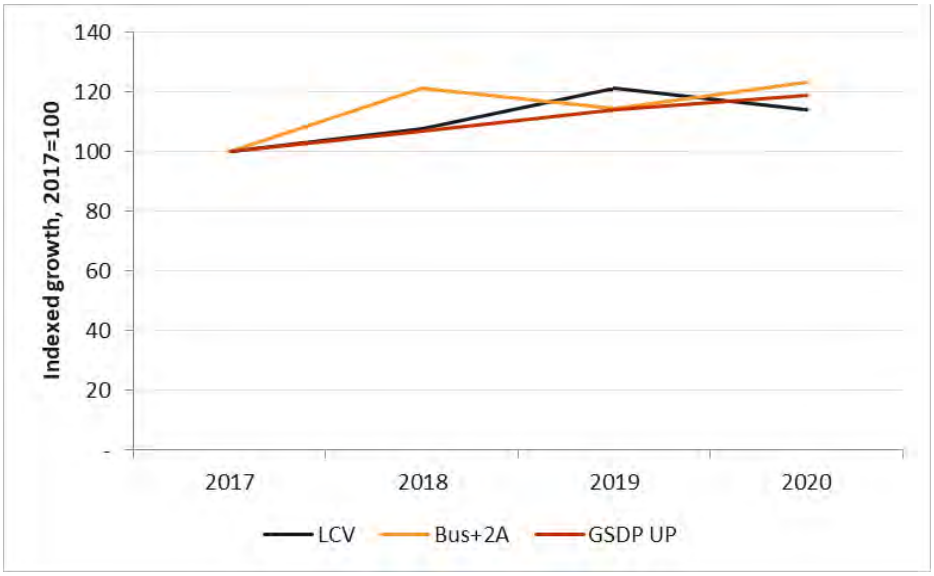
5.12 Taking note of the positive outlook for passenger traffic on the tourism-driven Asset, regression results on earlier historical years and the urban nature of the Asset, we have assumed a forecast background elasticity of 1.0 for TP1 and 0.9 for TP2 Somna for CJVs going forward.

LCV, Bus+2A

5.13 Compared to heavy vehicles like 3A and MAV, LCV and 2A have more regional movements within the state – Uttar Pradesh in this case as seen in the OD data analysis. More than 95% of LCVs and 80-90% of 2As have at least one trip end in Uttar Pradesh. We have therefore taken GSDP of Uttar Pradesh to be the growth driver to model growth of LCV and Bus+2A traffic. The following figure shows the relationship between indexed values of LCV and Bus+2A traffic and Uttar Pradesh's GSDP.

5.14 Through the historical period, especially between FY17 and FY19, we see that LCV and Bus+2A have grown faster than GSDP but LCVs have shown slower and even negative growth in the FY19-FY20 period.

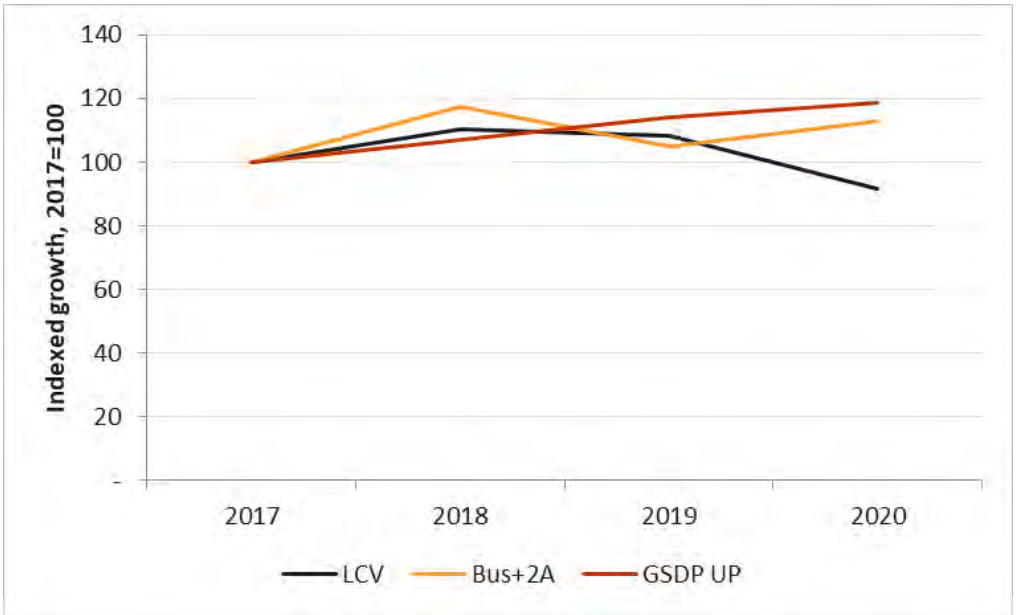
Figure 5.3: Relationship between LCV+2A combined traffic and Uttar Pradesh, TP1 Luharli



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.15 Though the regression results show 0.96 elasticity with GSDP Uttar Pradesh over the FY17-FY20 period, considering the higher volumes and growth rates of LCV on the Asset compared to 2A, we assume a preference for LCV over Bus+2A.

Figure 5.4: Relationship between LCV+2A combined traffic and Uttar Pradesh, TP2 Somna



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.16 As sufficient number of reliable years were not available for regression, we have relied on our experience of working on similar toll roads across India and in the vicinity to conclude that LCV will grow at a background elasticity of 1.1 for TP1 Luharli and 0.45 for TP2 Somna.

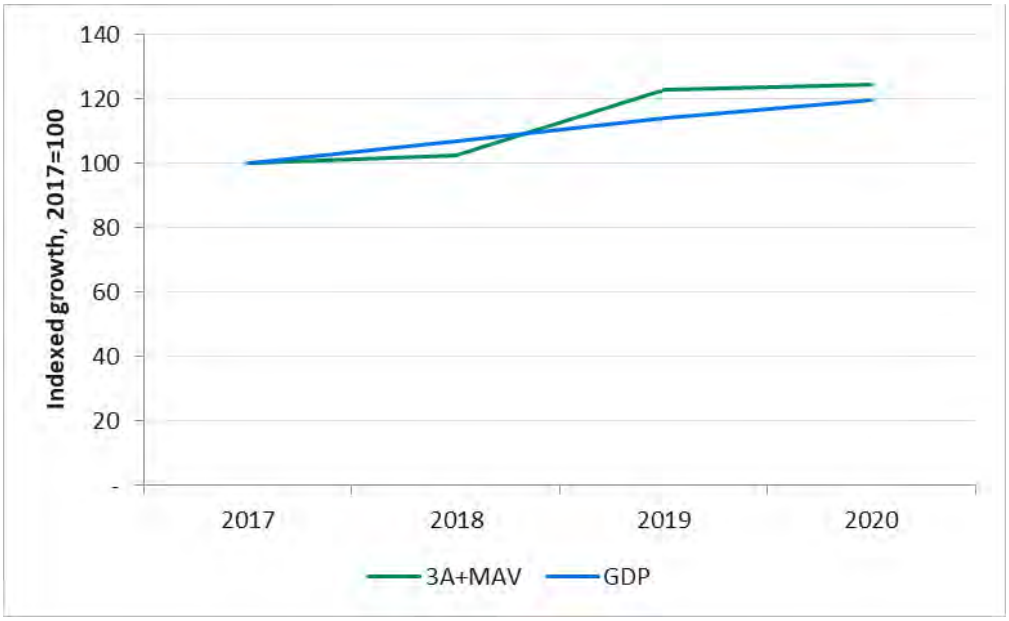
5.17 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at intervals of time. Based on our experience across the country, buses on inter-urban corridors with high urbanisation show elasticities of 0.4 to 0.6 with respect to the GSDP.

5.18 However, as seen in the graph presented above, buses (in combined category with 2A) have not shown good growth FY18 onwards. Considering benchmarks of roads with minimal growth in bus traffic, we have assumed an elasticity of 0.4 with respect to GSDP Uttar Pradesh going forward.

3A/MAV Trucks

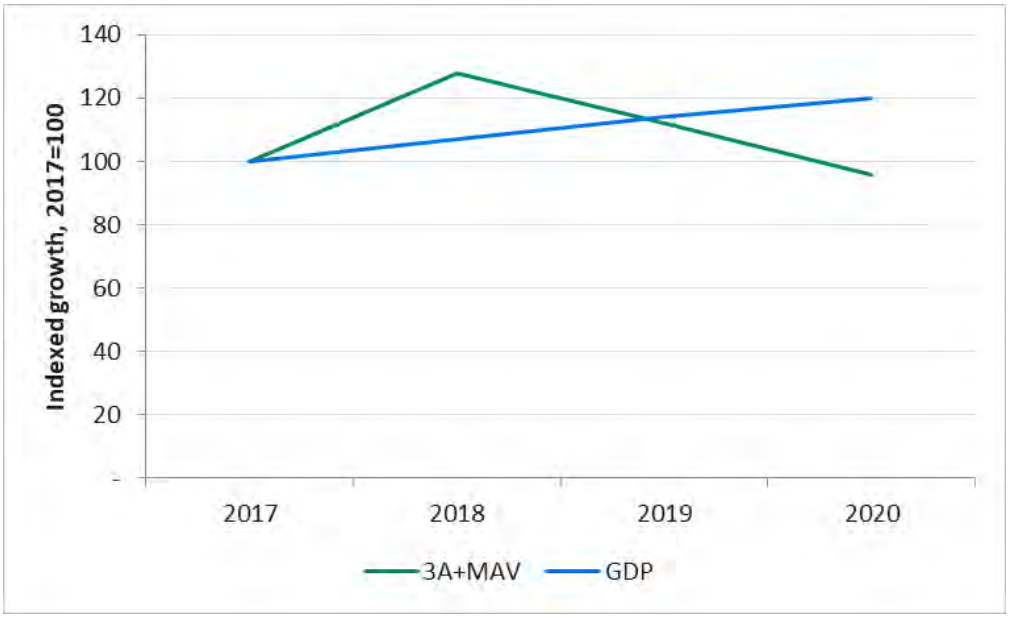
5.19 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in their commodity distribution which means that traffic growth in 3A and MAV is dependent on industry demand-supply ecosystems spread across the country, we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

Figure 5.5: Relationship between 3A+MAV traffic and Uttar Pradesh GSDP, TP1 Luharli



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

Figure 5.6: Relationship between 3A+MAV traffic and Uttar Pradesh GSDP, TP2 Somna



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.20 Based on our analysis of the historical data, we observed that growth has been affected in FY19 and FY20 due to the national economic slowdown, slump in regional economy due to regulatory changes, and network changes due to EPE/WPE completion and state highway networks. For each of these, we have made the following observations:

- **National economic slowdown:** We believe this has affected both TP1 Luharli and TP2 Somna with greater impact potentially at TP1 due to proximity to Ghaziabad. This is one of the impacts that is expected to be recovered in the immediate forecast period.

- **Slump in regional economy due to regulatory changes/Environmental Impact:** We believe this impact has primarily affected local/regional traffic related to industries located on and in the vicinity of the Asset including Sikandrabad and Khurja. This is also expected to marginally recover in the immediate forecast period. Ban on oil furnaces placed by NGT impacted the industrial production in the region. It is expected that it will take some time for the industry to switch to other sources of fuel and resume production.
- **Network changes due to EPE/WPE completion and state highway networks**: This impact resulted in a positive for TP1 and a negative for TP2 due to the nature of movement provided by the peripheral expressways and recently improved UP state highways to the Rajasthan traffic. The traffic lost due to this impact is expected to be permanent and therefore may not be recovered.

5.21 The table below shows the impacts historically and how this is foreseen to play out in the immediate forecast period.

Table 5.4: Impacts in FY19/FY20 and expected play-out in the immediate forecast period

TP#	Direction of impact			
	Historical FY19/FY20		Forecast	
	Local/regional	Long-distance	Local/regional	Long-distance
TP1 Luharli				
Network shift	↑	↓		
Environmental regulation	↓	Nil	Good recovery	Good recovery
Economic slowdown	↓	↓	Strong recovery	Strong recovery
TP2 Somna				
Network shift	↓	↑		
Environmental regulation	↓	Nil	Good recovery	Good recovery
Economic slowdown	↓	↓	Strong recovery	Strong recovery

Source: Steer analysis

5.22 We believe 3A to grow slower as compared to MAV due to a shift, as there is an increasing preference seen for MAVs instead of 3As for long-distance movements. This is because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are likely certain commodities or movements which are best served by 3As.

5.23 Considering the above points and the expected ramp-up of recovery from the economic slowdown and environmental regulations, we estimate that 3A will grow at elasticities of 0.3 while MAVs will grow at 0.5 with respect to India GDP at both toll plazas through the forecast period, respectively.

Forecasts for background elasticities

5.24 The below table presents a summary of the results of the regression analysis carried out on the historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.25 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000

people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle type	Growth driver	History		Forecast
		Derived elasticity	Years considered	Assumed forecast elasticity
TP1 Luharli				
Car	GSDP UP	1.33	FY17-FY20	1.10
LCV	GSDP UP	0.96	FY17-FY20	0.60
Bus	GSDP UP	1.04	FY17-FY20	0.40
2A	GSDP UP	1.04	FY17-FY20	0.50
	GDP Delhi			0.50
	GDP			0.50
3A	GSDP UP	1.04	FY17-FY20	0.30
	GDP Delhi			0.30
	GDP			0.30
MAV	GSDP UP	1.04	FY17-FY20	0.70
	GDP Delhi			0.70
	GDP			0.70
TP2 Somna				
Car	GSDP UP	1.17	FY17-FY20	1.0
LCV	GSDP UP	0.77	FY17-FY20	0.50
Bus	GSDP UP	0.95	FY17-FY20	0.40
2A	GSDP UP	0.95	FY17-FY20	0.50
	GDP			0.50
3A	GSDP UP	0.80	FY17-FY20	0.30
	GDP			0.30
MAV	GSDP UP	0.80	FY17-FY20	0.70
	GDP			0.70

Source: Steer analysis of Client data

Forecasts for growth drivers

5.26 Following the discussion in Chapter 4 on the nature of economic activity in the state of Uttar Pradesh, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth.

National GDP

5.27 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 being 4%. Related events to the economic slowdown

include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.28 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in chart below.

5.29 Based on that, GDP is forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.30 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

Uttar Pradesh GSDP

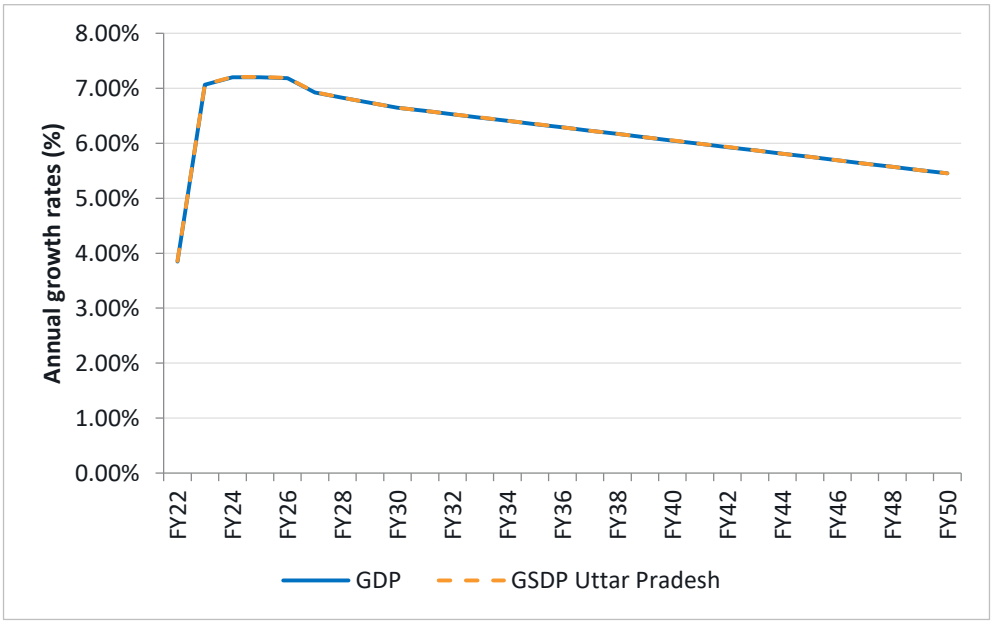
5.31 As per Client projections, Uttar Pradesh GSDP is in line with the national trend, during the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.32 There are significant investments expected to take place as part of the states' plans and Uttar Pradesh is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher-than-expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost the states' economy.

5.33 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.34 The GDP-GSDP lines have the same trends during the concession period. The chart below shows the forecast growth lines for GDP and Uttar Pradesh GSDP.

Figure 5.7: GDP-GSDP forecast



Source: GDP forecast provided by Client; GSDP forecast by Steer based on Client GDP

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of background growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years.

6.2 The following table lists key intermediate and final outputs that have presented in chapter 5 and 6.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Background historical elasticities with respect to growth drivers	Chapter 3, 5, Appendix B
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix B
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer

6.3 All traffic is presented as AADT by vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Though FY35 is the last year of concession, we have developed our forecasts until FY35 for the Client's reference.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied monthly traffic the seasonality – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3), excluding the years that were impacted by specific events. The averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 The seasonality factors assumed for individual vehicle types for each toll plaza are shown in the table below.

Table 6.2: Seasonality correction factors for TP1-Luharli

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.94	1.06	0.93	1.03	1.11	1.18	1.11	0.88	1.05	1.03	0.82	0.99
LCV	1.02	1.05	0.95	1.06	1.02	1.03	1.03	0.96	1.03	1.09	0.92	1.01
Bus	1.02	1.05	0.95	1.06	1.02	1.03	1.03	0.96	1.03	1.09	0.92	1.01
2A	1.02	1.05	0.95	1.06	1.02	1.03	1.03	0.96	1.03	1.09	0.92	1.01
MAV	0.91	0.95	0.95	1.06	1.07	1.05	1.10	0.95	1.00	1.04	0.92	1.08

Source: Steer analysis of Client TMS data

Table 6.3: Seasonality correction factors for TP2-Somna

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.94	1.06	0.93	1.03	1.11	1.18	1.11	0.88	1.05	1.03	0.82	0.99
LCV	1.02	1.04	0.96	1.08	1.06	1.03	1.03	0.96	1.06	1.04	0.92	1.05
Bus	1.02	1.04	0.96	1.08	1.06	1.03	1.03	0.96	1.06	1.04	0.92	1.05
2A	1.02	1.04	0.96	1.08	1.06	1.03	1.03	0.96	1.06	1.04	0.92	1.05
MAV	0.92	0.95	0.96	1.05	1.08	1.03	1.00	0.94	0.99	1.07	0.98	1.13

Source: Steer analysis of Client TMS data

Base year FY22 AADT estimates

6.8 As discussed earlier in chapter 1 and 3, The second wave of COVID-19 infections peaked in the in the months of April and May 2021. The largest impact of the wave was visible on passenger

vehicles mainly CJV and buses. However, goods vehicles continued to operate on near normal volumes. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.9 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. Similarly, as you can see in the below table the Q3FY22 volumes for 3A and MAV have seen a onetime jump, which was not observed in Q4FY22, hence Q3FY22 has not been included in AADT estimation for 3A and MAV. The adopted AADT for FY22 is presented below:

Table 6.4: Monthly MADT and base year FY22 AADT estimation for TP1 Luharli

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	17,014	20,706	19,149	17,042	20,995	19,828	18,788
LCV	1,727	1,574	1,641	1,513	1,698	1,641	1,639
Minibus	107	135	107	82	106	97	106
Bus	1,629	1,955	1,730	1,552	1,271	1,778	1,659
2A	1,191	1,118	1,106	1,037	1,226	1,177	1,146
3A	1,036	980	900	758	834	806	849
MAV	2,425	2,373	2,154	1,891	2,016	2,026	2,061
Total AADT	**25,128**	**28,840**	**26,787**	**23,873**	**28,145**	**27,353**	**26,249**
PCU#	**39,994**	**43,902**	**40,671**	**36,225**	**40,893**	**40,956**	**39,732**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV, Jan-21 has been excluded for the AADT determination of CJVs and Buses

Table 6.5: Monthly MADT and base year FY22 AADT estimation for TP2 Somna plaza

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	6,438	6,830	7,091	5,912	5,984	6,433	6,448
LCV	867	732	855	744	725	823	791
Minibus	84	109	105	68	82	85	89
Bus	1,145	1,317	1,256	1,125	813	1,298	1,159
2A	1,046	932	1,041	958	969	1,121	1,011
3A	863	764	774	738	708	819	778
MAV	1,508	1,400	1,394	1,262	1,209	1,365	1,357
Total AADT	**11,950**	**12,084**	**12,517**	**10,808**	**10,490**	**11,945**	**11,632**
PCU#	**22,411**	**22,133**	**22,725**	**20,102**	**18,985**	**22,387**	**21,457**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV, Jan-21 has been excluded for the AADT determination of CJVs and Buses

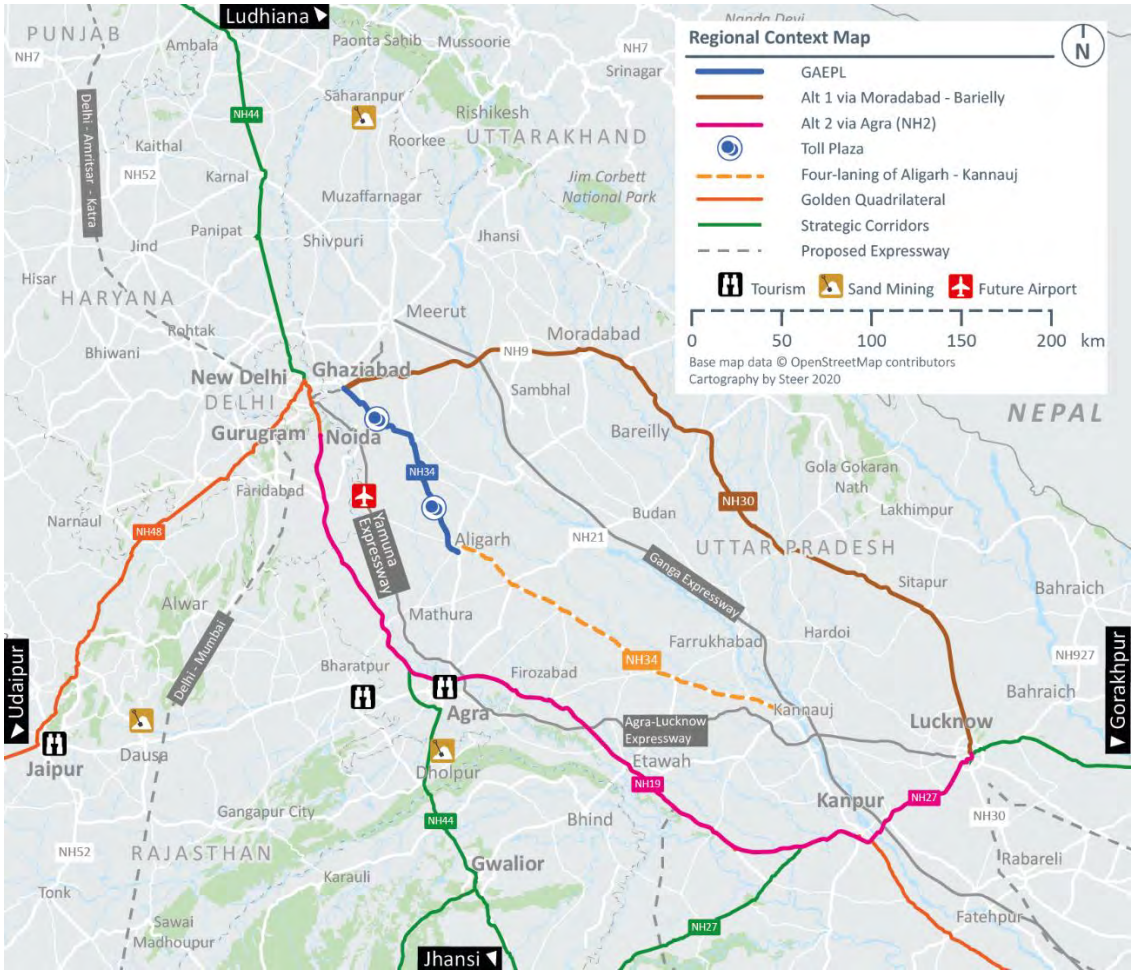
Analysis of potential impacts

Alternate routes and improvements

6.10 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in Chapter 2, in order to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.11 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset shown against the regional network context



Source: Steer analysis and cartography

6.12 Apart from the ongoing slump in traffic growth due to COVID-19, slowdown in regional industry and the national economy, network developments include the ongoing four-laning of Aligarh-Kannauj, planned six-laning of the Asset and implementation of check plaza on micro-diversion road. The following table presents the upcoming network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6.6: List of network/other developments

S. No.	Development	Route affected/ nature of impact	Year of completion	Impact (+/-)	
				TP1 Luharli	TP2 Somna
1.	Four-laning of Aligarh-Kannauj	Trips between Delhi/west/northwest and Lucknow/east	FY24	+ve	+ve
2.	Six-laning of Asset	Trips between Delhi/west/northwest and Lucknow/east	FY25	+ve	+ve
3.	THDC Khurja thermal Plant	Fly ash related movement from the thermal plant	FY24	+ve	
4.	Pahasu alternate alignment	Diversion to Pahasu road between Khurja and Aligarh, loss during GAEPL 6 laning and gain due to improved LOS	FY25		+ve
5.	Ganga expressway	Trips between Delhi/North and Lucknow/east	FY26	-ve	-ve

Source: Steer analysis

Impact assessment for network/other developments

6.13 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated from each of these. Please note that all traffic volumes for impacts were estimated as impact rates applied on FY21 AADT.

Four-laning of Aligarh-Kannauj and Six-laning of Asset

6.14 The long-distance traffic on the Asset, which is part of the Ghaziabad-Aligarh-Lucknow east-west corridor, is affected by any major upgrades to these east-west corridors. The ongoing four-laning of Aligarh-Kannauj section of the corridor, when completed, would improve the level of service compared to the alternate corridor via NH2 through Agra. The table below summarises the impact due to four laning of Aligarh Kannauj.

6.15 In addition, assuming six-laning of the Asset by FY25, this capacity augmentation would further add to this improvement in service levels. We have used a GJC-based logit model approach to estimate the potential shift from the Delhi-Moradabad-Lucknow corridor to the Asset corridor. The table below presents the positive impact of completion of 6 laning of the asset.

Table 6.7: Impact of six-laning of asset and four laning of Aligarh-Kannauj

Vehicle type	TP1 Luharli		TP2 Somna	
	FY25	FY26 onwards	FY25	FY26 onwards
CJV	1.3%	2.6%	1.3%	2.6%
LCV	1.0%	2.0%	1.0%	2.0%
2A	0.5%	1.0%	0.5%	1.0%
3A	0.9%	1.3%	2.3%	1.6%
MAV	0.9%	3.0%	1.1%	3.9%

Source: Steer analysis of Client OD data and publicly available information.

THDC Khurja super thermal power project

6.16 Khurja super thermal power project or Khurja STPS is a proposed 1320-megawatt, coal-fired supercritical power plant planned to be built at Khurja in Bulandshahr, Uttar Pradesh, India. It is expected to be completed by FY24. The thermal plants generate fly ash as residue of burning coal which is used in construction and manufacturing of cement and bricks. The THDC plant is expected to generate Fly ash carrying traffic and we have estimated the impact as shown in the table below, using a GJC-based logit model.

Table 6.8: Impact of THDC Khurja super thermal power project

Vehicle type	TP1 Luharli			
	FY24	**FY25**	**FY26**	**FY27 onwards**
LCV	1.0%	1.3%	1.6%	1.9%
2A	2.8%	3.6%	4.4%	5.1%
3A	0.8%	1.1%	1.3%	1.5%

Source: Steer analysis of Client OD data and publicly available information.

Pahasu alternate

6.17 The Aligarh Chattari Road was upgraded to 2 lane with paved shoulder in FY20 thereby improving level of service. The traffic movement on the asset between Khurja and Aligarh has an option to take state highway via Pahasu and Chattari for trips between Khurja/north of Khurja and Aligarh/west/east of Aligarh. There is no toll on Pahasu alternate, and traffic can bypass TP2 Somna while taking that alignment. As discussed, the Asset is expected to undergo 6 laning in FY23 and FY24. Although the travel patterns between the alternate and the Asset are now matured, during construction we expect a proportion of the in-scope traffic to shift to the alternate however, post the construction once the LOS improves, we believe additional traffic will prefer to use the Asset instead of the alternate.

6.18 The table below presents the negative impact of traffic diverting to alternate road from TP2 Somna.

Table 6.9: Impact of Pahasu alternate on TP2 Somna

Vehicle Category	TP2 Somna	
	FY25	**FY26 onwards**
LCV	1.0%	1.3%
2A	1.8%	2.4%
3A	1.1%	1.3%
MAV	0.6%	0.6%

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Ganga Expressway

6.19 The Ganga Expressway is a 596-km long greenfield expressway being developed to provide an improved level of service to long-distance traffic between western and eastern India. Competing with the traditional route using the Asset, the upcoming Ganga Expressway could provide faster and unhindered connectivity, as illustrated in the map above.

6.20 We have considered North-east movements for this impact for long distance traffic between Delhi/North of Delhi and Lucknow/east of Lucknow towards east, as these have distinct cost comparisons between the Asset corridor and the upcoming expressway. The route through the expressway provides a competitive route for long-distance traffic from Delhi and west to reach Lucknow and east. While toll costs are favourable for the Asset route, distance and time costs are lower on the expressway.

6.21 Assuming successful implementation of all the sections of both the expressway, we have estimated the impact as shown in the table below, using a GJC-based logit model.

Table 6.10: Impact of Ganga Expressway

Vehicle type	TP1 Luharli		TP2 Somna	
	FY26	FY27 onwards	FY26	FY27 onwards
2A	(1.2%)	(2.5%)	(3.2%)	(6.5%)
3A	(1.6%)	(3.2%)	(3.1%)	(6.3%)
MAV	(1.3%)	(2.5%)	(3.6%)	(7.3%)

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Summary of impact assessments

6.22 The table below summarises the potential impacts on the Asset due to the several ongoing and foreseen improvements on the alternate routes, the Asset route and other regulatory developments.

Table 6.11: Summary of impact assessments

Impact	Year of impact	Probability/ scale of impact	In-scope traffic	Magnitude of impact	
				TP1 Luharli	TP2 Somna
Four-laning of Aligarh-Kannauj and six-laning of Asset (b)	FY24 onwards	Medium	Trips between Delhi/west/ north-west	CJV: +2.6% LCV: +2.0% 3A: +1.3% MAV: +3.0%	CJV: +2.6% LCV: +2.0% 3A: +1.6% MAV: +3.9%
THDC Khurja super thermal power project	FY24 onwards	Medium	Fly ash related movement from the thermal plant	LCV: +1.9% 2A: +5.1% 3A: +1.5%	
Pahasu alternate (b)	FY25 onwards	Low	Trips between Khurja and Aligarh		LCV: +1.3% 2A: +2.4% 3A: +1.3% MAV: +0.6%
Ganga Expressway (b)	FY26 onwards	Medium	Trips between Delhi/North and Lucknow/east	2A: -2.5% 3A: -3.2% MAV: -2.5%	2A: -6.5% 3A: -6.3% MAV: -7.3%

Source: Steer analysis of OD data, Client TMS data and publicly available information; a – staged in three years 25%, 50% and 100%, b – staged in two years 50% and 100%

Revenue forecasting assumptions

6.23 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e. traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e. the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip Factors

6.24 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY22 data available and listed in the table below:

Table 6.12: Trip factors for the forecast years for TP1 Luharli

Vehicle category	CJV	Mini Bus	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	45	48.2	48.7	48.2	48.7	45	45	45
Local	27.4	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

Table 6.13: Trip factors for the forecast years for TP2 Somna

Vehicle category	CJV	Mini Bus	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	45	45	43.4	45	43.4	45	45	45
Local	15	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

6.25 There is no major toll category being charged, apart from the official list of toll categories in the toll notification. This assumes that further changes in toll categories, unless specific discounts are offered, are unlikely.

Toll Segmentation

6.26 We have analysed the historical TMS data split by ticket categories, to understand trends, as shown in Chapter 3. For the traffic and revenue forecast, we believe that the ticket segmentation from Oct-21 to Mar-22 is a good representative of the segmentation for the Asset. As per the historical analysis we have also observed that the ticket segmentation of the Asset has been stabilised over the Q3FY22 and Q4FY22. We believe with FASTag penetration stabilising and reaching upto 100% in MAVs and minimal impact of COVID-19 during these

months, Oct-Mar FY22 segmentation provide us with stable toll segmentation which can be used for the forecast years.

6.27 The table below provides the toll segmentation assumed for the period of forecast

Table 6.14: Toll segmentation for FY22, TP1 Luharli

Ticket type	CJV	Mini Bus	Bus	LCV	2A	3A	MAV	OSV
Single	19%	18%	8%	29%	56%	63%	54%	39%
Return	24%	57%	91%	46%	37%	23%	40%	60%
Monthly	0%	8%	0%	1%	0%	0%	0%	0%
Local	9%	0%	0%	0%	0%	0%	0%	0%
Exemptions	47%	17%	1%	24%	7%	14%	6%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%

Source: Steer analysis of Client TMS data

Table 6.15: Toll segmentation for FY22, TP2 Somna

Ticket type	CJV	Mini Bus	Bus	LCV	2A	3A	MAV	OSV
Single	32%	15%	10%	54%	73%	87%	85%	93%
Return	34%	32%	89%	45%	26%	13%	15%	7%
Monthly	0%	0%	0%	0%	0%	0%	0%	0%
Local	10%	0%	0%	0%	0%	0%	0%	0%
Exemptions	25%	53%	1%	1%	1%	0%	0%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%

Source: Steer analysis of Client TMS data

6.28 As discussed earlier in Chapter 3, TP1 Luharli has more reported exemptions (including forced exemptions) (except mini-bus category) compared to TP2 Somna due to proximity to the urban area of Ghaziabad and high proportion of local traffic.

Toll evolution

6.29 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.30 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.16: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.3%
FY24	5.6%
FY25	5.4%

Financial year	WPI growth (%)
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY33 onwards	4.0%

Source: Shared by client, *FY23 WPI as per the latest March 2022 WPI released by RBI The table below gives an overview of toll estimation.

Revenue reconciliation

6.31 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset. To reconcile we have used the segmentation Oct-Mar FY22 average, MADT of the month and compared it with the reported revenue for that month. The exercise was undertaken for Feb and Mar 2022. The comparison, as shown in the table below, depicts the modelled revenue vs the reported revenue difference, and the difference lies within 0.8%, this gives us the confidence in the assumptions around segmentation and trip factors for future forecast purposes:

Table 6.17: Revenue reconciliation summary (INR Lakhs)

Asset	Modelled Feb-22	Actual Feb-22	Difference (%)	Modelled Mar-22	Actual Mar-22	Difference (%)
TP-1 Luharli	939.4	946.7	(0.8%)	1059.7	1065.29	(0.5%)
TP-2 Somna	857.0	857.8	(0.1%)	961.95	968.05	(0.6%)

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.32 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.18: Traffic forecast (With Impacts) for TP1 Luharli

Vehicle Type	FY22*	FY23	FY27	FY30	FY35	FY40
CJV	17,516	18,931	26,565	33,228	47,486	66,217
LCV	1,570	1,638	2,017	2,276	2,762	3,315
Minibus	101	104	117	127	144	163
Bus	1,614	1,661	1,864	2,023	2,305	2,606
2A	1,052	1,090	1,302	1,441	1,694	1,973
3A	832	850	922	980	1,081	1,185
MAV	1,865	1,958	2,396	2,757	3,449	4,265
AADT	**24,551**	**26,233**	**35,183**	**42,832**	**58,921**	**79,725**
PCU	**37,181**	**39,343**	**50,590**	**60,012**	**79,404**	**103,962**

Source: Steer analysis, FY22* Normalised AADT

Table 6.19: Traffic growth CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	8.1%	8.8%	7.7%	7.4%	7.67%
LCV	4.3%	5.3%	4.1%	3.9%	4.24%
Mini Bus	2.9%	2.9%	2.7%	2.6%	2.68%
Bus	2.9%	2.9%	2.8%	2.6%	2.70%
2A	3.6%	4.5%	3.4%	3.3%	3.55%
3A	2.2%	2.1%	2.1%	2.0%	1.99%
MAV	5.0%	5.2%	4.8%	4.6%	4.70%
AADT	**6.8%**	**7.6%**	**6.8%**	**6.6%**	**6.76%**
PCU	**5.8%**	**6.5%**	**5.9%**	**5.8%**	**5.88%**

Source: Steer analysis

Table 6.20: Revenue forecast (With Impacts) for TP1 Luharli (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	30.5	36.0	61.7	90.4	159.7	279.2
Bus	7.0	8.0	12.2	15.9	24.1	36.2
Mini Bus	0.5	0.5	0.7	0.9	1.3	1.8
LCV	17.4	19.8	27.4	34.4	49.0	69.3
2A	12.6	14.3	21.1	27.0	39.7	57.9
3A	14.6	16.5	21.9	26.9	37.1	50.9
MAV	**34.4**	**39.8**	**59.8**	**79.4**	**124.2**	**192.1**
Total Revenue	**116.9**	**135.0**	**205.0**	**274.9**	**435.1**	**687**

Source: Steer analysis

Table 6.21: Revenue growth CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	18.2%	14.4%	13.6%	12.1%	13.09%
Bus	15.3%	11.1%	9.2%	8.6%	9.58%
Mini Bus	13.7%	8.5%	7.8%	7.3%	7.94%
LCV	13.4%	8.4%	7.9%	7.3%	7.96%
2A	14.2%	10.2%	8.5%	8.0%	8.86%
3A	12.5%	7.5%	7.0%	6.6%	7.18%
MAV	15.7%	10.7%	9.9%	9.4%	10.03%
Total	**15.4%**	**11.0%**	**10.3%**	**9.6%**	**10.34%**

Source: Steer analysis

Table 6.22: Traffic forecast (With Impacts) for TP2 Somna

Vehicle Type	FY22*	FY23	FY27	FY32	FY35	FY40
CJV	6,206	6,645	8,979	10,919	14,939	20,153
LCV	744	770	915	1,011	1,185	1,380
Minibus	80	83	92	100	114	128
Bus	1,110	1,142	1,278	1,384	1,572	1,776
2A	926	959	1,069	1,180	1,384	1,611
3A	732	747	785	834	918	1,006
MAV	1,210	1,270	1,498	1,720	2,146	2,652
AADT	**11,008**	**11,615**	**14,616**	**17,148**	**22,258**	**28,705**
PCU	**20,068**	**21,002**	**25,235**	**28,922**	**36,175**	**45,065**

Source: Steer analysis, FY22* Normalised AADT

Table 6.23: Traffic growth CAGR (%) for TP2 Somna

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	7.1%	7.8%	6.7%	6.5%	6.76%
LCV	3.5%	4.4%	3.4%	3.2%	3.49%
Minibus	2.8%	2.9%	2.7%	2.6%	2.64%
Bus	2.8%	2.9%	2.7%	2.6%	2.64%
2A	3.5%	2.7%	3.4%	3.2%	3.12%
3A	2.1%	1.3%	2.0%	1.9%	1.79%
MAV	4.9%	4.2%	4.7%	4.5%	4.46%
AADT	**5.5%**	**5.9%**	**5.4%**	**5.3%**	**5.6%**
PCU	**4.7%**	**4.7%**	**4.6%**	**4.5%**	**4.6%**

Source: Steer analysis

Table 6.24: Revenue forecast (With Impacts) for TP2 Somna (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	21.0	24.7	40.9	57.7	98.4	166.6
Bus	5.8	6.6	9.7	12.3	18.1	26.3
Minibus	0.3	0.3	0.4	0.5	0.8	1.1
LCV	15.4	17.4	24.0	30.0	42.6	60.1
2A	15.4	17.5	24.2	30.8	45.0	65.6
3A	19.2	21.6	27.9	34.2	47.0	64.5
MAV	31.6	36.5	53.1	70.3	109.6	169.4
Total Revenue	**108.7**	**124.8**	**180.3**	**235.8**	**361.5**	**554**

Source: Steer analysis

Table 6.25: Revenue growth CAGR (%) for TP2 Somna

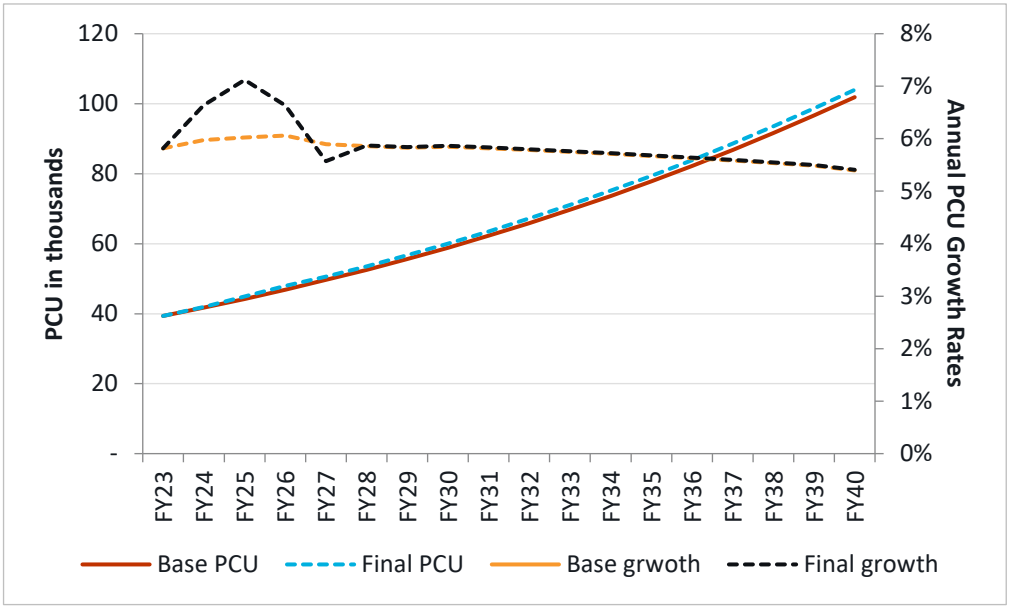
Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	17.6%	13.5%	12.1%	11.3%	12.20%
Bus	14.4%	9.9%	8.3%	8.0%	8.76%
Mini Bus	13.8%	8.3%	7.6%	7.3%	7.88%
LCV	13.3%	8.3%	7.7%	7.3%	7.86%
2A	14.1%	8.4%	8.3%	7.9%	8.39%
3A	12.4%	6.7%	7.0%	6.6%	6.97%
MAV	15.5%	9.8%	9.8%	9.3%	9.77%
Total	**14.8%**	**9.6%**	**9.4%**	**8.9%**	**9.47%**

Source: Steer analysis

6.33 As presented in the table above, for TP1 Luharli, CAGRs (FY22-FY35) in terms of PCUs is around 6.0%, the corresponding CAGRs in terms of revenue being 10.6%. At TP2 Somna, the final (background & impacts) growth rates in terms of PCUs are 4.6% while the corresponding CAGRs in terms of revenue being around 9.7%.

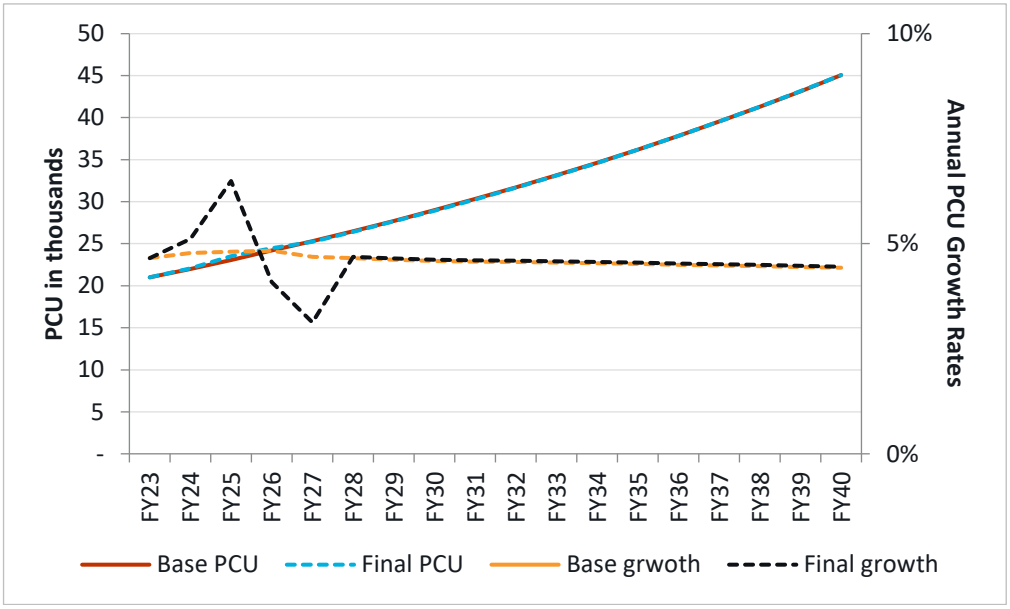
6.34 While the background growth is primarily driven by car growth and MAVs to some extent, the major uplift in final growth rates (as also seen in the chart below) is driven by the estimated impacts due to implementation of check plaza on the micro-diversion road in FY21 (for TP1 Luharli), and the combined impact of four-laning Aligarh-Kannauj road section and six-laning of Asset, both modelled to set in during FY26. For this Asset, the growth in CJVs can also be rationalised by the presence of large urban settlements and cater to the passenger traffic of settlements like Delhi, Ghaziabad, Bulandshahr and traffic destined to Lucknow, Kanpur, Etah etc. For TP-1 the MAV growth (CAGR) of around 5.7% for the remaining concession as this Asset caters to the local freight demand and for TP-2 this CAGR is around 5.4% which caters toa major share of agricultural and fast moving consumer goods (FMCG) traffic traveling between Haryana, Punjab and Uttar Pradesh along with industrial traffic between Meerut, Aligarh, Kanpur, and Lucknow

Figure 6.2: Traffic and growth rates for forecast PCUs - Background and final, TP1



Source: Steer analysis

Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP2



Source: Steer analysis

Upside and Downside Cases

6.35 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.36 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices.

However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.37 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.26: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
NDEPL	GDP/GSDP	+1% every year	-1% every year
NDEPL	WPI	+1% every year	-1% every year
NDEPL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.38 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.39 The upside case impacts included in forecasts are summarised in below:

Table 6.27: Summary of impacts on the Assets

Impact	4 laning of Aligarh-Kannauj + Six laning of the Asset	THDC Khurja Super Thermal Power Plant	Pahasu Alternate	Ganga Expressway
Year	**FY24 Onwards**	**FY24 Onwards**	**FY25 onwards**	**FY26 onwards**
TP-1	CJV: 3.2% LCV: 2.5% 2A: 1.3% 3A: 1.7% MAV:3.8%	LCV: 2.3% 2A: 6.4% 3A: 1.9%		2A: -3.1% 3A: -4.0% MAV: -3.2%
TP-2	CJV: 3.2% LCV: 2.5% 2A: 1.3% 3A: 2.0% MAV:4.8%		LCV: 1.6% 2A: 2.3% 3A: 1.4% MAV: 0.7%	2A: -8.1% 3A: -7.9% MAV: -9.2%

Source: Steer analysis of OD data, and publicly available information

6.40 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.41 The downside case impacts included in forecasts are summarised in below:

Table 6.28: Summary of impacts on the Assets

Impact	4 laning of Aligarh-Kannauj + Six laning of the Asset	THDC Khurja Super Thermal Power Plant	Pahasu Alternate	Ganga Expressway
Year	**FY26 Onwards**	**FY25 Onwards**	**FY26 onwards**	**FY26 onwards**
TP-1	CJV: 3.2% LCV: 2.5% 2A: 1.3% 3A: 1.7% MAV:3.8%	LCV: 1.4% 2A: 3.8% 3A: 1.1%		2A: -1.9% 3A: -2.4% MAV: -1.9%
TP-2	CJV: 3.2% LCV: 2.5% 2A: 1.3% 3A: 2.0% MAV:4.8%		LCV: 1.0% 2A: 1.8% 3A: 1.0% MAV: 0.4%	2A: -4.9% 3A: -4.7% MAV: -5.5%

Source: Steer analysis of OD data, and publicly available information

6.42 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.43 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case. Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.29: Traffic forecast (With Upside Impacts) for TP1 Luharli

Vehicle Type	FY22*	FY23	FY27	FY30	FY35	FY40
CJV	17,516	19,284	29,329	38,751	60,593	92,268
LCV	1,570	1,655	2,144	2,496	3,185	4,017
Minibus	101	105	121	134	158	185
Bus	1,614	1,673	1,931	2,140	2,523	2,950
2A	1,052	1,100	1,373	1,558	1,911	2,321
3A	832	854	946	1,022	1,156	1,300
MAV	1,865	1,982	2,548	3,038	4,029	5,276
AADT	**24,551**	**26,654**	**38,393**	**49,138**	**73,555**	**108,317**
PCU	**37,181**	**39,885**	**54,579**	**67,705**	**96,770**	**137,128**

Source: Steer analysis, FY22* Normalised AADT

Table 6.30: Traffic growth (With upside Impacts) CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	10.1%	11.1%	9.7%	9.4%	9.67%
LCV	5.4%	6.7%	5.2%	5.0%	5.36%
Mini Bus	3.6%	3.6%	3.5%	3.3%	3.39%
Bus	3.6%	3.6%	3.5%	3.4%	3.41%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
2A	4.5%	5.7%	4.3%	4.2%	4.49%
3A	2.7%	2.6%	2.6%	2.5%	2.51%
MAV	6.3%	6.5%	6.0%	5.8%	5.95%
AADT	**8.6%**	**9.6%**	**8.6%**	**8.4%**	**8.60%**
PCU	**7.3%**	**8.2%**	**7.4%**	**7.4%**	**7.52%**

Source: Steer analysis

Table 6.31: Revenue forecast (With Upside Impacts) for TP1 Luharli (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	30.5	36.7	69.9	108.6	220.8	440.8
Bus	7.0	8.1	13.3	18.3	30.2	49.7
Mini Bus	0.5	0.5	0.8	1.0	1.5	2.4
LCV	17.4	19.9	29.1	38.0	58.1	88.6
2A	12.6	14.5	22.9	30.5	48.5	76.9
3A	14.6	16.5	23.1	29.4	43.1	63.2
MAV	34.4	40.3	65.2	91.6	157.4	268.7
Total Revenue	**116.9**	**136.6**	**224.2**	**317.4**	**559.7**	**990**

Source: Steer analysis

Table 6.32: Revenue growth (With upside Impacts) CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	20.4%	17.5%	15.8%	15.2%	16.00%
Bus	16.5%	13.2%	11.2%	10.5%	11.53%
Mini Bus	14.5%	9.9%	9.3%	8.8%	9.44%
LCV	14.3%	9.9%	9.3%	8.9%	9.44%
2A	15.2%	12.1%	10.1%	9.7%	10.59%
3A	13.1%	8.7%	8.4%	8.0%	8.47%
MAV	17.1%	12.8%	12.0%	11.4%	12.11%
Total	**16.8%**	**13.2%**	**12.3%**	**12.0%**	**12.60%**

Source: Steer analysis

Table 6.33: Traffic forecast (With Upside Impacts) for TP2 Somna

Vehicle Type	FY22*	FY23	FY27	FY32	FY35	FY40
CJV	6,206	6,757	9,826	12,555	18,633	27,236
LCV	744	777	963	1,092	1,335	1,620
Minibus	80	83	96	106	124	145
Bus	1,110	1,150	1,323	1,463	1,720	2,009
2A	926	967	1,107	1,255	1,535	1,862
3A	732	751	799	862	973	1,094

Vehicle Type	FY22*	FY23	FY27	FY32	FY35	FY40
MAV	1,210	1,285	1,579	1,878	2,484	3,249
AADT	**11,008**	**11,770**	**15,694**	**19,210**	**26,804**	**37,215**
PCU	**20,068**	**21,241**	**26,743**	**31,798**	**42,377**	**56,384**

Source: Steer analysis, FY22* Normalised AADT

Table 6.34: Traffic growth (With upside Impacts) CAGR (%) for TP2 Somna

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	8.9%	9.8%	8.5%	8.2%	8.56%
LCV	4.4%	5.5%	4.3%	4.1%	4.42%
Minibus	3.6%	3.6%	3.4%	3.3%	3.35%
Bus	3.6%	3.6%	3.4%	3.3%	3.35%
2A	4.4%	3.4%	4.3%	4.1%	3.95%
3A	2.7%	1.6%	2.6%	2.5%	2.26%
MAV	6.2%	5.3%	6.0%	5.8%	5.64%
AADT	**6.9%**	**7.5%**	**7.0%**	**6.9%**	**7.00%**
PCU	**5.8%**	**5.9%**	**5.9%**	**5.9%**	**5.91%**

Source: Steer analysis

Table 6.35: Revenue forecast (With upside Impacts) for TP2 Somna (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	21.0	25.1	46.0	69.0	133.9	254.0
Bus	5.8	6.7	10.5	14.0	22.2	35.0
Minibus	0.3	0.3	0.5	0.6	0.9	1.4
LCV	15.4	17.5	25.4	33.2	50.5	77.0
2A	15.4	17.7	25.7	34.2	54.2	85.9
3A	19.2	21.7	29.1	37.0	54.2	79.4
MAV	31.6	37.0	57.4	80.4	137.7	235.0
Total Revenue	**108.7**	**126.1**	**194.5**	**268.4**	**453.6**	**768**

Source: Steer analysis

Table 6.36: Revenue growth (With upside Impacts) CAGR (%) for TP2 Somna

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	19.6%	16.3%	14.5%	14.2%	14.86%
Bus	15.4%	11.8%	10.1%	9.7%	10.50%
Mini Bus	14.6%	9.7%	9.2%	8.9%	9.37%
LCV	14.1%	9.7%	9.3%	8.8%	9.36%
2A	15.1%	9.7%	10.1%	9.7%	10.03%
3A	13.0%	7.7%	8.3%	7.9%	8.21%
MAV	16.9%	11.6%	11.9%	11.4%	11.79%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
Total	**16.0%**	**11.5%**	**11.3%**	**11.1%**	**11.47%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.44 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.45 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.37: Traffic forecast (With Downside Impacts) for TP1 Luharli

Vehicle Type	FY22*	FY23	FY27	FY30	FY35	FY40
CJV	17,516	18,616	24,269	28,888	38,062	49,039
LCV	1,570	1,623	1,903	2,093	2,428	2,788
Minibus	101	104	113	121	133	146
Bus	1,614	1,651	1,805	1,923	2,126	2,333
2A	1,052	1,082	1,235	1,342	1,519	1,705
3A	832	846	900	945	1,018	1,092
MAV	1,865	1,937	2,267	2,526	2,999	3,523
AADT	**24,551**	**25,858**	**32,492**	**37,838**	**48,286**	**60,627**
PCU	**37,181**	**38,860**	**47,210**	**53,862**	**66,606**	**81,416**

Source: Steer analysis, FY22* Normalised AADT

Table 6.38: Traffic growth (With Downside Impacts) CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	6.3%	6.9%	6.0%	5.7%	5.89%
LCV	3.3%	4.1%	3.2%	3.0%	3.24%
Mini Bus	2.2%	2.2%	2.1%	2.0%	2.05%
Bus	2.2%	2.3%	2.1%	2.0%	2.07%
2A	2.8%	3.4%	2.8%	2.5%	2.72%
3A	1.7%	1.6%	1.6%	1.5%	1.52%
MAV	3.9%	4.0%	3.7%	3.5%	3.60%
AADT	**5.3%**	**5.9%**	**5.2%**	**5.0%**	**5.15%**
PCU	**4.5%**	**5.0%**	**4.5%**	**4.3%**	**4.45%**

Source: Steer analysis

Table 6.39: Revenue forecast (With Downside Impacts) for TP1 Luharli (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	30.5	35.4	55.8	74.6	118.2	183.2
Bus	7.0	8.0	11.3	14.0	19.6	27.0
Mini Bus	0.5	0.5	0.7	0.8	1.1	1.5

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
LCV	17.4	19.7	26.0	31.3	41.6	54.9
2A	12.6	14.2	19.6	24.1	32.8	44.4
3A	14.6	16.4	21.0	24.8	32.3	41.6
MAV	34.4	39.3	55.4	69.6	99.7	140.8
Total Revenue	**116.9**	**133.5**	**189.9**	**239.1**	**345.3**	**494**

Source: Steer analysis

Table 6.40: Revenue growth (With Downside Impacts) CAGR (%) for TP1 Luharli

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	16.2%	12.0%	10.1%	9.7%	10.48%
Bus	14.2%	9.1%	7.4%	7.0%	7.82%
Mini Bus	12.9%	7.2%	6.3%	6.0%	6.58%
LCV	12.7%	7.2%	6.3%	5.9%	6.58%
2A	13.3%	8.4%	7.0%	6.4%	7.27%
3A	12.0%	6.4%	5.8%	5.4%	5.98%
MAV	14.5%	8.9%	7.9%	7.4%	8.15%
Total	**14.2%**	**9.2%**	**8.0%**	**7.6%**	**8.33%**

Source: Steer analysis

Table 6.41: Traffic forecast (With Downside Impacts) for TP2 Somna

Vehicle Type	FY22*	FY23	FY27	FY32	FY35	FY40
CJV	6,206	6,545	8,271	9,620	12,232	15,356
LCV	744	764	865	934	1,054	1,183
Minibus	80	82	90	95	105	115
Bus	1,110	1,134	1,238	1,316	1,451	1,591
2A	926	952	1,028	1,109	1,253	1,406
3A	732	744	770	806	867	930
MAV	1,210	1,256	1,424	1,584	1,877	2,203
AADT	**11,008**	**11,477**	**13,685**	**15,465**	**18,840**	**22,783**
PCU	**20,068**	**20,790**	**23,897**	**26,517**	**31,388**	**36,950**

Source: Steer analysis, FY22* Normalised AADT

Table 6.42: Traffic growth (With Downside Impacts) CAGR (%) for TP2 Somna

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	5.5%	6.0%	5.2%	4.9%	5.16%
LCV	2.7%	3.1%	2.6%	2.5%	2.61%
Minibus	2.2%	2.2%	2.1%	2.0%	2.02%
Bus	2.2%	2.2%	2.1%	2.0%	2.02%
2A	2.7%	1.9%	2.6%	2.5%	2.34%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
3A	1.6%	0.9%	1.5%	1.5%	1.34%
MAV	3.8%	3.2%	3.6%	3.4%	3.39%
AADT	**4.3%**	**4.5%**	**4.2%**	**4.0%**	**4.12%**
PCU	**3.6%**	**3.5%**	**3.5%**	**3.4%**	**3.45%**

Source: Steer analysis

Table 6.43: Revenue forecast (With Downside Impacts) for TP2 Somna (INR Crores)

Vehicle Type	FY22	FY23	FY27	FY32	FY35	FY40
CJV	21.0	24.3	36.7	48.8	74.6	112.5
Bus	5.8	6.6	9.0	10.9	14.8	20.1
Minibus	0.3	0.3	0.4	0.5	0.7	0.9
LCV	15.4	17.3	22.7	27.3	36.2	47.8
2A	15.4	17.4	22.6	27.6	37.7	50.8
3A	19.2	21.5	26.7	31.7	41.1	52.9
MAV	31.6	36.2	49.3	62.0	88.6	124.9
Total Revenue	**108.7**	**123.6**	**167.4**	**208.7**	**293.7**	**410**

Source: Steer analysis

Table 6.44: Revenue growth (With Downside Impacts) CAGR (%) for TP2 Somna

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY30	FY30-FY35	FY23-FY40
CJV	15.9%	10.9%	9.9%	8.9%	9.78%
Bus	13.5%	8.0%	6.8%	6.3%	7.14%
Mini Bus	13.1%	7.0%	6.3%	5.8%	6.53%
LCV	12.6%	7.0%	6.2%	5.8%	6.51%
2A	13.2%	6.8%	6.8%	6.4%	6.86%
3A	11.9%	5.6%	5.8%	5.4%	5.79%
MAV	14.3%	8.0%	8.0%	7.4%	7.93%
Total	**13.7%**	**7.9%**	**7.6%**	**7.1%**	**7.65%**

Source: Steer analysis

Summary outlook

6.46 Passenger movement on the asset is largely local in nature, connecting the high population density region of Ghaziabad, Luharli, Gabhana, Somna, Aligarh over short-medium distance and cities of Meerut, Muzaffarnagar, Kanpur, Lucknow. Cars are expected to see a healthy growth on the asset following the overall behavioural shift of users away from public transport. Additionally, we have seen a positive shift towards better compliance as a result of compulsory FASTag implementation on the Asset.

6.47 This Asset is unique in nature as both the toll plazas have very different traffic profiles serving key strategic movements specific to each of them where TP1 caters to an industrial demand generated by local centres of Luharli, Sikandrabad, Ghaziabad, Aligarh, Dadri while also serving

to the consumption needs of the Delhi-NCR region. On the other hand, TP2 serves a significant proportion of agricultural and grocery traffic traveling between Haryana, Punjab and Uttar Pradesh along with industrial traffic between Meerut, Aligarh, Kanpur, and Lucknow.

6.48 Plans to develop the dedicated freight corridor and the thermal power plant in the vicinity of the Asset coupled with an overall industrial growth of the region will directly have a positive impact on the Asset.

6.49 It has been observed that even though traffic across the country saw significant impact of COVID 19 impact and dropped to 50-60% of pre-COVID levels during first half of FY21, only to recover during the second half of the year, this Asset saw a growth and subsequent stabilisation of traffic volumes. This was driven by two main reasons: network shifts which are external impacts, and secondly, the nature of commodities and regions being connected by the road. The agricultural and manufacturing goods being transported form a part of essential commodities and are expected to show a healthy growth in the future years as well.

6.50 We expect that the implementation of FASTag rules, will also help in improving the operational efficiency and overall compliance levels on the Asset and overall corridor as a whole which should result in an improved level of service, thereby resulting in an improved level of service for all users.

6.51 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.52 With regards to the short-term background growth, we see the following risk:

- It was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. It can be seen from the FY22 traffic data that the traffic is following the similar trends as seen in the Q3 and Q4FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure has seen a major comeback in the second part of FY22 resulting in increased activity in the corridor.

6.53 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Delhi NCR, Ghaziabad, Aligarh, Lucknow and it being the part of the traditional Grand Trunk Road serving the east-west movement across the country. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Detailed forecasts

A.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

A.2 This section presents the detailed traffic forecasts for the forecast period until FY37. The following two tables show the traffic growth rates and AADT, respectively.

Table A.1: Traffic Forecast (with impacts) over horizon years at TP1 Luharli

	CJV	LCV	Minibus	Bus	2A	3A	MAV	AADT	PCU
FY22	17,516	1,570	101	1,614	1,052	832	1,865	**24,551**	**37,181**
FY23	18,931	1,638	104	1,661	1,090	850	1,958	**26,233**	**39,343**
FY24	20,488	1,728	107	1,710	1,161	906	2,066	**28,167**	**41,953**
FY25	22,461	1,827	111	1,760	1,219	904	2,218	**30,500**	**44,940**
FY26	24,615	1,930	114	1,812	1,264	916	2,313	**32,965**	**47,921**
FY27	26,565	2,017	117	1,864	1,302	922	2,396	**35,183**	**50,590**
FY28	28,641	2,101	120	1,916	1,348	942	2,512	**37,580**	**53,561**
FY29	30,852	2,187	124	1,969	1,394	961	2,632	**40,118**	**56,689**
FY30	33,228	2,276	127	2,023	1,441	980	2,757	**42,832**	**60,012**
FY31	35,756	2,368	130	2,078	1,489	1,000	2,886	**45,707**	**63,512**
FY32	38,439	2,462	134	2,133	1,539	1,020	3,019	**48,747**	**67,195**
FY33	41,284	2,559	137	2,190	1,590	1,040	3,158	**51,958**	**71,067**
FY34	44,298	2,659	141	2,247	1,641	1,060	3,301	**55,347**	**75,134**
FY35	47,486	2,762	144	2,305	1,694	1,081	3,449	**58,921**	**79,404**
FY36	50,854	2,867	148	2,364	1,748	1,102	3,602	**62,684**	**83,882**
FY37	54,409	2,975	152	2,424	1,803	1,122	3,760	**66,644**	**88,575**
FY38	58,156	3,086	156	2,484	1,859	1,143	3,923	**70,806**	**93,488**
FY39	62,101	3,199	159	2,545	1,916	1,164	4,092	**75,176**	**98,627**
FY40	66,217	3,315	163	2,606	1,973	1,185	4,265	**79,725**	**103,962**

Source: Steer analysis

Table A.2 Forecasts (with impacts) for AADT growth rates (%) at TP1 Luharli

Vehicle Category	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total	PCU
FY22	12.9%	(13.9%)	25.0%	7.0%	32.4%	-	(24.2%)	**10.7%**	**9.1%**
FY23	8.1%	4.3%	2.9%	2.9%	3.6%	2.2%	5.0%	**6.8%**	**5.8%**
FY24	8.2%	5.5%	2.9%	2.9%	6.5%	6.7%	5.5%	**7.4%**	**6.6%**
FY25	9.6%	5.7%	2.9%	2.9%	5.0%	(0.2%)	7.4%	**8.3%**	**7.1%**
FY26	9.6%	5.7%	2.9%	2.9%	3.7%	1.3%	4.3%	**8.1%**	**6.6%**
FY27	7.9%	4.5%	2.8%	2.8%	3.0%	0.7%	3.6%	**6.7%**	**5.6%**
FY28	7.8%	4.2%	2.8%	2.8%	3.5%	2.1%	4.8%	**6.8%**	**5.9%**
FY29	7.7%	4.1%	2.7%	2.8%	3.4%	2.1%	4.8%	**6.8%**	**5.8%**
FY30	7.7%	4.1%	2.7%	2.7%	3.4%	2.0%	4.7%	**6.8%**	**5.9%**
FY31	7.6%	4.0%	2.7%	2.7%	3.4%	2.0%	4.7%	**6.7%**	**5.8%**
FY32	7.5%	4.0%	2.7%	2.7%	3.3%	2.0%	4.6%	**6.7%**	**5.8%**
FY33	7.4%	3.9%	2.6%	2.6%	3.3%	2.0%	4.6%	**6.6%**	**5.8%**
FY34	7.3%	3.9%	2.6%	2.6%	3.2%	1.9%	4.5%	**6.5%**	**5.7%**
FY35	7.2%	3.9%	2.6%	2.6%	3.2%	1.9%	4.5%	**6.5%**	**5.7%**
FY36	7.1%	3.8%	2.5%	2.6%	3.2%	1.9%	4.4%	**6.4%**	**5.6%**
FY37	7.0%	3.8%	2.5%	2.5%	3.1%	1.9%	4.4%	**6.3%**	**5.6%**
FY38	6.9%	3.7%	2.5%	2.5%	3.1%	1.9%	4.3%	**6.2%**	**5.5%**
FY39	6.8%	3.7%	2.5%	2.5%	3.1%	1.8%	4.3%	**6.2%**	**5.5%**
FY40	6.6%	3.6%	2.4%	2.4%	3.0%	1.8%	4.2%	**6.1%**	**5.4%**

Source: Steer analysis

Table A.3: Traffic Forecast AADT (with impacts) over horizon years at TP2 Somna

	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total	PCU
FY22	6,206	744	80	1,110	926	732	1,210	**11,008**	**20,068**
FY23	6,645	770	83	1,142	959	747	1,270	**11,615**	**21,002**
FY24	7,124	798	85	1,175	994	777	1,342	**12,293**	**22,076**
FY25	7,736	843	87	1,208	1,053	797	1,456	**13,181**	**23,509**
FY26	8,398	884	90	1,243	1,068	794	1,483	**13,960**	**24,470**
FY27	8,979	915	92	1,278	1,069	785	1,498	**14,616**	**25,235**
FY28	9,593	946	95	1,312	1,105	801	1,570	**15,422**	**26,417**
FY29	10,239	978	97	1,348	1,143	817	1,644	**16,266**	**27,646**
FY30	10,919	1,011	100	1,384	1,180	834	1,720	**17,148**	**28,922**
FY31	11,639	1,044	103	1,420	1,219	850	1,799	**18,074**	**30,254**

	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total	PCU
FY32	12,399	1,078	105	1,457	1,259	867	1,882	**19,047**	**31,644**
FY33	13,201	1,113	108	1,495	1,300	884	1,967	**20,067**	**33,092**
FY34	14,047	1,149	111	1,533	1,342	901	2,055	**21,137**	**34,602**
FY35	14,939	1,185	114	1,572	1,384	918	2,146	**22,258**	**36,175**
FY36	15,878	1,222	117	1,612	1,428	935	2,241	**23,433**	**37,814**
FY37	16,868	1,260	119	1,652	1,472	953	2,338	**24,663**	**39,520**
FY38	17,909	1,299	122	1,693	1,518	970	2,439	**25,950**	**41,296**
FY39	19,003	1,339	125	1,734	1,564	988	2,544	**27,297**	**43,143**
FY40	20,153	1,380	128	1,776	1,611	1,006	2,652	**28,705**	**45,065**

Source: Steer analysis

Table A.4: Forecasts (with impacts) for AADT growth rates (%) at TP2 Somna

	CJV	LCV	Minibus	Bus	2A	3A	MAV	AADT	PCU
FY22	3.2%	(20.8%)	25.5%	4.6%	22.6%	-	(39.4%)	**1.6%**	**(0.2%)**
FY23	7.1%	3.5%	2.8%	2.8%	3.5%	2.1%	4.9%	**5.5%**	**4.7%**
FY24	7.2%	3.6%	2.9%	2.9%	3.6%	4.0%	5.7%	**5.8%**	**5.1%**
FY25	8.6%	5.7%	2.9%	2.9%	6.0%	2.6%	8.5%	**7.2%**	**6.5%**
FY26	8.6%	4.9%	2.9%	2.9%	1.4%	(0.4%)	1.8%	**5.9%**	**4.1%**
FY27	6.9%	3.5%	2.8%	2.8%	0.1%	(1.1%)	1.0%	**4.7%**	**3.1%**
FY28	6.8%	3.4%	2.7%	2.7%	3.4%	2.0%	4.8%	**5.5%**	**4.7%**
FY29	6.7%	3.4%	2.7%	2.7%	3.4%	2.0%	4.7%	**5.5%**	**4.7%**
FY30	6.6%	3.3%	2.7%	2.7%	3.3%	2.0%	4.7%	**5.4%**	**4.6%**
FY31	6.6%	3.3%	2.6%	2.6%	3.3%	2.0%	4.6%	**5.4%**	**4.6%**
FY32	6.5%	3.3%	2.6%	2.6%	3.3%	2.0%	4.6%	**5.4%**	**4.6%**
FY33	6.5%	3.2%	2.6%	2.6%	3.2%	1.9%	4.5%	**5.4%**	**4.6%**
FY34	6.4%	3.2%	2.6%	2.6%	3.2%	1.9%	4.5%	**5.3%**	**4.6%**
FY35	6.3%	3.2%	2.5%	2.5%	3.2%	1.9%	4.4%	**5.3%**	**4.5%**
FY36	6.3%	3.1%	2.5%	2.5%	3.1%	1.9%	4.4%	**5.3%**	**4.5%**
FY37	6.2%	3.1%	2.5%	2.5%	3.1%	1.9%	4.4%	**5.2%**	**4.5%**
FY38	6.2%	3.1%	2.5%	2.5%	3.1%	1.9%	4.3%	**5.2%**	**4.5%**
FY39	6.1%	3.1%	2.4%	2.4%	3.1%	1.8%	4.3%	**5.2%**	**4.5%**
FY40	6.1%	3.0%	2.4%	2.4%	3.0%	1.8%	4.2%	**5.2%**	**4.5%**

Source: Steer analysis

Revenue forecasts

A.3 The following table presents the year-wise annual revenue forecasts for the forecast period

Table A.5: Revenue Forecasts (with impacts) for horizon years (INR Crores) at TP1

Vehicle Category	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total
FY22	30	7	0	17	13	15	**34**	**117**
FY23	36	8	1	20	14	16	**40**	**135**
FY24	42	9	1	22	16	19	**44**	**152**
FY25	47	10	1	23	18	19	**50**	**168**
FY26	55	11	1	25	20	21	**55**	**187**
FY27	62	12	1	27	21	22	**60**	**205**
FY28	71	13	1	30	23	24	**66**	**228**
FY29	80	15	1	32	25	25	**72**	**250**
FY30	90	16	1	34	27	27	**79**	**275**
FY31	100	17	1	37	29	29	**87**	**300**
FY32	113	19	1	40	32	31	**95**	**331**
FY33	127	20	1	42	34	33	**104**	**362**
FY34	143	22	1	46	37	35	**114**	**397**
FY35	160	24	1	49	40	37	**124**	**435**
FY36	180	26	1	53	43	40	**136**	**479**
FY37	201	28	2	56	46	42	**148**	**524**
FY38	223	31	2	60	50	45	**161**	**572**
FY39	251	33	2	64	54	48	**176**	**627**
FY40	279	36	2	69	58	51	**192**	**687**

Source: Steer analysis

Table A.6: Revenue Forecasts (with impacts) for horizon years (INR Crores) at TP2

Vehicle Category	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total
FY22	21	6	0	15	15	19	**32**	**109**
FY23	25	7	0	17	18	22	**37**	**125**
FY24	28	7	0	19	19	24	**41**	**138**
FY25	32	8	0	20	21	26	**47**	**154**
FY26	37	9	0	22	23	27	**50**	**168**
FY27	41	10	0	24	24	28	**53**	**180**
FY28	46	11	0	26	26	30	**59**	**198**
FY29	52	11	1	28	28	32	**64**	**217**

Vehicle Category	CJV	LCV	Minibus	Bus	2A	3A	MAV	Total
FY30	58	12	1	30	31	34	**70**	**236**
FY31	64	13	1	32	33	37	**77**	**257**
FY32	72	14	1	35	36	39	**84**	**281**
FY33	80	15	1	37	39	41	**92**	**305**
FY34	89	17	1	40	42	44	**100**	**332**
FY35	98	18	1	43	45	47	**110**	**361**
FY36	110	20	1	46	49	50	**120**	**395**
FY37	121	21	1	49	52	53	**131**	**428**
FY38	135	23	1	52	56	57	**142**	**466**
FY39	150	24	1	56	61	61	**155**	**509**
FY40	167	26	1	60	66	64	**169**	**554**

Source: Steer analysis

B Top OD Pairs

B.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Luharli

Table B.1: CJV top 10 OD pair shares at TP1 Luharli

	OD Pair	Share
1.	Ghaziabad-Akbapur, Bulandshahr, & Nausana	5%
2.	Central part of Delhi-Akbapur, Bulandshahr, & Nausana	5%
3.	Akbapur, Bulandshahr, & Nausana-Ghaziabad	5%
4.	Akbapur, Bulandshahr, & Nausana-Central part of Delhi	4%
5.	Sanwli & Sikandrabad-Badhpura, Dadri, Chithara, & Bairangpur Urf Naibasti	4%
6.	Budaun & Sambhal districts-Central part of Delhi	3%
7.	Aligarh-Central part of Delhi	3%
8.	Sanwli & Sikandrabad-Ghaziabad	3%
9.	Badhpura, Dadri, Chithara, & Bairangpur Urf Naibasti-Sanwli & Sikandrabad	3%
10.	Central part of Delhi-Aligarh	3%

Source: Steer analysis of OD data

Table B.2: MAV and OSV top 10 OD pair shares at TP1 Luharli

	OD Pair	Share
1.	Ghaziabad-Sanwli & Sikandrabad	6%
2.	Sanwli & Sikandrabad-Ghaziabad	4%
3.	Sanwli & Sikandrabad-Badhpura, Dadri, Chithara, & Bairangpur Urf Naibasti	3%
4.	Badhpura, Dadri, Chithara, & Bairangpur Urf Naibasti-Sanwli & Sikandrabad	3%
5.	Sanwli & Sikandrabad-Jaipur	2%
6.	Aligarh-Ghaziabad	2%
7.	Sanwli & Sikandrabad-Central part of Delhi	2%
8.	Ghaziabad-Akbapur, Bulandshahr, & Nausana	2%
9.	Central part of Delhi-Sanwli & Sikandrabad	2%
10.	Akbapur, Bulandshahr, & Nausana-Ghaziabad	2%

Source: Steer analysis of OD data

TP2 Somna

Table B.3: CJV top 10 OD pair shares at TP2 Somna

	OD Pair	Share
1.	Central part of Delhi-Aligarh	11%
2.	Hazratpur, Munda Khera, Khurja, Jhamka, Usmapur, & Nagla Shekhu-Aligarh	7%
3.	Aligarh-Central part of Delhi	6%
4.	Aligarh-Hazratpur, Munda Khera, Khurja, Jhamka, Usmapur, & Nagla Shekhu	3%
5.	Ghaziabad-Aligarh	3%
6.	Etah, Firozabad, & Mainpuri districts-Central part of Delhi	3%
7.	Akbapur, Bulandshahr, & Nausana-Aligarh	3%
8.	Central part of Delhi-Kanpur Nagar district	3%
9.	Central part of Delhi-Eastern part of Agra district	2%
10.	Aligarh-Akbapur, Bulandshahr, & Nausana	2%

Source: Steer analysis of OD data

Table B.4: MAV and OSV top 10 OD pair shares at TP2 Somna

	OD Pair	Share
1.	Central part of Delhi-Aligarh	3%
2.	Ghaziabad-Aligarh	2%
3.	Aligarh-Eastern part of Ghaziabad district	2%
4.	Hazratpur, Munda Khera, Khurja, Jhamka, Usmapur, & Nagla Shekhu-Aligarh	2%
5.	Central part of Delhi-Kanpur Nagar district	2%
6.	Kanpur Nagar district-Punjab	1%
7.	Kanpur Nagar district-Central part of Delhi	1%
8.	Kanpur Nagar district-Meerut district	1%
9.	Aligarh-Central part of Delhi	1%
10.	Punjab-West Bengal	1%

Source: Steer analysis of OD data

C Data collection exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1

Date	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
03-09-19	TVC	12,908	1,378	1,916	2,344	375	829	1,519	5	21,274
04-09-19	TVC	12,834	1,359	1,964	2,424	405	912	1,310	1	21,209
05-09-19	TVC	11,686	1,204	1,847	2,405	458	996	1,415	9	20,020
06-09-19	TVC	12,974	1,365	1,884	2,524	458	923	1,513	2	21,643
07-09-19	TVC	13,336	1,278	1,907	2,478	439	893	1,510	5	21,846
08-09-19	TVC	15,318	1,200	2,010	1,806	326	821	1,328	2	22,811
09-09-19	TVC	14,727	1,290	2,061	2,011	387	833	1,351	6	22,666

Source: Steer analysis

Table C.2: 7-day TVC counts at TP2

Date	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
03-09-19	TVC	4,234	661	1,269	1,396	482	828	1,067	6	9,943
04-09-19	TVC	4,331	730	1,313	1,530	455	919	1,104	2	10,384
05-09-19	TVC	3,766	691	1,252	1,519	456	936	1,141	1	9,762
06-09-19	TVC	4,425	761	1,262	1,481	485	935	1,076	1	10,426
07-09-19	TVC	4,690	711	1,273	1,518	501	930	1,197	6	10,826
08-09-19	TVC	5,511	680	1,318	1,340	450	877	1,116	1	11,293
09-09-19	TVC	4,563	629	1,250	1,187	428	876	936	5	9,874

Source: Steer analysis

Table C.3: Weekly average daily traffic of TVC vs TMS

Figure 4: Toll plaza	Source	CJV+MLCV	LCV	Bus	2 Axle	3A+MAV	OSV	Total
TP1 Luharli	TVC	15,518	2,402	1,659	970	2,341	0	22,890
	TMS	14,694	2,285	1,941	407	2,308	4	21,638

Figure 4: Toll plaza	Source	CJV+MLCV	LCV	Bus	2 Axle	3A+MAV	OSV	Total
TP2 Somna	TVC	5,785	1,420	1,084	874	1,997	0	11,159
	TMS	5,198	1,424	1,277	465	1,991	3	10,358

Source: Steer analysis

Zone list

Table C.4: Zone list used for OD analysis

Zone No	Zone Name	State
1	Lucknow district	Uttar Pradesh
2	Unnao district	Uttar Pradesh
3	Kanpur Nagar district	Uttar Pradesh
4	Hardoi & Sitapur districts	Uttar Pradesh
5	Farrukhabad & Kannauj districts	Uttar Pradesh
6	Etawah district	Uttar Pradesh
7	Etah, Firozabad, & Mainpuri districts	Uttar Pradesh
8	Eastern part of Agra district	Uttar Pradesh
9	Western part of Agra district	Uttar Pradesh
10	Aligarh	Uttar Pradesh
11	Hathras district	Uttar Pradesh
12	Kasganj district	Uttar Pradesh
13	Shahjahanpur, Kheri, & Pilibhit districts	Uttar Pradesh
14	Budaun & Sambhal districts	Uttar Pradesh
15	Rampur district	Uttar Pradesh
16	Akbapur, Bulandshahr, & Nausana	Uttar Pradesh
17	Mathura	Uttar Pradesh
18	Amroha district	Uttar Pradesh
19	Muzaffarnagar & Bijnor districts	Uttar Pradesh
20	Meerut district	Uttar Pradesh
21	Ghaziabad	Uttar Pradesh
22	Northern part of Gautam Buddha Nagar district	Uttar Pradesh
23	North-Central part of Gautam Buddha Nagar district	Uttar Pradesh
24	Southern part of Gautam Buddha Nagar district	Uttar Pradesh

Zone No	Zone Name	State
25	Baghpat district	Uttar Pradesh
26	Saharanpur district	Uttar Pradesh
27	Barabanki, Raebareli, Pratapgarh, & Amethi districts	Uttar Pradesh
28	Fatehpur, Banda, Chitrakoot, Kaushambi, St. Ravidas Nagar, & Allahabad districts	Uttar Pradesh
29	Sultanpur, Ambedkar Nagar, Azamgarh, & Jaunpur districts	Uttar Pradesh
30	Varanasi, Mirzapur, & Sonbhadra districts	Uttar Pradesh
31	Bahraich, Sravasti, Balrampur, Gonda, Faizabad, Basti, Siddharth Nagar, Maharajganj, St. Kabir Nagar, Gorakhpur, Kushinagar, Deoria, Mau, Ballia, Ghazipur, & Chandauli districts	Uttar Pradesh
32	Lalitpur & Jhansi districts	Uttar Pradesh
33	Mahoba, Hamirpur, Jalaun, Kanpur Dehat, & Auraiya districts	Uttar Pradesh
34	Central part of Delhi	Delhi
35	Northern part of Delhi	Delhi
36	Western part of Delhi	Delhi
37	South-Western part of Delhi	Delhi
38	South-Eastern part of Delhi	Delhi
39	Eastern part of Delhi	Delhi
40	North-Eastern part of Delhi	Delhi
41	Northern part of Haryana	Haryana
42	Western part of Haryana	Haryana
43	South-Western part of Haryana	Haryana
44	Rohtak district	Haryana
45	Jhajjar district	Haryana
46	Gurgaon district	Haryana
47	Rewari district	Haryana
48	Mewat & Palwal districts	Haryana
49	Faridabad district	Haryana
50	Northern part of Madhya Pradesh	Madhya Pradesh

Zone No	Zone Name	State
51	Central part of Madhya Pradesh	Madhya Pradesh
52	Eastern part of Madhya Pradesh	Madhya Pradesh
53	Western part of Madhya Pradesh	Madhya Pradesh
54	Jaipur	Rajasthan
55	Eastern part of Rajasthan	Rajasthan
56	Bhiwadi	Rajasthan
57	Southern part of Rajasthan	Rajasthan
58	Western part of Rajasthan	Rajasthan
59	Northern part of Rajasthan	Rajasthan
60	Eastern part of Maharashtra	Maharashtra
61	Western part of Maharashtra	Maharashtra
62	Punjab	Punjab
63	Himachal Pradesh	Himachal Pradesh
64	Garhwal division of Uttarakhand	Uttarakhand
65	Jammu & Kashmir	Jammu & Kashmir
66	Gujarat	Gujarat
67	Telangana	Telangana
68	Chhattisgarh	Chhattisgarh
69	Odisha	Odisha
70	Bihar	Bihar
71	Jharkhand	Jharkhand
72	West Bengal	West Bengal
73	Goa	Goa
74	Andhra Pradesh	Andhra Pradesh
75	Karnataka	Karnataka
76	Kerla	Kerala
77	Tamilnadu	Tamilnadu
78	Assam & Sikkim	Assam & Sikkim
79	Arunachal Pradesh	Arunachal Pradesh
80	Nagaland	Nagaland
81	Manipur, Mizoram, Tripura, Meghalaya	Manipur, Mizoram, Tripura, Meghalaya
82	Northern part of Mathura district	Uttar Pradesh
83	Southern part of Mathura district	Uttar Pradesh

Zone No	Zone Name	State
84	South-Central part of Gautam Buddha Nagar district	Uttar Pradesh
85	North-Eastern part of Gautam Buddha Nagar district	Uttar Pradesh
86	Badalpur, Deri Machha, & Dhoom Manikpur	Uttar Pradesh
87	Badhpura, Dadri, Chithara, & Bairangpur Urf Naibasti	Uttar Pradesh
88	Luharali & Nagla Chamroo	Uttar Pradesh
89	Sanwli & Sikandrabad	Uttar Pradesh
90	Junedpur & Bilsuri	Uttar Pradesh
91	Aminagar, Chanderu, & Audera	Uttar Pradesh
92	Gangarua, Machkauli, Hartauli, & Jalkhera	Uttar Pradesh
93	Khalsia Chuharpur & Dharpa Chuharpur	Uttar Pradesh
94	Hazratpur, Munda Khera, Khurja, Jhamka, Usmapur, & Nagla Shekhu	Uttar Pradesh
95	Rohinda, Ishanpur, & Jawal	Uttar Pradesh
96	Pahavati & Madhaula	Uttar Pradesh
97	Somna & Gabhana	Uttar Pradesh
98	Ogar & Pairai	Uttar Pradesh
99	Kaurah Rustampur	Uttar Pradesh
100	Bharatri, Bhankari Khas, & Mehrawal	Uttar Pradesh
101	Western part of Ghaziabad district	Uttar Pradesh
102	Eastern part of Ghaziabad district	Uttar Pradesh
103	Southern part of Ghaziabad district	Uttar Pradesh
104	Western part of Hapur district	Uttar Pradesh
105	Central part of Hapur district	Uttar Pradesh
106	Eastern part of Hapur district	Uttar Pradesh
107	North-Western part of Bulandshahr district	Uttar Pradesh
108	North-Eastern part of Bulandshahr district	Uttar Pradesh
109	Central part of Bulandshahr district	Uttar Pradesh
110	South-Western part of Bulandshahr district	Uttar Pradesh

Zone No	Zone Name	State
111	South-Eastern part of Bulandshahr district	Uttar Pradesh
112	Left North-Western part of Aligarh district	Uttar Pradesh
113	Right North-Western part of Aligarh district	Uttar Pradesh
114	Western part of Aligarh district	Uttar Pradesh
115	Northern part of Aligarh district	Uttar Pradesh
116	North-Eastern part of Aligarh district	Uttar Pradesh
117	Eastern part of Aligarh district	Uttar Pradesh
118	Southern part of Aligarh district	Uttar Pradesh
119	Northern part of Moradabad district	Uttar Pradesh
120	Moradabad	Uttar Pradesh
121	Southern part of Moradabad district	Uttar Pradesh
122	Eastern part of Moradabad district	Uttar Pradesh
123	Northern part of Bareilly district	Uttar Pradesh
124	Western part of Bareilly district	Uttar Pradesh
125	Eastern part of Bareilly district	Uttar Pradesh
126	South-Eastern part of Bareilly district	Uttar Pradesh
127	South-Western part of Bareilly district	Uttar Pradesh
128	Bareilly	Uttar Pradesh
129	Nepal	Nepal
130	Bhutan	Bhutan
131	Bangladesh	Bangladesh
132	Kumaon division of Uttarakhand	Uttarakhand

Direction-wise commodity distribution

Table C.5: Commodity distribution towards Dadri for TP1

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	25%	17%	25%	12%
Construction	6%	7%	14%	12%
Steel & Metal	4%	3%	5%	7%
Petroleum	2%	9%	5%	3%
Manufacturing	4%	7%	5%	4%

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Automobiles	0%	1%	0%	0%
Miscellaneous	16%	18%	14%	13%
Container	0%	-	-	0%
Empty	42%	37%	31%	49%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.6: Commodity distribution towards Khurja for TP1

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	19%	15%	23%	14%
Construction	4%	4%	8%	23%
Steel & Metal	5%	6%	5%	12%
Petroleum	4%	15%	7%	7%
Manufacturing	6%	4%	6%	3%
Automobiles	1%	2%	1%	2%
Miscellaneous	25%	19%	15%	12%
Container	-	-	-	1%
Empty	35%	35%	36%	25%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.7: Commodity distribution towards Aligarh for TP2

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	27%	25%	30%	34%
Construction	0%	-	-	1%
Steel & Metal	4%	6%	6%	9%
Petroleum	4%	7%	4%	9%
Manufacturing	11%	13%	8%	9%
Automobiles	2%	3%	2%	1%
Miscellaneous	29%	28%	31%	19%
Container	1%	-	-	-
Empty	22%	18%	19%	17%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.8: Commodity distribution towards Khurja for TP2

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	35%	28%	47%	37%
Construction	6%	4%	5%	6%
Steel & Metal	3%	3%	9%	14%
Petroleum	4%	12%	5%	7%
Manufacturing	7%	10%	11%	9%
Automobiles	-	0%	0%	1%
Miscellaneous	9%	11%	9%	5%
Container	0%	-	1%	-
Empty	36%	32%	14%	21%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Trip Length Distribution

Table C.9: Trip Length distribution at TP1 Luharli

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	46%	33%	23%	32%	28%	27%
65-300 km	45%	54%	42%	50%	43%	42%
300-500 km	5%	9%	11%	11%	9%	8%
500-1000 km	3%	3%	10%	5%	9%	9%
>1000 km	1%	1%	14%	3%	11%	13%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.10: Trip Length distribution at TP2 Somna

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV	3A+MAV
0-65 km	25%	8%	27%	11%	5%	3%	4%
65-300 km	65%	54%	51%	51%	34%	37%	35%
300-500 km	7%	29%	10%	14%	16%	15%	16%
500-1000 km	2%	8%	7%	14%	18%	17%	17%
>1000 km	2%	0%	5%	9%	27%	28%	28%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

D Impact analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the asset.

D.2 Please find below the table comparing the GJC across the following 4 routes for Delhi-Lucknow movement.

- Route 1: Delhi-Ghaziabad-Aligarh-Kanpur-Lucknow
- Route 2: Delhi-Agra-Etawah-Lucknow
- Route 3: Delhi-Yamuna Exp-Luncknow Exp
- Route 4: Delhi-Moradabad-Bareilly-Sitapur-Lucknow

Table D.1: GJC comparison Delhi-Lucknow movement

MAV impacts	Route 1	Route 2	Route 3	Route 4
Length	482	567	512	514
Existing Toll rates	2,165	3,255	4,890	2,445
Time (hrs)	15	14	10	13
Existing GJC	27,936	30,067	26,697	26,751
GJC post improvement	27,296	29,742	26,697	27,626

Source: Steer Analysis

D.3 Please find below the table comparing the GJC across the following 4 routes for Delhi-Lucknow movement.

- Route 1: Karnal-Panipat-Delhi-Ghaziabad-Aligarh-Kanpur-Lucknow
- Route 2: Karnal-Panipat-EPE-Agra-Etawah-Lucknow
- Route 3: Karnal-Panipat-EPE-Yamuna Exp-Luncknow Exp
- Route 4: Karnal-Meerut-Moradabad-Bareilly-Sitapur-Lucknow
- Route 5: Karnal-Meerut-Bulandshahr-Aligarh-Kanpur-Lucknow

Table D.2: GJC comparison Delhi-Lucknow movement

MAV impacts	Route 1	Route 2	Route 3	Route 4	Route 5
Length	595	816	715	606	483
Existing Toll rates	3,270	4,980	6,530	2,255	2,255
Time (hrs)	18	20	16	15	14
Existing GJC	33,871	43,231	38,476	31,091	27,255

MAV impacts	Route 1	Route 2	Route 3	Route 4	Route 5
GJC post improvement	33,644	42,832	38,330	31,422	27,766

Source: Steer Analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Kanwardeep Kahlon

Reviewer/approver

Vaibhav Gupta

Other contributors

Aditya Karan

Distribution

Client:

Steer:

Version control/issue number

V1.0

Date

April 2022

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Hazaribagh Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304

steer

Report
April 2022

Project Transit: Traffic Due Diligence for Hazaribagh Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer i

Glossary Items i

1 Introduction 1

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset 6

Introduction 6

Strategic network 6

Concession and tolling details 8

Key economic activities 9

Alternate Routes 10

3 Traffic description 11

Introduction 11

Historical trends of traffic 11

Key findings of the TVC data analysis 18

Key findings of origin-destination analysis 19

Conclusions 26

4 Socio economic context and traffic growth 28

Introduction 28

Population growth 28

Economic growth 29

5 Traffic Growth Analysis 31

Estimation of background elasticities 31

Overview 31

Forecasts for growth drivers 33

6 Forecasts: Base year AADT and Impacts 35

Introduction 35

Base year traffic 36
Analysis of potential network/developmental impacts 36
Revenue forecasting assumptions 37
Traffic and Revenue forecasts 39
Upside and Downside Cases 41
Traffic and Revenue Forecasts-Upside case 43
Traffic and Revenue Forecasts-Downside case 44
Target revenues and modification of concession period 46
Summary outlook 46

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4
Figure 2.1: Asset location in the regional network context 6
Figure 2.2: Asset context 7
Figure 2.3: Road cross section 8
Figure 3.1: Vehicle share at TP1 Pundag 13
Figure 3.2: Ticket segmentation for CJV at TP1 Pundag 16
Figure 3.3: Ticket segmentation for MAV at TP1 Pundag 17
Figure 3.4: Comparison between TVC and TMS daily traffic data on TP1 Pundag 18
Figure 3.5: Comparison between vehicle shares from TVC and TMS WADTs 19
Figure 3.6: Zonal influence at TP1 Pundag 21
Figure 3.7 Internal-external distribution at TP1 Pundag 22
Figure 3.8: Commodity distribution at TP1 Pundag 24
Figure 3.9: Commodity distribution at TP1 Pundag (Towards Hazaribagh) 24
Figure 3.10: Commodity distribution at TP1 Pundag (Ranchi) 25
Figure 3.11: Trip length distribution at TP1 Pundag 26
Figure 4.1: Evolution of Jharkhand's state GDP and National GDP 30
Figure 5.1: GDP-GSDP forecast 34
Figure 6.1: Forecast PCUs and growth rates at TP1 Pundag 41

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Summary of concession 8
Table 2.2: Single toll rates on the Asset (INR), applicable from April 2022 to March 2023 9
Table 3.1: PCU factors 11
Table 3.2: Quarterly Traffic Levels at TP1 Pundag 12
Table 3.3: Revenue (INR Lakhs) by vehicle type at TP1 Pundag (Oct 20' to Mar'22) 13
Table 3.4: Typical ticket types sold at NHAI plazas 14
Table 3.5: Timeline of national ETC implementation 15
Table 3.6: Percentage of Traffic via Fast Tag, March 2022 at Pundag Toll Plaza 15
Table 3.7: Data collection schedule 17
Table 3.8: WADT from TVC counts 18
Table 3.9: Sample rates for OD data 20
Table 3.3.10: Zone aggregations for zonal influence analysis 20
Table 3.11: Aggregate commodity categories 22
Table 4.1: CAGR of population in India 28
Table 4.2: Population Growth in India (2001 – 2011) 29
Table 5.1: Identified growth drivers to model traffic growth 32
Table 5.2: Elasticity recommendations for the Asset 32
Table 6.1: Adopted SCF for the Asset based on benchmarks 35
Table 6.2: Monthly MADT and Adopted AADT for FY22-TP1 Pundag 36
Table 6.3: Impact of 6 laning LOS improvement 37
Table 6.4: Trip factors at TP1 Pundag 38
Table 6.5: Toll segmentation for FY22, TP1 Pundag (Oct-21 to Mar-22) 38
Table 6.6: WPI growth forecast assumptions 39
Table 6.7: FY22 Revenue reconciliation summary 39
Table 6.8: Final traffic forecast for TP1 Pundag 40
Table 6.9: Traffic CAGR (%) for TP1 Pundag 40
Table 6.10: Revenue forecast for TP1 Pundag (INR crores) 40
Table 6.11: Revenue growth CAGR (%) for TP1 Pundag 41
Table 6.12: Summary of Macro Assumptions for upside and downside cases 42
Table 6.13: Summary of impacts on the Assets 42

Table 6.14: Summary of impacts on the Assets 42
Table 6.15: Traffic forecast (With Upside Impacts) for TP1: Pundag 43
Table 6.16: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Pundag 43
Table 6.17: Revenue forecast (With Upside Impacts) for TP1: Pundag (In Cr) 44
Table 6.18: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Pundag 44
Table 6.19: Traffic forecast (With Downside Impacts) for TP1: Pundag 44
Table 6.20: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Pundag 45
Table 6.21: Revenue forecast (With Downside Impacts) for TP1: Pundag (In Cr) 45
Table 6.22: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Pundag 45
Table 6.23: Target Revenues for Extension 1 46
Table 6.24: Target Revenues for Extension 2 46

Appendices

A Top 10 OD pairs

B Detailed Forecasts

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre- COVID-19and post-COVID-19views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Oversized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an Asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March

RNP	Registered Number Plate
SCF	Seasonality Correction Factor
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get normalised AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on Hazaribagh Ranchi Tollway Limited ("Asset") to be carried out on the Asset.

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by the client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from Assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI, and WPI

Scope of work	Data source
	forecast based on forecasts provided by the client

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - Toll Plaza (TMS data) from October 2020 to March 2022
  - Concession agreement and toll notifications
  - Previous studies
  - Bid and Lender studies.
- Steer-commissioned TVC counts from 27th January to 2nd February 2021
- OD data collected from Steer-commissioned surveys which were conducted from 27th January to 28th January 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.7 The estimation of future traffic demand on the Asset was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.

- Investigating the elasticity of historic traffic growth compared to state (GSDP) and national (GDP) growth. Where historic data is limited, we have benchmarked the Asset against our Steer knowledge base (e.g., similar Asset types in the same state), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of toll, network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.8 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until 03rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery etc.

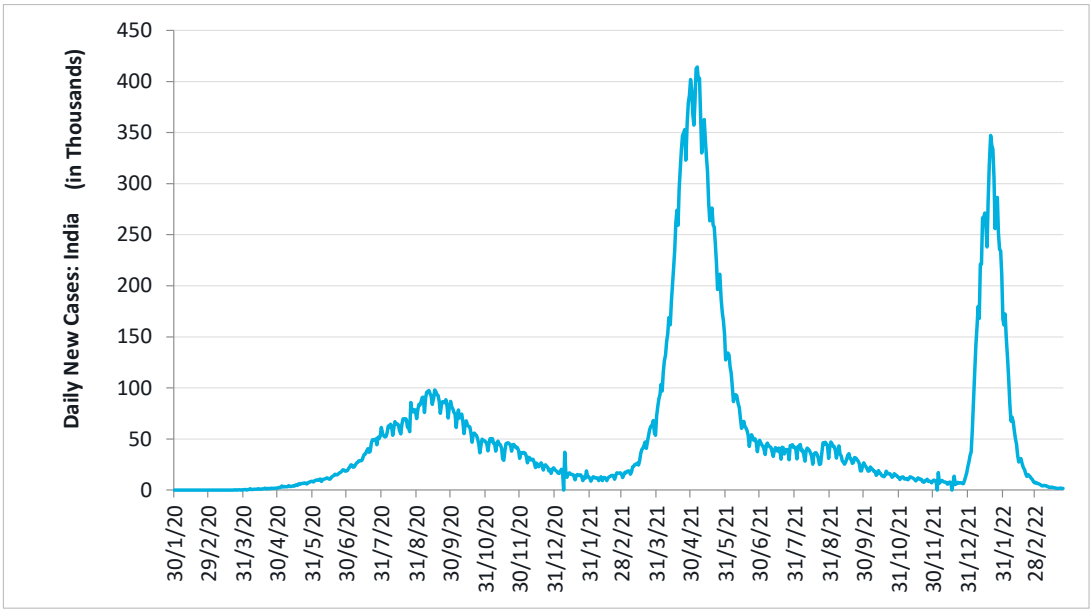
1.9 The traffic volumes since then gradually started recovering on most assets in India, with varying extent. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

1.10 As the TMS data for the Asset is available from Oct 2020, the observation is that the traffic volumes have ramped up in the Q3FY21 and Q4FY21, which can be driven by following factors - a release of pent-up demand in certain vehicle categories, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network as well as the stabilization of the tolling systems on the Asset. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., are more stable and are driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to Feb 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, **https://data.COVID19india.org/**

1.13 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for first quarter. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but the fatality rate experienced in the third wave was lesser as compared to the former two, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.15 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus services. This considerable shift in mode choice is expected to sustain for longer periods. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely

that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.16 The report has been divided into the following chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 and 6 summarises our approach and results on estimating background traffic demand growth; and our key forecasting assumptions, assessment of network impacts, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

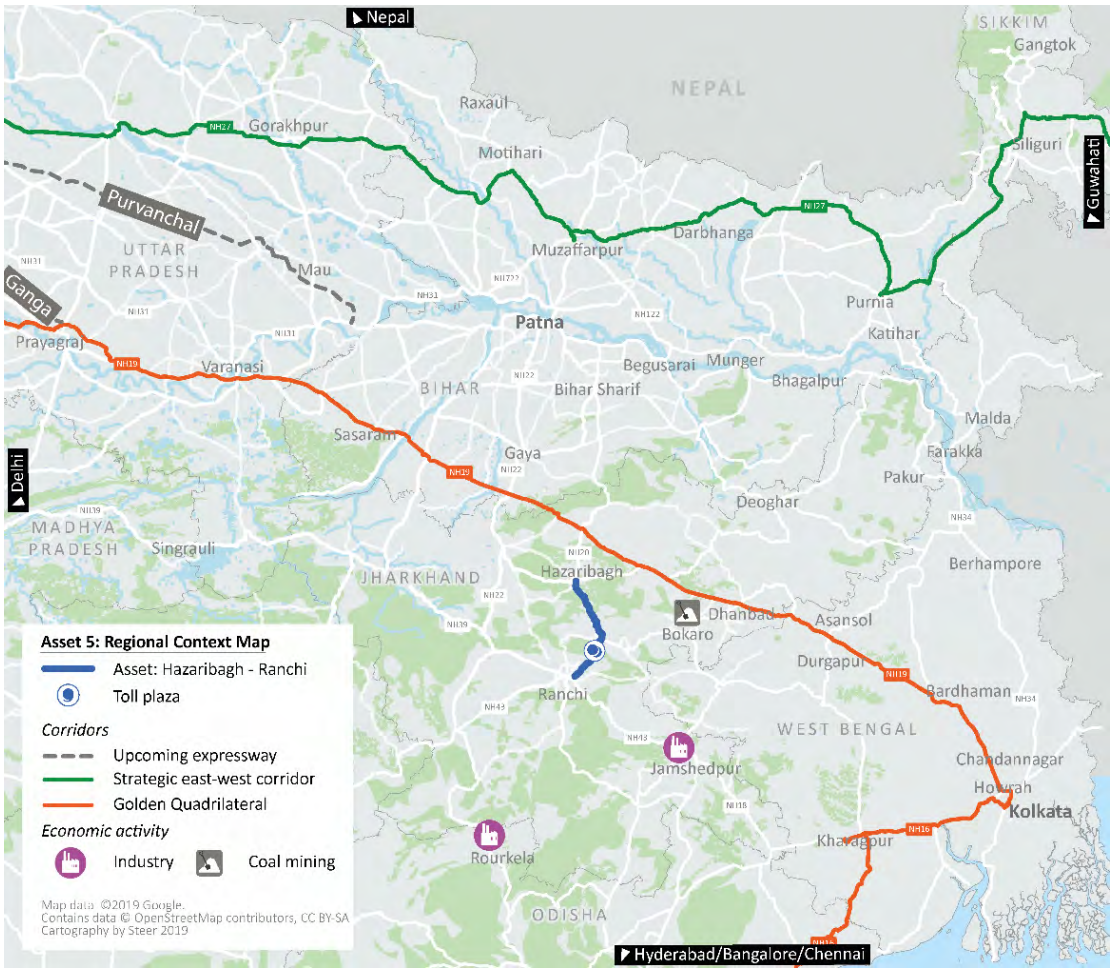
Introduction

2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Jharkhand, connecting Ranchi, the capital of Jharkhand, and Hazaribagh, on the NH 20 (old NH 33). The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



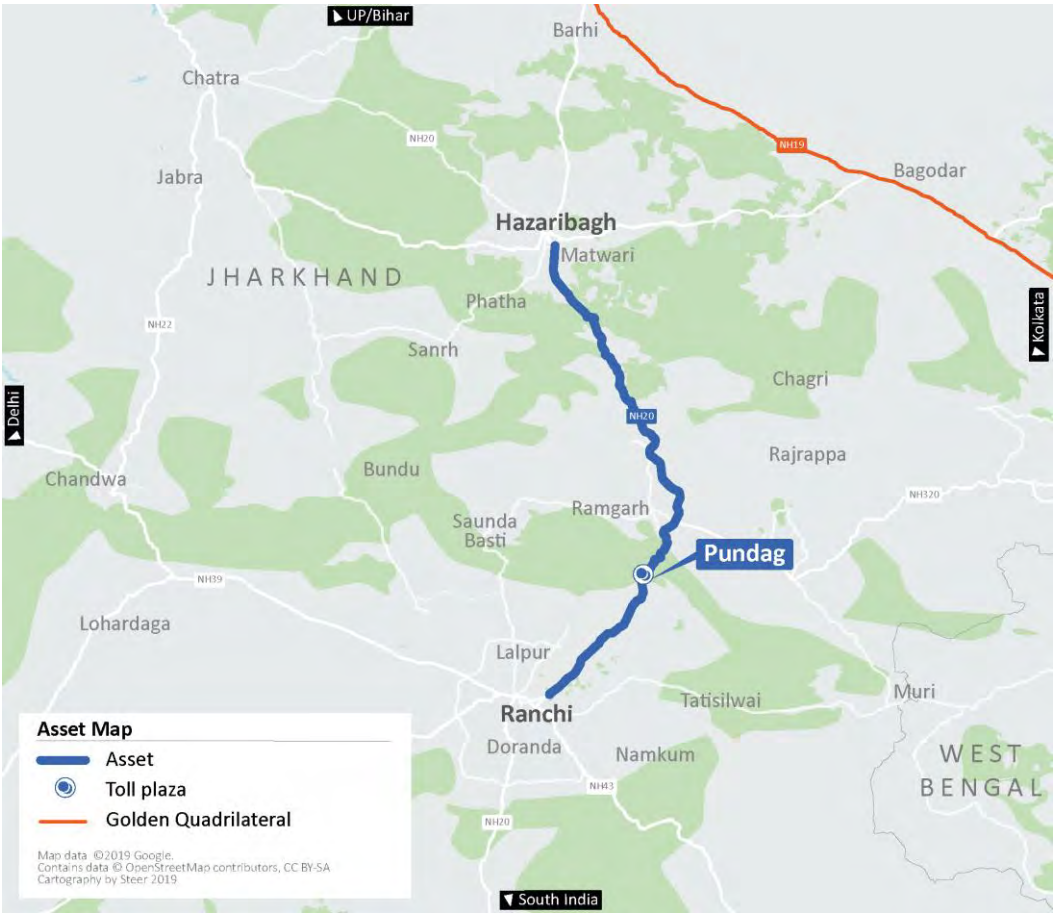
Source: Steer cartography

2.3 This Asset primarily caters to three different types of strategic movements:

- **Short-distance trips** including tourism and leisure travel trips between some of the key tourist destinations in Jharkhand. Many CJV users are either local or travel between Ramgarh and Patratu at one end and Ranchi at the other.
- **Medium-distance trips** between Bihar/rest of Jharkhand connecting the mines situated close to the Asset, to industries in Jharkhand. The Asset also transports a significant number of minerals, steel, and related products across the states of Bihar, West Bengal, and Odisha.
- **Long-distance trips** between Bihar/southern West Bengal and southern as well as central states of India.

2.4 The Asset is a 73.79 km long toll road which forms a part of the NH 20 (old NH 33) in Jharkhand. It is a four-lane divided road with one toll plaza, namely, Pundag (TP1) at Km 100.4. The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer Cartography

2.5 About 65% of vehicles on the Asset are CJVs, which predominantly commute between Ranchi, Ramgarh, Hazaribagh and other local destinations along the Asset. The commercial vehicles on the Asset cover a mix of medium and long distances. Trucks from Jharkhand, Bihar are observed, as well as those from UP, Delhi, Haryana, and Rajasthan.

Concession and tolling details

2.6 The toll plaza on the Asset has been operational since September 2013 and the Client took over the operations in October 2020. The concession period ends in FY51. The following table presents a summary of the concession.

Table 2.1: Summary of concession

Particulars	Details
State	Jharkhand
Highway and lane configuration	NH 33 (old NH 20), 4-lane divided
Toll plaza	TP1: Pundag
Length (km) as per concession agreement, applicable	TP1: 73.79 km
Commencement of operations	TP1: September 2013
Operated by Client since	20th October 2020
Concession period	30 years
Last year of concession	2051

Source: Client data

2.7 The following images show a typical cross section of Asset and its toll plaza.

Figure 2.3: Road cross section

Source: Steer site visit

2.8 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable from April 2022 to March 2023

Type of Vehicle	Single Journey Fee
	TP1 Pundag
CJV	115
LCV	190
Bus/Truck	395
3A	430
HCM/EME/MAV	620
OSV	755

Source: NHAI Revision of User fee Rate w.e.f 01.04.2022

2.9 Apart from single tickets, ticket categories like monthly, local personal and local commercial passes are also available on the Asset.

Key economic activities

2.10 The Asset is situated in Jharkhand which has significant mineral resources, contributing 40% to the country's mineral reserve. Minerals ranging from iron ore, coal, copper ore, mica, bauxite, Manganese, limestone, china clay, fire clay, graphite, kainite, chromite asbestos, thorium, sillimanite, uranium (Jaduguda mines, Narwa Pahar) and even gold (Rakha Mines) and silver and several other minerals are found in Jharkhand. In the vicinity of the Asset, large deposits of coal and iron ore support a concentration of industry, in centres like Jamshedpur, Dhanbad, Bokaro and Ranchi. It should be noted that Hazaribagh and Chattra near the Asset contribute significantly to the state's total coal reserves, making coal one of the common commodities being transported on the Asset.

2.11 Jharkhand contributes 20-25% of the total steel produced in India and is home to industries like Tata Steel, SAIL, JSPL etc. TATA Steel in Jamshedpur is 130 km from Ranchi towards the south-east of the Asset and accounts for a significant amount of traffic on the Asset. Jindal Steel and Power Limited operates a steel plant as well as power plant in Patratu (40 km from the Asset) and is planning to invest in order to add 2-2.5 million tonnes per annum to its current capacity of 0.6 million tonnes per annum (wire rod mill) and 1.2 million tonnes per annum (bar mill)[1]. The expansion is expected to add further steel carrying tollable traffic from Ranchi – Patratu.

2.12 The Ramgarh and Hazaribagh areas are rich in limestone mines. Since the state has reserves of cement grade limestone, the region is well-suited for creating additional capacities. Burnpur Cement's plant in Patratu attracts cement carrying traffic towards the Asset. Burnpur Cement is planning to launch new cement products from the Patratu plant as well as increase its

[1] https://www.thehindubusinessline.com/companies/jspl-looking-to-set-up-2-25-mtpa-steel-plant-at-patratu-in-jharkhand/article31088657.ece

capacity utilisation[2]. Further exploration of limestone would help in developing new cement plants and hence, would generate additional traffic on our Asset.

2.13 The industrial area in Hazaribagh is also a significant traffic generator for the Asset. 1500+ industries are present in the industrial area involved in the production of cement, coke, and stone.

2.14 Although no major tourism spot is present on the Asset, PTPS dam at Patratu attracts CJV traffic from Ranchi and nearby areas.

Alternate Routes

2.15 Few of the alternate available for users and our observations from the site visit are discussed below.

2.16 For short/medium – distance traffic connecting Ranchi and southern states to Ramgarh, there is an alternate route via Patratu on SH 2 that bypasses the toll plaza. The same route also leads to Hazaribagh bypassing the whole Asset. The route is not preferred by truck drivers as it is longer and present on hilly terrain. Also, it is two-laned most of the route and passes through uninhabited areas.

2.17 For Hazaribagh – Jamshedpur traffic, an alternate route is available at Kothar (near Ramgarh). The alternate is two-lane undivided road connecting Hazaribagh – Jamshedpur. During our site visit we found that few local Coal carrying trucks from Hazaribagh/Barhi take this route instead of the Asset as the route is shorter (23 kms) and has no tolls. However, the route is known to be affected by local Naxal based insurgency and deemed unsafe. Long distance trucks follow the Asset as it is four-laned throughout the way (till Jamshedpur) and is safer as it doesn't pass through uninhabited areas. Therefore, for the reasons stated above the alternate is not considered to be favourable route for majority of the users.

2.18 During our site visit to the Asset, no major micro-diversions through local roads were observed close to the toll plazas.

[2] https://www.globalcement.com/news/item/5828-burnpur-cement-to-launch-pozzolona-portland-cement-brand-in-april-2017

3 Traffic description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

PCU Factor assumption

3.4 The PCU values have been taken from '*IRC 64:1990- Guidelines for Capacity of Roads in Rural Areas'*. For MAV, based on the discussion with the Client. For forecasting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5.

Table 3.1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV*	3.8
OSV	4.5

Source: Steer analysis, * Rigid-Trailer PCU calculated using TVC splits of such vehicle types

Historical trends of traffic

3.5 The following table explains the quarterly recorded MADT by vehicle class, at the Asset's toll plaza over the period of 18 months from October 2020 to March 2022.

Table 3.2: Quarterly Traffic Levels at TP1 Pundag

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	9,203	8,454	8,869	7,173	8,607	9,400	8,926	8,516	9,149	3.2%
LCV	1,120	768	907	408	425	506	533	467	519	(42.8%)
Bus	595	715	678	257	396	595	546	447	570	(15.9%)
2A	535	492	514	490	573	633	650	586	641	24.9%
3A	530	532	532	446	437	463	474	455	468	(11.9%)
MAV	1,678	1,721	1,699	1,473	1,618	1,661	1,768	1,629	1,714	0.9%
Total	**13,662**	**12,681**	**13,198**	**10,246**	**12,056**	**13,258**	**12,896**	**12,101**	**13,062**	(1.0%)
PCU	**22,194**	**21,310**	**21,803**	**16,915**	**19,565**	**21,496**	**21,401**	**19,826**	**21,430**	(1.7%)

Source: Steer analysis of Client data, FY22# Average traffic from Oct-21 to Mar-22 for comparison

3.6 There is lack of long-term historical data available on the Asset since tolling was started by the client only in October 2020 and both the available years of data, FY21 and FY22 were impacted by COVID-19 related restrictions on traffic movement, therefore a reasonable estimate of historical growth cannot be made on the Asset.

3.7 It is observed that CJVs have the dominant share in traffic, comprising more than 70% over the of the vehicles using the toll plaza. This can be attributed to the presence of large urban centres on this Asset like Ranchi, Hazaribagh and Ramgarh Cantt which has a number of pilgrimage sites thus, attracts large quantum of CJV traffic. More than 50% of the CJV trips are generating from/to these urban centres and also CJV traffic generating from/to Patna and Ranchi and other nearby urban settlements in the influence area like Bokaro, Patratu, Jamshedpur also uses this Asset. This is further validated by the analysis of the OD data discussed later.

3.8 CJV volumes have registered an 3% growth over FY21, this can be explained by the growth in choice for personal mobility due to COVID-19 related change in user patterns and also can be attributed to bus and train volumes not returning back to pre-pandemic levels. Since, the COVID-19 related effects on user behaviour has now been witnessed for over 24 months now, these shift to personal mobility are believed to be more permanent and we expect will continue in the future.

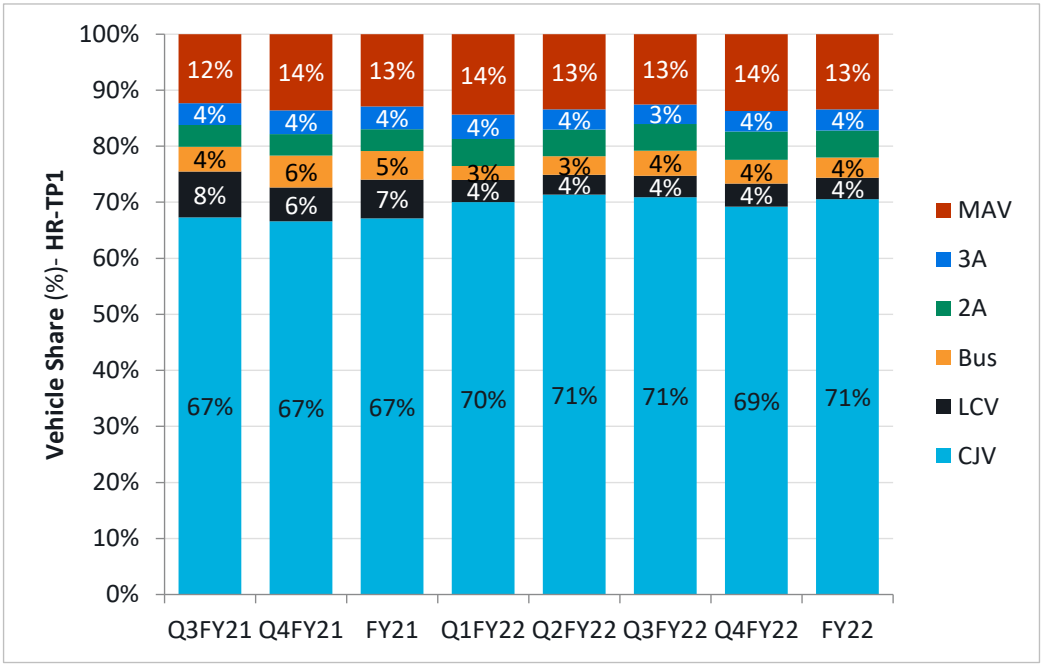
3.9 As can be seen from the table above, the average traffic for the MAV have been consistent over the 6 quarters and is maintained over 1,600 vehicles, but a dip in the average traffic can be seen Q1FY22 which can be attributed to the COVID-19 second wave. The consistency of the MAV traffic over the course of the dataset is because of the presence of steel industries, mining activities etc in the vicinity of the Asset.

3.10 LCVs have seen a reduction in volumes in FY22 as compared to historical volumes observed on the Asset. This can be explained partly by a reclassification of a number of LCVs into Mini-LCV, which are reported under the CJV category. This reclassification is predominantly driven by the mandatory implementation of FASTag starting Feb-21, where several Mini-LCV's which were being tolled as LCV's are now being tolled under the CJV category. As per the vehicle classes defined by National Electronic Toll Collection (NETC) and Motor Vehicle act, if the Gross Vehicle Weight (GVW) of the vehicle does not exceed 7,500kg should be classified as a “Light

Motor Vehicle (LMV)". Hence, the mini-LCVs which were being classified as the LCVs are now being reported under the CJV category, hence, the reduction of the LCVs can be seen from the historical data presented above of the Asset.

3.11 The figure below depicts the category-wise share of traffic at the toll plazas from October 2020 to March 2022. The CJVs have the highest share in the overall traffic and more or less stable over the dataset followed by MAVs which have a share of around 13% in traffic and contributes to approximately around 43% of the revenue generated on the Asset.

Figure 3.1: Vehicle share at TP1 Pundag



Source: Steer analysis of Client data

3.12 The following table shows the revenue (in INR Lakhs) by vehicle type at the toll plaza for FY21 and FY22.

Table 3.3: Revenue (INR Lakhs) by vehicle type at TP1 Pundag (Oct 20' to Mar'22)

Time Period	Total (INR Cr)	AADC (lakhs/day)
FY21*	**38.07**	**23**
FY22	**78.70**	**21**

Source: Steer analysis of Client data, *Oct-20 (12 days) to Mar-21

3.13 The MAVs are the biggest revenue contributor on the Asset followed by CJVs. The average daily revenue observed at the toll plaza from October 2020 to March 2021 was INR 23 lakhs whereas the average daily revenue observed in FY22 is 21 lakhs. The reduction is average revenue in FY22 can be attributed to multiple factors— the effect of two COVID-19 waves in the FY22, above average monsoon witnessed in FY22 and the dataset for FY21 being partial and more importantly of the period which had a pent-up demand post first wave of COVID-19.

Toll Frequencies

3.14 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of

historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.15 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets as long haul trips are attributed to this vehicle category. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the Asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.16 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows for a return journey within a day with a 50% discount on the return trip
Monthly Pass	Discounted single entry ticket for users who undertake multiple trips within a month can buy the monthly pass.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.17 Further, the toll plazas also record violations which are non-paying users, who are not officially allowed under exemptions category but are forced exemptions. For the Asset, the segmentation discussed below reports Exemption and violations together.

3.18 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

Impact of FASTag implementation

3.19 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via “FASTag”. The timeline of ETC implementation is presented in the following table.

Table 3.5: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.20 With the FASTag implementation in December 2019, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls.

3.21 On the Asset, the proportion of transactions via FASTag has reached 97% overall by March FY22. It has increased from 80% in March 21 to 88% in March 22 for CJVs while for MAV category it has reached almost 100%. While for buses it has increased to 98% by March 2022. The increased use of FASTag in FY22 ensured efficient tolling operations as well as increased compliance. These high penetration levels have led to improvement in overall service levels of the toll plaza and reduction in the transaction time.

Table 3.6: Percentage of Traffic via Fast Tag, March 2022 at Pundag Toll Plaza

Toll Plaza	CJV	LCV	Bus	MAV
Pundag toll plaza	88%	98%	98%	100%

Source: Steer Analysis

3.22 It is expected that these penetration levels may increase a bit more to cross 90-95% across all categories however, these levels are not expected to reach 100% due to local users among other reasons.

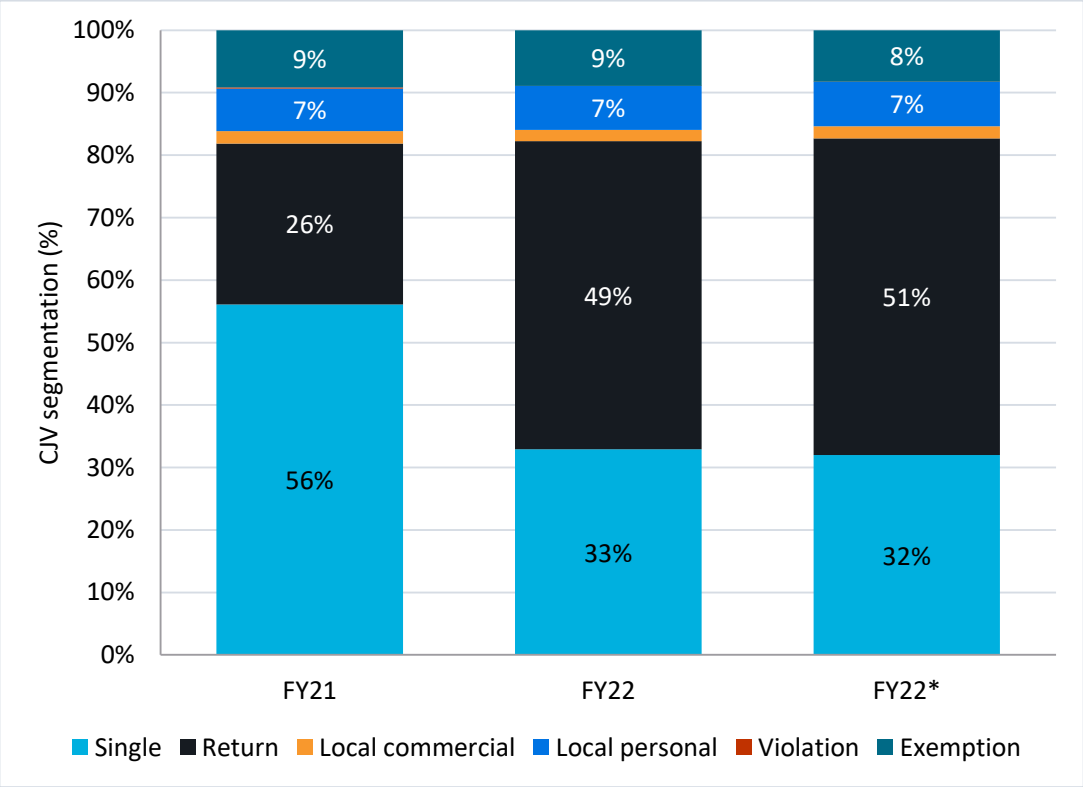
Share of traffic by payment type

3.23 FY21 was a partial year in terms of operation of the toll plaza. Further, there was a change in ticket patterns due to the mandatory implementation of FASTag as a mode of payment (share of single tickets increased in FY21). FY22 was also impacted by 2nd wave of COVID-19 in Q1 and Q2 of FY22. Hence, during this period travel patterns were also disrupted, with more shorter trips being undertaken since several states implemented state entry barriers, resulting in an increase in the proportion of short distance trips.

3.24 By Q3FY22 travel patterns returned to normal levels and hence, it is assumed that an average of segmentation from Oct-21 up to Mar-22 can be considered to follow normal travel behaviour on the Asset. Hence the resultant segmentation has been assumed as the forecast segmentation as well.

3.25 The figures below show ticket segmentation for CJV and MAV categories, for FY21, full FY22 and Oct-Mar average of FY22 or FY22*.

Figure 3.2: Ticket segmentation for CJV at TP1 Pundag

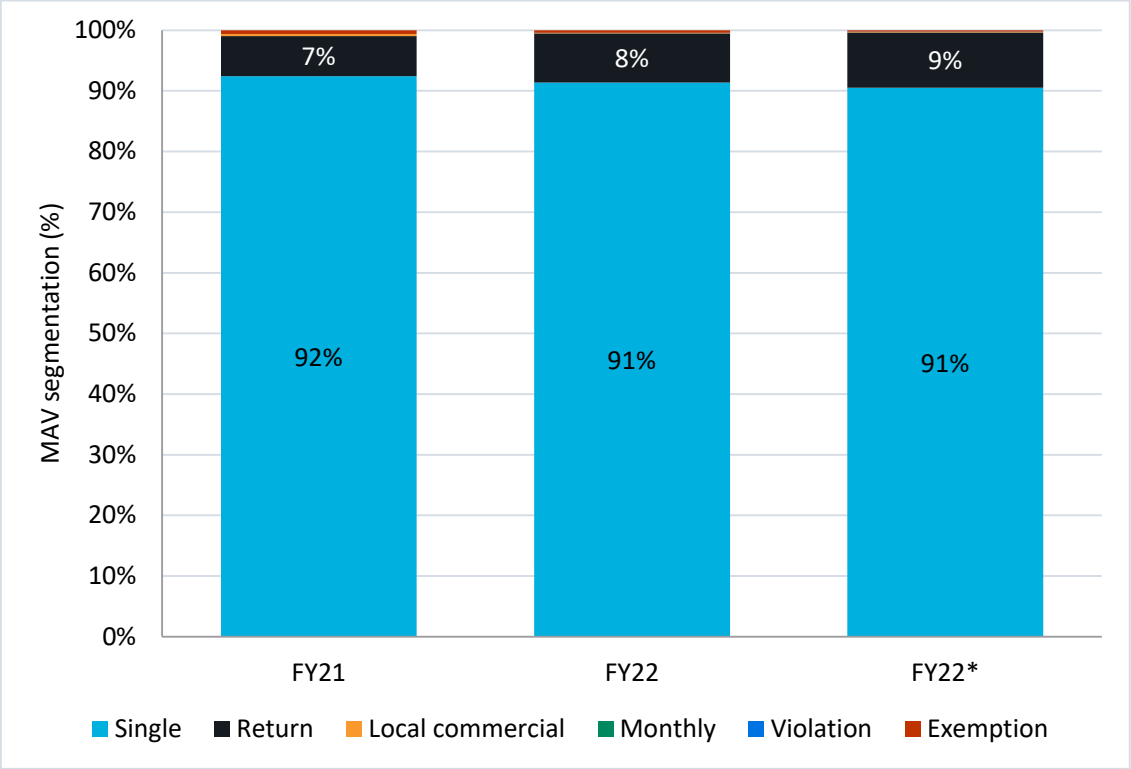


Source: Steer analysis of Client TMS data, (FY21 represents Oct-20 to Mar-21 data, FY22* represents Oct-21 to Mar-22 data)

3.26 As shown in the chart above, from the period of Oct-20 to Mar-21, more than half of the CJVs paid for single journeys with the remainder ticket-share being made up of return tickets, local passes, and exemptions. However, in FY22 the segmentation of CJV category has stabilised with single journeys have reduced to one third in CJVs and the return journeys have increased to around half of the overall traffic, this shift of the segmentation can be attributed to the implementation of FASTag Norms from 2019. High CJV return trips can be because of the travel pattern of the commuters, as per the OD analysis more than 80% of trips under the CJV category have an average trip length <300 kms and most of the trips generating in the vicinity of the Asset.

3.27 The stabilisation of the segmentation on this Asset is also understood by looking at the monthly level data and the average segmentation over the months from Oct-21 to Mar-22, which follows the similar trend.

Figure 3.3: Ticket segmentation for MAV at TP1 Pundag



Source: Steer analysis of Client TMS data, FY22* has the data from Oct-21 to Mar-22

3.28 MAVs are observed to have high share of single tickets which is aligned to observation of MAVs doing medium to long distance trips on the Asset. As discussed, and validated from the OD data, around 60% of the MAVs on the Asset travel >300 kms. A slight increase in return tickets is visible due to implementation of FASTag, allowing trucks to avail return journey discounts if they return within 24 hrs. Ranchi, Ramgarh and Patna are the major trip generators for the MAV traffic.

Data Collection exercise

3.29 As mentioned previously, to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. Both OD surveys and TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.7: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	State time
TP1 Pundag	27 Jan 2021	02 Feb 2021	0000-2359	27 Jan 2021	0900 hours

Source: Steer analysis

3.30 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at the toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.31 Taking an average of the seven-day TVC counts (27th Jan – 2nd Feb 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Table 3.8: WADT from TVC counts

Toll Plaza	CJV	LCV	Mini LCV	Bus	2A	3A	MAV	OSV	Total
TP1 Pundag	7831	862	1,136	756	433	555	1,717	-	13,290

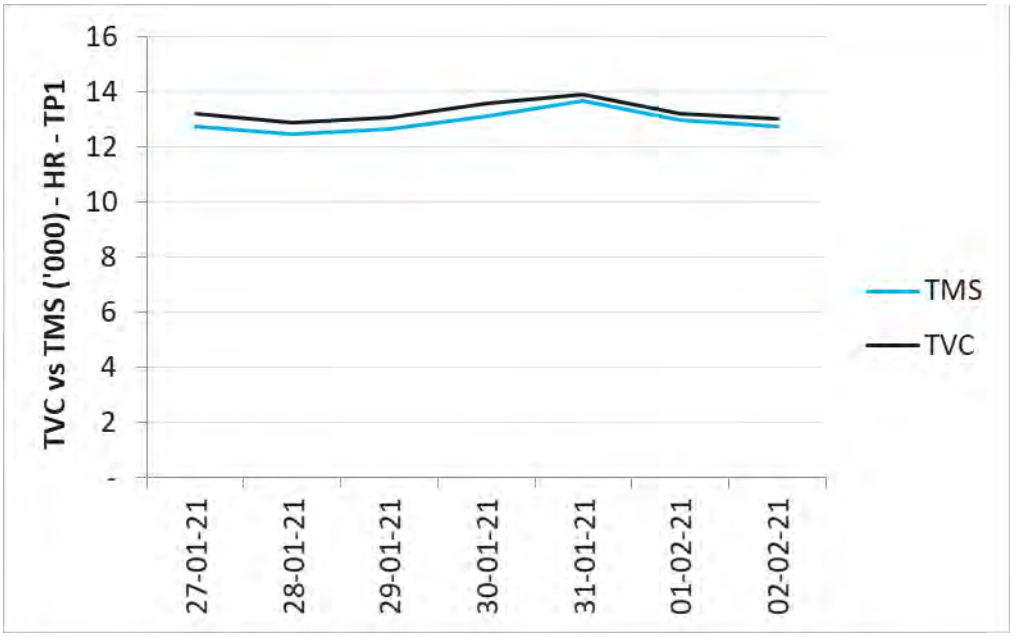
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.32 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those days, as provided by the Client.

3.33 The following figures show the comparison between the daily traffic observed by TVC and TMS for the toll plaza.

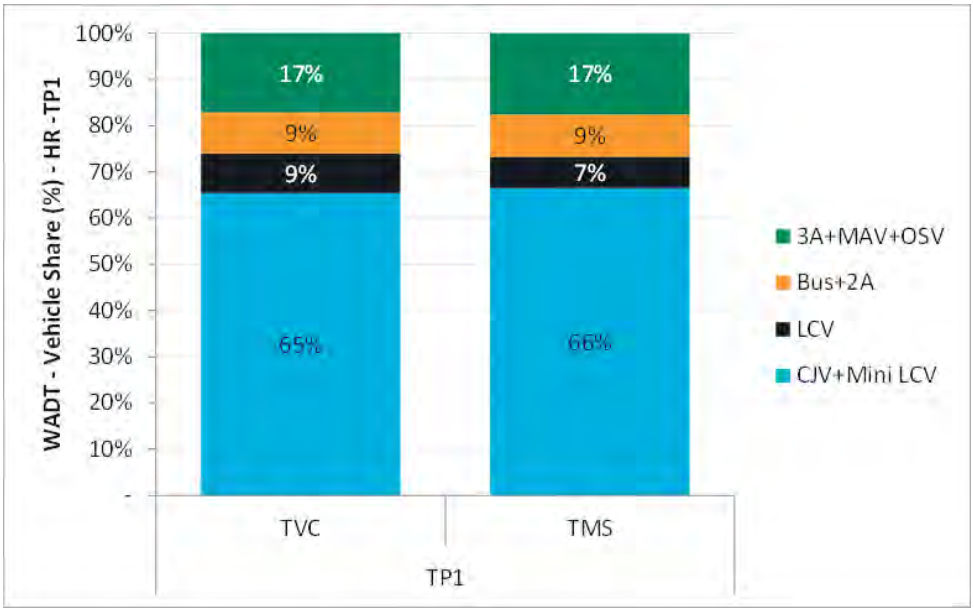
Figure 3.4: Comparison between TVC and TMS daily traffic data on TP1 Pundag



Source: Steer analysis of TVC and Client TMS data

3.34 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. As can be seen, whilst the share of CJVs and 3A+MAV+OSV is marginally higher for TMS compared to TVC, it is equal for bus/2A and lower for LCV category. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.5: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.35 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, our TVC-TMS analysis gives us confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.36 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. As mentioned previously, the OD analysis presented here has been based on the data collected on 27th-28th January 2021.

3.37 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.38 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.39 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TMS data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.9: Sample rates for OD data

Vehicle type	TP1 Pundag
CJV	17%
Mini Bus + Bus	39%
Mini LCV + LCV	11%
2A	95%
3A	45%
MAV + OSV	51%
Total	26%

Source: Steer analysis of OD data

Zone categories

3.40 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different assets being studied.

Table 3.3.10: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Jharkhand	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
East & Northeast India	West Bengal, Jharkhand, and Northeast Indian states
Bihar	Bihar (Including Patna etc.)
Odisha	Delhi State, including New Delhi
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central India	Madhya Pradesh, Chhattisgarh
West India	Rajasthan, Gujarat
Delhi	Delhi State, including New Delhi

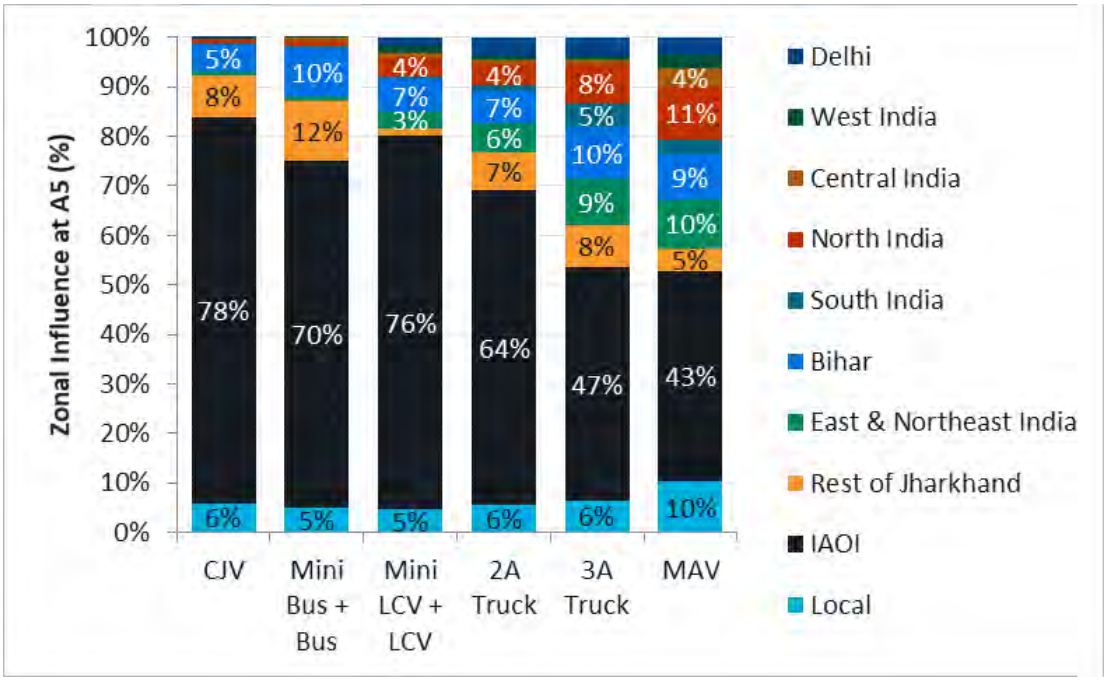
Source: Steer analysis

Zonal influence

3.41 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[3] at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.42 From the figures below, it can be observed that the plaza has high share of IAOI trips with 43% for MAVs and 78% for CJVs. 3A and MAV trips are comparable with higher proportion of local trips for MAV traffic because of the presence of coal mines and large-scale industries close to the Asset. We see a high share of Bihar and East and Northeast India in 2A, 3A and MAV zonal influence, comparable to that of rest of Jharkhand region.

Figure 3.6: Zonal influence at TP1 Pundag



Source: Steer analysis of OD data

Internal External analysis

3.43 Internal-External analysis helps in identifying the trips which have both the origin and destination on the Asset (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). 'Internal' zones are those that were analysed as 'local' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are all other zones.

[3] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

3.44 Figure 3.7 below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

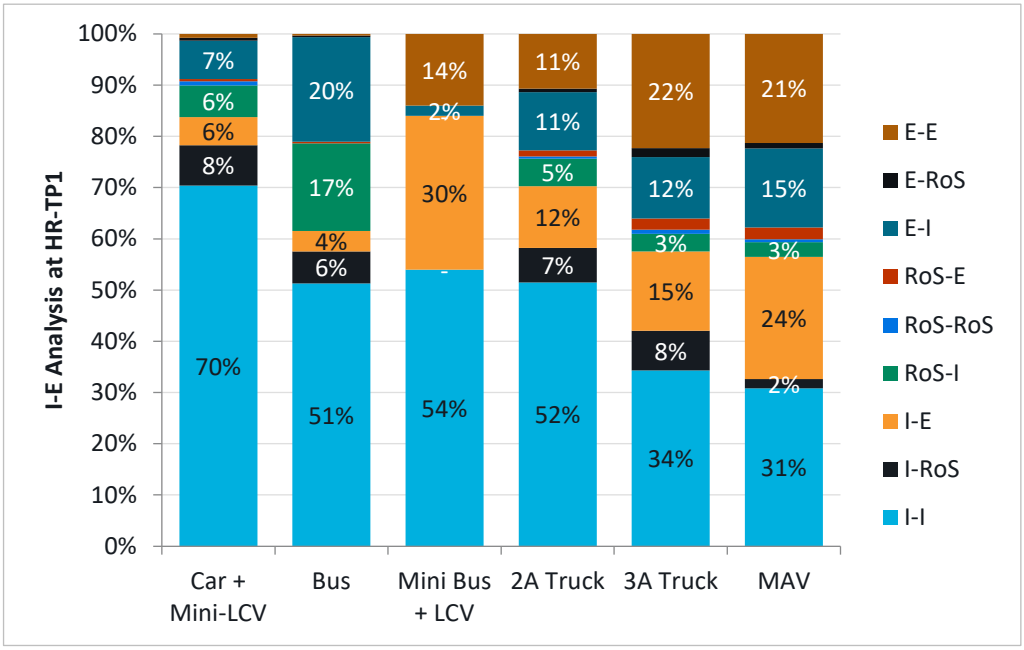
3.45 We see that I-I and I-E trips dominate for 3A and MAV categories suggesting Jharkhand as a significant origin of truck traffic. Presence of big industries near the Asset as well as in the state can be the reason behind this high number of Internal trips. This proportion also suggests that the trips are local in nature. 21-22% proportion of E-E trips validates that the Asset is not being solely used by through traffic.

3.46 Since, a majority of the traffic is attributed to Internal zones, it can be inferred that the growth of traffic is directly proportional to the growth of state.

3.47 The Asset is used by through traffic traveling from Odisha and south-eastern states to Bihar.

3.48 As expected, CJVs and Bus show much lower E-E trips and more trips in the I-E, I-RoS and I-I mix. LCVs and 2As show almost a similar proportion of I-I and E-E trips. 2As vary from LCVs in I-RoS trips as the former is preferred for medium/long-distance trips.

Figure 3.7 Internal-external distribution at TP1 Pundag



Source: Steer analysis of OD data

Commodity distribution

3.49 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.11: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR

Commodity Description	Code	Combined codes used for charts
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

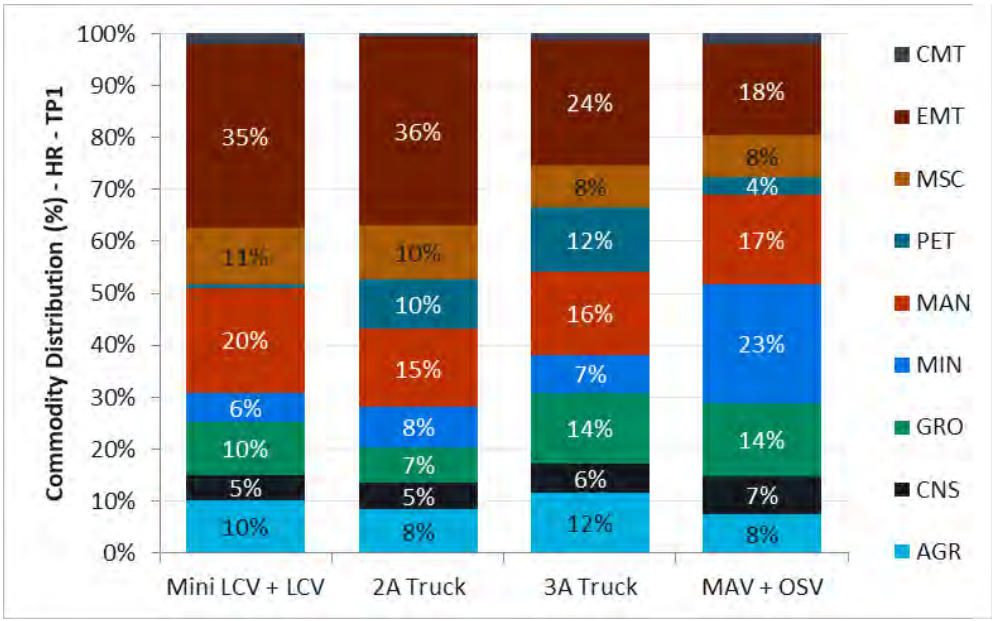
Source: Steer analysis

3.50 The following figures present the commodity distribution for goods vehicles at the toll plaza at the total level and also split by direction, towards Ranchi and towards Hazaribagh. As observed during our site visit, a proportion of the vehicles were travelling empty. Those not empty, were carrying manufactured goods and related commodities (15-17%) across all goods vehicles.

3.51 For MAVs, minerals and related commodities were observed to have the highest proportion and made up for 23% of the total. Coal mines at Ramgarh and Patratu are the main reason behind high shares. As the vehicle size decreases, the proportion of mineral commodities being transported also decreases.

3.52 Groceries and related commodities dominated the Mini LCV and LCV category. Agricultural and groceries made up 20% of the total share. The share decreases for 2A trucks but increases comparably for 3As and MAVs. 10% of 2A trucks and 12% of 3A trucks are also observed to transport petroleum products.

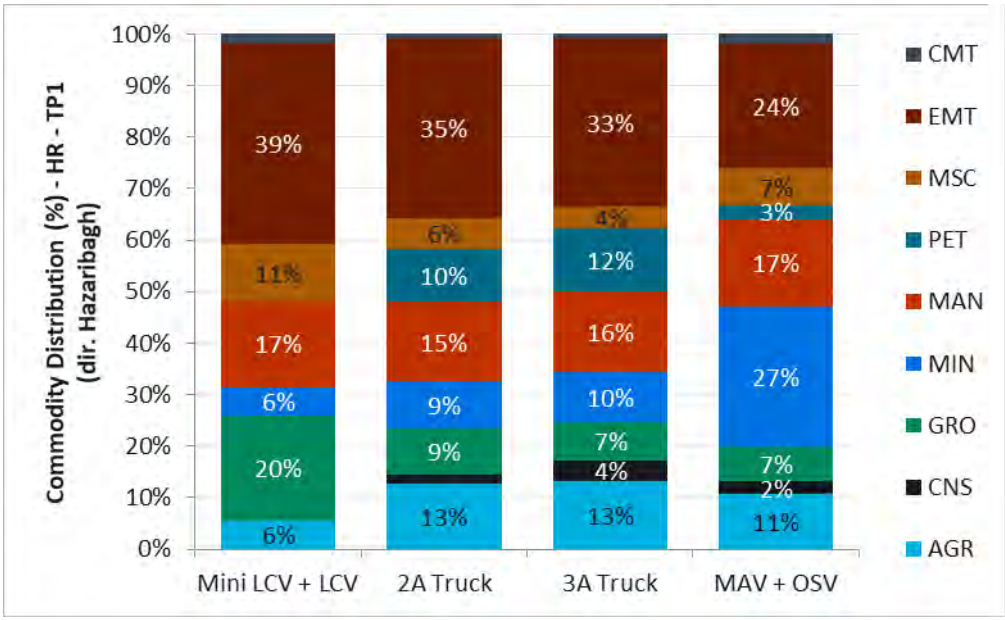
Figure 3.8: Commodity distribution at TP1 Pundag



Source: Steer analysis of OD data

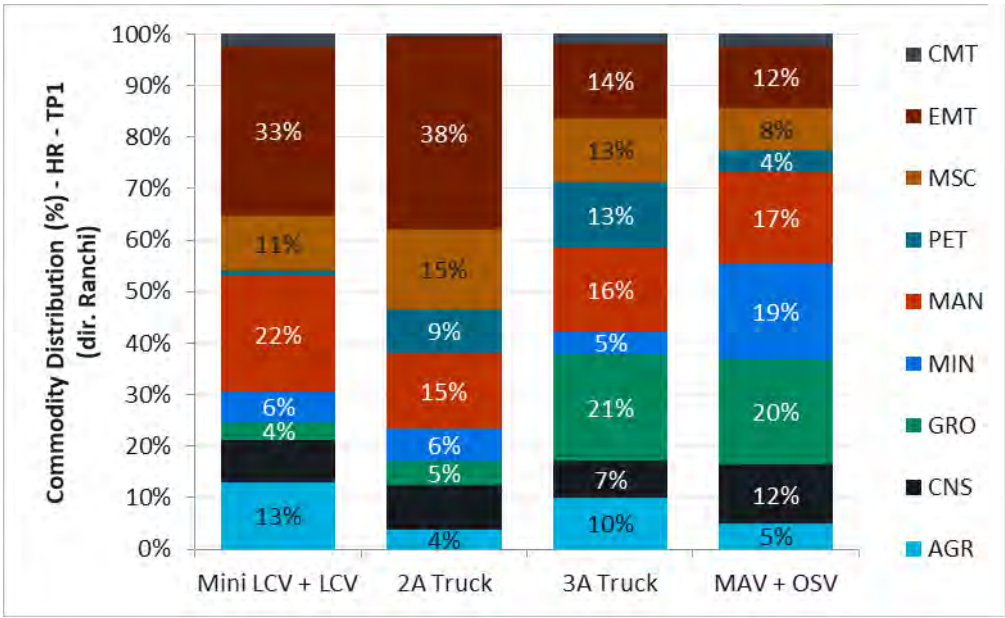
3.53 Considering these trends by direction (shown in the following two figures), a much greater share of vehicles is travelling empty towards Hazaribagh than those travelling in the opposite direction towards Ranchi. This is due to the fact that vehicles travel empty up to industries and mines in Ramgarh and Hazaribagh in order to load commodities at those destinations. For the LCV category, the share of groceries drops from 20% to 4% when the origin direction changes from Ranchi to Hazaribagh indicating the production/consumption balance between these two cities. On the other hand, the same increases from 7% to 20% for 3A and MAV categories. Manufactured and miscellaneous commodities share comparable proportion in both the directions.

Figure 3.9: Commodity distribution at TP1 Pundag (Towards Hazaribagh)



Source: Steer analysis of OD data

Figure 3.10: Commodity distribution at TP1 Pundag (Ranchi)



Source: Steer analysis of OD data

Trip length analysis

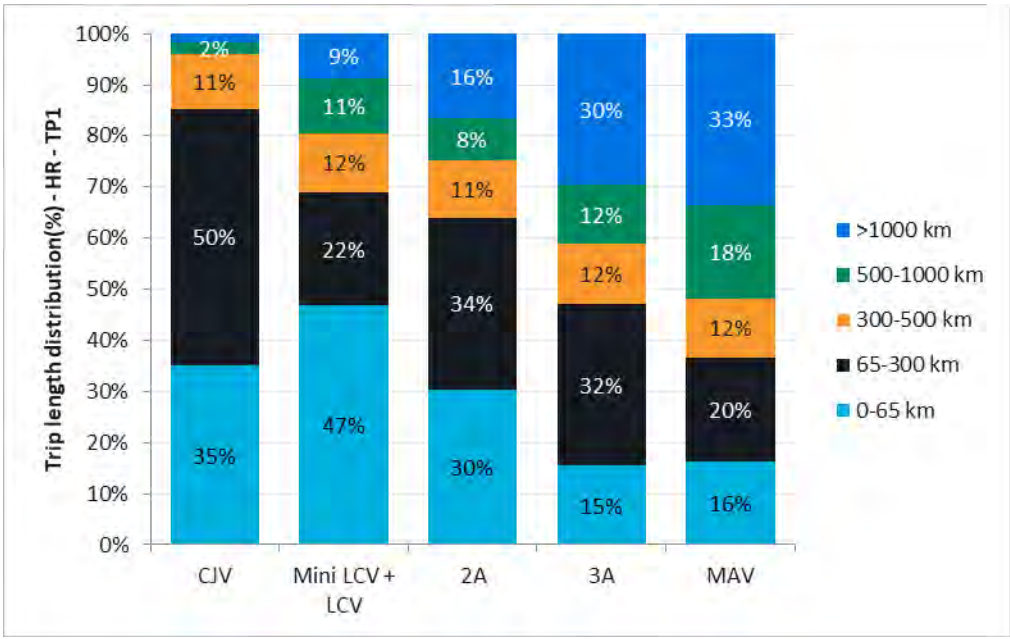
3.54 Trip-length distribution provides the distance-based profile of various vehicle types. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[4]

3.55 As observed in the Internal-External analysis, trips at the toll plaza are largely influenced by internal or local zones. The same is validated by the following figure, as the share of local and short-distance trips (up to 300 km) is considerably high in all the categories, ranging from 36% for MAVs to 85% for CJVs.

3.56 Medium-distanced trips remain same across all the categories. In terms of long-distance and very-long-distance trips (greater than 500 km), CJVs do not have any significant proportion, as has been seen across other Assets around the country. As expected, MAVs show a much higher share, up to 18% for 500-1000 km and 33% for >1000 km trips.

[4] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.11: Trip length distribution at TP1 Pundag



Source: Steer analysis of OD data

Conclusions

3.57 In summary, as per the traffic volume data, CJVs contribute to the highest share in traffic around 70% followed by MAVs with 14% share. Even though CJVs make up for the highest share in traffic, MAVs are the biggest revenue contributor.

3.58 Both, CJV and MAV category vehicles, predominantly buy single tickets. However, with the onset of strict FASTag implementation, the share of single journeys has reduced across the categories as the share of return journey tickets increased especially in CJV's. For MAVs Single, tickets have remained dominant, holding a share of 91-93% across the months at the plaza. The proportion of local personal tickets as well as exemptions has remained constant over the months. The Asset observes almost negligible non-paying traffic.

3.59 There has been a significant growth in ETC traffic due to recent government mandate aimed at 100% FASTag penetration. The proportion of vehicles with active FASTag grew by approximately 64% to 84% in five months. The last ten days of February observed average 93% traffic using FASTag to pay toll fees.

3.60 The TVC data shows minor variation on the TMS data, where at a total level, the TVC data is approximately 3% higher than the TMS data. However, the difference is negligible for the larger revenue generating categories (3A, MAV, and OSV combined), 0.4% at a total level. This gives us confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

3.61 The OD analysis indicates that in terms of zonal influence, TP1 has high share of traffic originating/ending at IAOI areas and hence, the Asset serves largely local traffic, more so for CJVs: Local and IAOI zonal influence ranges from 53% for MAVs to 84% for CJVs. The key commodities transported on the Asset include minerals, groceries, and manufactured products, which when combined, make up around 54% of the commodity share for MAV

traffic. Agricultural products also contribute an average 9% share across all goods vehicle's categories.

3.62 When considering the internal and external distribution, it is observed that I-I and I-E trips dominate for 3A and MAV categories suggesting Jharkhand as a significant origin of truck traffic. Since, a majority of the traffic is attributed to Internal zones, it can be inferred that the traffic is greatly local in nature and the growth of traffic is directly proportional to the growth of state. The trip length analysis supports these findings, with 3A and MAV traffic at the plaza having an average 53% share of trips ending within 500 km.

3.63 In summary, analysing the vehicle share on the Asset and understanding the OD analysis, CJVs are the dominant vehicle class and as found by the zonal influence, internal-external and trip length analysis and are greatly contributing to the local traffic. Heavy goods vehicles, although accounting for 27% of the traffic, are the largest revenue generator for the Asset.

4 Socio economic context and traffic growth

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the roads are in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the region where the Asset is located and the country. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Asset.

4.2 In turn, the change in the relative competitive position of the Asset (and thus of the traffic capture they can achieve) derives from how the relative offer for the roads changes, i.e. the service offered, and the tolls charged on the project roads, in comparison to that on competing roads; and whether any competing road facilities are planned.

4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the regions surrounding the Asset.

Population growth

4.4 We have analysed the key socioeconomic drivers of the background traffic demand in Jharkhand state, where the Asset is located.

National level

4.5 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth.

State level

4.6 The following table shows the evolution of population in Jharkhand state compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, the state has grown at a higher rate than the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Jharkhand	26.9	21.0	6.0	33.0	25.1	7.9	2.0%	1.8%	2.8%
India	**1,028.7**	**742.6**	**286.1**	**1,210.9**	**833.7**	**377.1**	**1.6%**	**1.2%**	**2.8%**

Source: Ministry of Housing and Urban Affairs – Census Data, http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf

4.7 Due to the complexities of the patterns in which urbanisation takes place, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide a socio-economic context of the trend in the region in which the Asset is located.

Economic growth

GDP and GSDP Growth

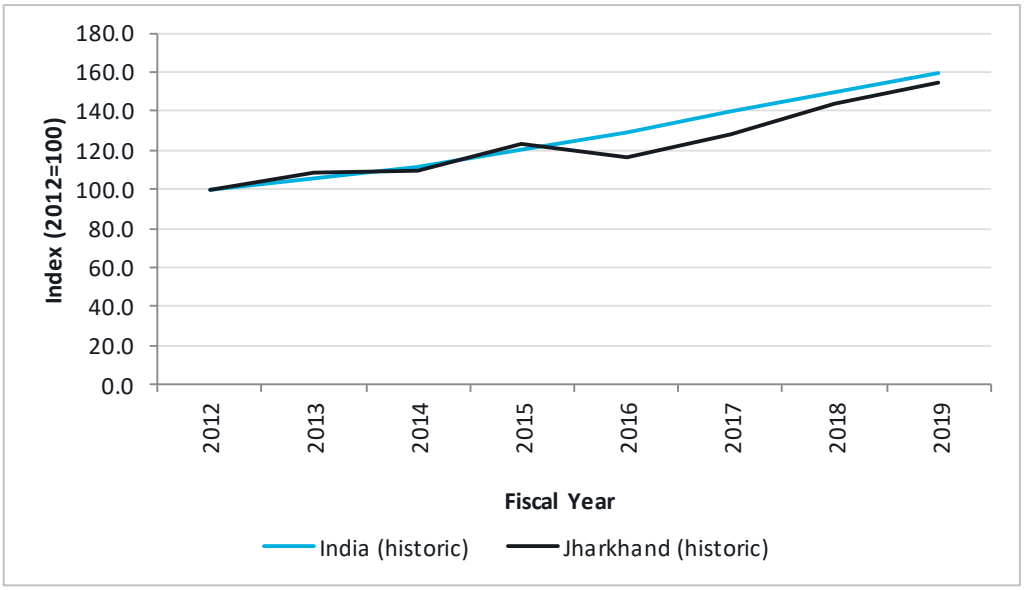
4.8 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.9 JH 1, Hazaribagh-Ranchi, lies in the state of Jharkhand. Jharkhand is one of the richest mineral zones in the country with a share of around 40% and 29% of India's mineral and coal reserves respectively. Due to its large mineral reserves, mining and mineral extraction are the major industries driving the state economy. The state houses the country's oldest and one of the largest steel plants, operated by the Tata steel, in Jamshedpur.

4.10 Since the Jharkhand's economy is largely dependent upon the mining, the state GSDP growth rate fell rapidly after growing by over 10% in FY15 to -6% in FY16, with the ban on illegal mining.

4.11 The following figures illustrates the evolution of Jharkhand's GSDP during FY12-FY19.

Figure 4.1: Evolution of Jharkhand's state GDP and National GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

5 Traffic Growth Analysis

Introduction

5.1 In this section, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 In the absence of historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

Overview

5.5 For brownfield assets, where sufficient historical traffic evolution is available, it is common practice to use regression model analysis to determine the relationship, expressed as elasticity, between traffic growth and key socioeconomic drivers. This relationship is then applied to assumptions of future socio-economic evolution to estimate future traffic growth.

5.6 As for the Asset under consideration, a consistent historical trend was not available. Therefore, we undertook a benchmark in order to estimate our forecast elasticities, Sources used included our understanding of the Asset, the elasticities used during the bid for TOT3 package by the client and the subsequent lender study that was undertaken by the Client. We have also undertaken a regional benchmarking against Assets having similar traffic profiles, which give us reasonable confidence the relationships proposed.

5.7 In terms of selection of growth drivers for vehicle types, in general we have assumed state GDP as the key driving factor for the passenger traffic given this traffic is generally driven by the local economies of the cities and state containing the Asset. The heavier commercial vehicles generally ply long-distance and the underlying growth is governed by the general economies of several states or nation as whole.

5.8 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

5.9 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.1: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP Jharkhand
Car		100%
LCV		100%
Bus		100%
2A		100%
3A	100%	
MAV	100%	

Source: Steer

5.10 The sections below detail out the reasoning for selection of respective growth driver(s) for each vehicle category.

Table 5.2: Elasticity recommendations for the Asset

Vehicle Category	Proposed	Growth Driver	Comments
CJV	1.0	Jharkhand GSDP	The cars predominantly commute between Ranchi, Ramgarh, Hazaribagh and other local destinations along the Asset. With the increase in urbanisation and trip generators along the Asset, cars are expected to grow faster in the near future, therefore we have assumed a 1 relationship to GSDP for cars.
Buses	0.5	Jharkhand GSDP	Buses are local and interstate, around 85% of the buses have one end of their trip in Jharkhand, while 10% of trip have one end of their trip in Bihar. It seems that buses currently are serving local intercity demand. As these cities grow, the buses are also expected to respond to the increasing demand however only at a 0.5 relationship to GSDP.
LCV	0.4	Jharkhand GSDP	As discussed in chapter 3, the trip lengths of LCV and 2A category (up to 70%) are predominantly short distance <300Km. Which confirms the understanding that the movements cater to local demand. Considering the above observations, and our experience across other toll roads in the region, we believe that elasticities of 0.4 with respect to state GSDP are considered reasonable.
2A	0.4	Jharkhand GSDP	

Vehicle Category	Proposed	Growth Driver	Comments
3A	0.6	GDP India	Mix of medium and long-distance trips between Bihar-Jharkhand, and traffic OD between Haryana, Rajasthan and Jamshedpur and Bokaro Steel plant. We expect as these industries grow, which are linked to national economy. Historically on similar Assets 3A showed a decline but after the Axle load revisions there has been a resurgence the 3A category traffic volumes returning to the roads. We expect this to continue with a small growth in the future. Trip lengths for almost 60% of the MAV are more than 300km, signifying long distance nature of the movement. This in addition to the various mix of commodities which include a healthy mix of agri based and manufacturing commodities.
MAV	0.9	GDP India	

Source: Steer Analysis

Forecasts for growth drivers

5.13 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.14 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.15 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in Figure 5.1.

5.16 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.17 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are optimistic.

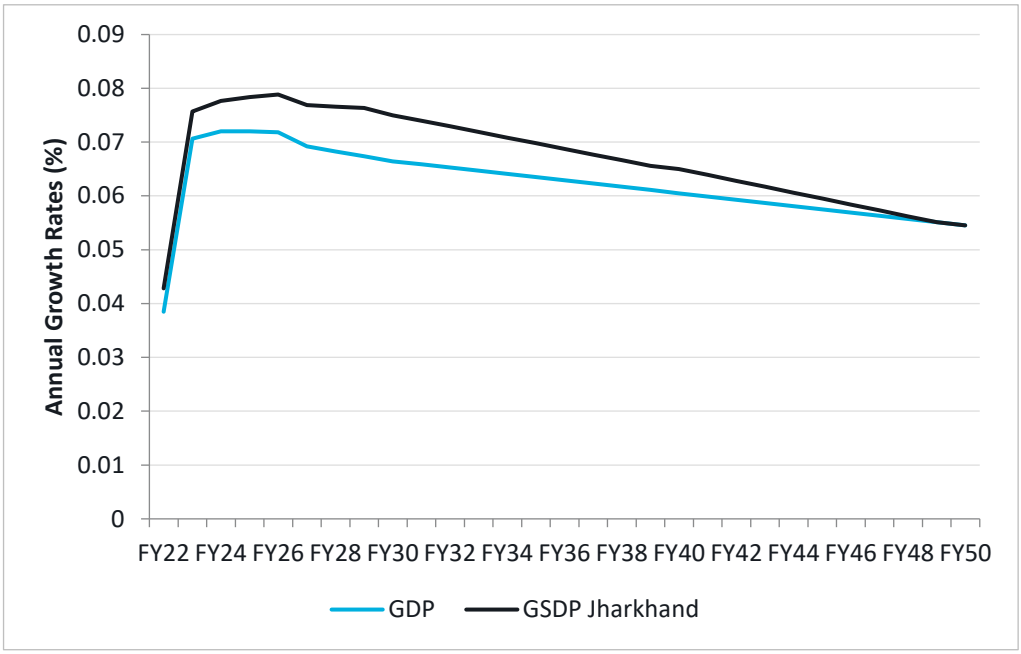
State GSDP

5.18 As per Client projections, Jharkhand GSDP growth assumes to continue outpacing the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.19 Since Jharkhand is largely a mineral and manufacturing (iron & steel) dependent economy, the state is largely impacted by the fluctuations in these sectors. During the last decade, the mining industry was badly impacted by bans, new mining policy and change in steel and iron market scenario due to overall economic fluctuations. However, going forward, we expect as Jharkhand grows its economy stabilises overtime with magnitude of these cycles coming down.

5.20 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing. The chart below shows the forecast growth lines for GDP and Jharkhand GSDP.

Figure 5.1: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP forecast based on GDP forecast

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of background growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years

Seasonal Correction Factors

6.2 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.3 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.4 Historical traffic data was available for all toll vehicle categories starting October 2020 up-to March 2022. Therefore, in absence of longer-term historical data to arrive at the SCF, we have benchmarked our SCF from various sources:

- Assets in the vicinity, south or north of the Asset carrying very similar traffic profiles
- SCF assumptions assumed during the Bid by the Client, and
- Site observations and information provided by the toll plaza.

6.5 The below table presents the assumptions in SCF used to estimate the AADT:

Table 6.1: Adopted SCF for the Asset based on benchmarks

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.90	0.96	0.97	1.11	1.04	1.03	0.99	1.04	1.10	1.02	0.96	1.05
LCV	0.99	1.02	0.97	1.01	1.08	1.05	1.04	0.99	1.03	1.01	0.90	0.95

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Bus	1.00	0.97	0.99	1.12	1.11	1.09	1.04	0.94	1.03	1.00	0.88	0.98
2A	1.06	1.04	1.04	1.07	1.07	1.04	1.09	1.00	1.02	0.98	0.87	0.93
3A	1.01	1.01	0.99	1.04	1.06	1.04	1.06	0.97	1.03	1.00	0.91	0.95
MAV	1.08	1.06	1.04	1.06	1.08	1.04	1.04	0.94	1.00	0.99	0.88	0.90

Source: Steer analysis of various sources

Base year traffic

FY22 AADT estimation

6.6 As discussed earlier in chapter 1 and 3, the second wave of COVID-19 infections peaked in the northern half of the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.7 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.8 Further, we believe that the traffic levels observed during the October 2021 - March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below.

Table 6.2: Monthly MADT and Adopted AADT for FY22-TP1 Pundag

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-21	FY22 Adopted AADT (FY22*)
CJV	8,562	9,994	9,643	7,995	9,739	9,044	9,618
LCV	479	493	547	481	556	562	511
Bus	541	618	626	486	575	576	570
2A	655	602	643	587	667	697	629
3A	451	466	471	440	482	501	460
MAV	1,684	1,575	1,725	1,742	1,777	1,785	1,639
Total AADT	**12,374**	**13,749**	**13,656**	**11,731**	**13,797**	**13,166**	**13,426**
PCU#	**20,572**	**21,728**	**22,187**	**19,821**	**22,444**	**21,937**	**21,540**

Source: Steer analysis, #Rigid Trailer PCU factor used for MAV

Analysis of potential network/developmental impacts

6.9 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous Chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6 laning LOS improvement

6.10 As per the concession agreement as soon as the Asset his 40,000 PCU's the Asset is eligible for capacity augmentation. The PCU level need to be maintained above the 40,000 levels for 4 consecutive years and 1 year will be earmarked for DPR preparation. After that a three-year period is factored in for construction, during which the Year 1 of construction toll rates will be maintained at 75% and will remain flat at 75%. After the construction is over the toll rates will be calculated as normal, as they should have been in that year.

6.11 On the Asset, it is expected based on our forecasts that traffic volumes will go beyond the 40,000 PCUs mark in FY33, thus breaching the Level of Service requirements set out in the concession agreement. We expect the level of service on the Asset to improve post capacity augmentation. To calculate this impact, we have employed a GJC based approach.

6.12 A comparison of generalised journey costs (GJC) provides how different elements of cost and time affect traffic. This comparison was done for both light and heavy vehicles. Lower GJCs correspond to higher induced traffic. Based on Steer's studies and research in India, we have found that for every 1% reduction in the GJCs, the traffic increases by a factor of 0.3. We then applied the difference of GJCs to the elasticity of 0.3 to get net influence on the traffic.

6.13 The improvement in travel costs or GJC is translated into the impact on that share of local + IAOI OD movements using a linear inverse relationship. Therefore, the impact of improvement in level of service is applied on the corresponding shares of traffic, which were extracted from OD data.

6.14 The table below shows the extent of the LOS impact and the expected timelines of the impact on the Asset.

Table 6.3: Impact of 6 laning LOS improvement

Vehicle category	FY41
CJV	2.2%
Mini LCV	0.4%
Buses	0.4%
LCV	0.4%
2A	1.1%
3A	1.0%
MAV	0.9%

Source: Steer analysis

Revenue forecasting assumptions

6.15 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e., traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e., the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.16 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY21 data available and listed in the table below:

Table 6.4: Trip factors at TP1 Pundag

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	14	45	50	50	45	45	45
Local commercial	1	1	1	1	1	1	1
Local Personal	13	20	20	20	20	20	20

Source: Steer analysis of Client TMS data

Toll segmentation

6.17 We have analysed the historical TMS data split by ticket categories, to understand trends, as shown in Chapter 3. The travel trends observed during the Q3 and Q4FY22 are devoid of any significant events and we believe the travel patterns (segmentation) observed area reasonable reflection of the normal segmentation, hence, Oct-Mar average for FY22 has been adopted for forecast segmentation.

6.18 The table below provides the toll segmentation assumed for the period of forecast.

Table 6.5: Toll segmentation for FY22, TP1 Pundag (Oct-21 to Mar-22)

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	32%	23%	14%	63%	74%	91%
Return	51%	69%	85%	34%	23%	9%
Monthly	0%	0%	0%	0%	0%	0%
Local commercial	2%	7%	0%	0%	2%	0%
Local personal	7%	0%	0%	0%	0%	0%
Exemptions	8%	1%	1%	3%	1%	0%
Violations	0%	0%	0%	0%	0%	0%

Source: Steer analysis of Client TMS data

Toll evolution

6.19 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.20 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.6: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.27%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by the Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Revenue reconciliation

6.21 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset. To reconcile we have used the segmentation Oct-Mar FY22 average, MADT of the month and compared it with the reported revenue for that month. The exercise was undertaken for Feb and Mar 2022. The comparison, as shown in the table below, depicts the modelled revenue and the reported revenue and the difference between the two is within 0.6%, this gives us the confidence on the assumptions around segmentation and trip factors used for estimating forecasting revenue.

Table 6.7: FY22 Revenue reconciliation summary

Vehicle Category	Modelled Feb-22	Actual Feb-22	Difference (%)	Modelled Mar-22	Actual Mar-22	Difference (%)
Total	658.3	657.9	0.1%	719	715	0.6%

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.22 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.8: Final traffic forecast for TP1 Pundag

Vehicle Type	FY22*	FY27	FY32	FY42	FY51
CJV	8,664	12,581	18,059	35,407	58,580
Mini LCV	954	1,111	1,288	1,687	2,070
Bus	570	689	828	1,158	1,495
LCV	511	595	690	903	1,109
2A	629	732	849	1,119	1,373
3A	460	567	690	1,004	1,355
MAV	1,639	2,235	2,991	5,196	8,112
AADT	**13,426**	**18,512**	**25,395**	**46,475**	**74,093**
PCUs	**21,540**	**28,979**	**38,761**	**67,884**	**105,566**

Source: Steer analysis, FY22* is normalised traffic (AADT).

Table 6.9: Traffic CAGR (%) for TP1 Pundag

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	7.7%	7.5%	7.0%	6.8%
Mini LCV	3.1%	3.0%	2.7%	2.7%
Bus	3.9%	3.7%	3.4%	3.4%
LCV	3.1%	3.0%	2.7%	2.7%
2A	3.1%	3.0%	2.8%	2.7%
3A	4.3%	4.0%	3.8%	3.8%
MAV	6.4%	6.0%	5.7%	5.7%
AADT	**6.6%**	**6.5%**	**6.2%**	**6.1%**
PCUs	**6.1%**	**6.0%**	**5.8%**	**5.6%**

Source: Steer analysis

Table 6.10: Revenue forecast for TP1 Pundag (INR crores)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	24.3	47.9	87.1	266.1	657.3
Mini LCV	2.7	4.2	6.2	12.6	23.1
Bus	5.8	9.5	14.5	31.5	60.8
LCV	2.5	4.0	5.8	11.9	21.8
2A	7.3	11.6	17.0	34.8	63.8
3A	6.1	10.2	15.6	35.4	71.7
MAV	32.9	60.8	102.9	278.1	650.5
OSV	0.0	0.0	0.0	0.0	0.0
Total revenue	**81.7**	**148.3**	**249.1**	**670.3**	**1,549.0**

Source: Steer analysis

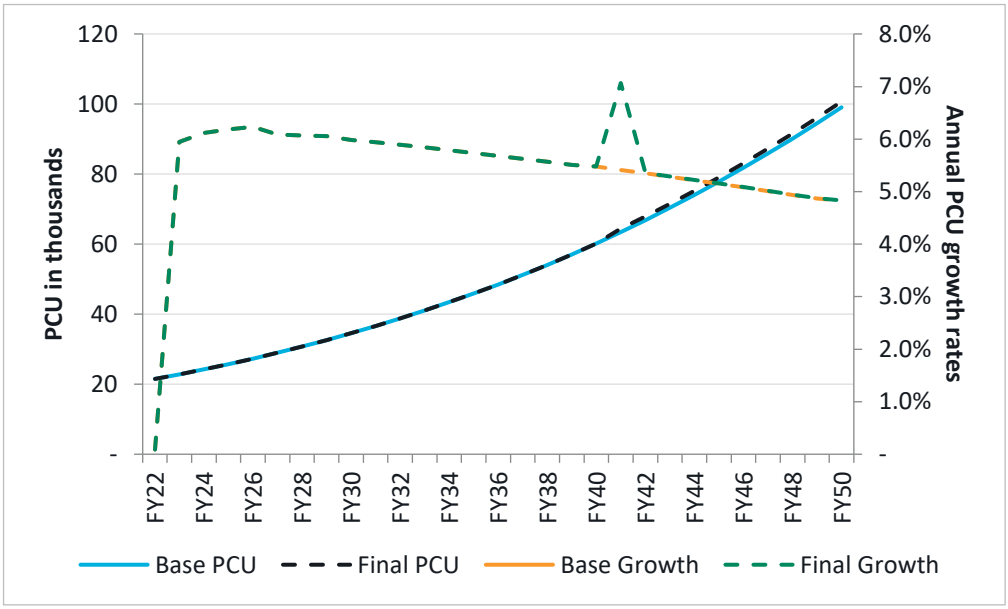
Table 6.11: Revenue growth CAGR (%) for TP1 Pundag

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	14.6%	12.7%	11.8%	12.0%
Mini LCV	9.6%	8.0%	7.4%	7.7%
Bus	10.4%	8.8%	8.1%	8.4%
LCV	9.6%	7.9%	7.4%	7.7%
2A	9.6%	7.9%	7.4%	7.7%
3A	10.8%	8.9%	8.5%	8.9%
MAV	13.1%	11.1%	10.4%	10.8%
Total revenue	**12.7%**	**10.9%**	**10.4%**	**10.7%**

Source: Steer analysis

6.23 As presented in the tables above, traffic CAGRs (PCUs) for the traffic forecast (with impacts) on the Asset over the concession period is around 5.6% and corresponding revenue CAGR is around 10.7%. This growth is majorly driven by both CJVs and MAVs, as discussed in the historical section, this Asset connects major urban settlements of Hazaribagh, Ramgarh and Ranchi and because of which CJVs on the Asset are expected to grow with increasing per capita income levels of the region and are expected to grow at a healthy rate for a longer period, given the low car ownership levels in the state. While for the strong growth of the MAVs can be attributed to the growing industrial landscape in the vicinity of the Asset which includes steel plants, power plants and mining activities.

Figure 6.1: Forecast PCUs and growth rates at TP1 Pundag



Source: Steer analysis

Upside and Downside Cases

6.24 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken

due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.25 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.26 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.12: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
HTL	GDP/GSDP	+1% every year	-1% every year
HTL	WPI	+1% every year	-1% every year
HTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.27 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.28 The upside case impacts included in forecasts are summarised in below:

Table 6.13: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning of the Asset)
Year	**FY39**
TP-1	CJV:2.8%, Buses:0.5%, LCV:0.5%, 2A:1.3%, 3A:1.3%, MAV:1.2%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.29 The downside case impacts included in forecasts are summarised in below:

Table 6.14: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning of the Asset)
Year	**FY46**

Impact	LoS Improvement (6 Laning of the Asset)
TP-1	CJV:2.2%, Buses:0.4%, LCV:0.4%, 2A:0.8%, 3A:0.8%, MAV:0.4%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.30 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.31 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.15: Traffic forecast (With Upside Impacts) for TP1: Pundag

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	8,664	9,480	13,715	21,439	49,832	94,973
Mini LCV	954	990	1,152	1,384	1,944	2,530
Bus	570	597	721	906	1,380	1,917
LCV	511	530	617	741	1,041	1,355
2A	629	652	759	912	1,291	1,681
3A	460	485	597	765	1,232	1,812
MAV	1,639	1,770	2,412	3,477	7,003	12,416
AADT	**13,426**	**14,504**	**19,973**	**29,624**	**63,723**	**116,684**
PCU's	**21,540**	**23,140**	**31,119**	**44,791**	**91,451**	**162,579**

Source: Steer analysis

Table 6.16: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Pundag

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	9.4%	9.7%	9.3%	8.8%	8.6%
Mini LCV	3.8%	3.9%	3.7%	3.5%	3.4%
Bus	4.7%	4.8%	4.7%	4.3%	4.3%
LCV	3.8%	3.9%	3.7%	3.5%	3.4%
2A	3.8%	3.9%	3.7%	3.5%	3.4%
3A	5.3%	5.4%	5.1%	4.9%	4.8%
MAV	8.0%	8.0%	7.6%	7.3%	7.2%
AADT	**8.0%**	**8.3%**	**8.2%**	**8.0%**	**7.7%**
PCU's	**7.4%**	**7.7%**	**7.6%**	**7.4%**	**7.2%**

Source: Steer analysis

Table 6.17: Revenue forecast (With Upside Impacts) for TP1: Pundag (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	24.3	29.6	54.4	110.4	435.1	1,346.8
Mini LCV	2.7	3.1	4.5	7.1	16.8	35.6
Bus	5.8	6.7	10.3	16.9	43.5	98.3
LCV	2.5	2.9	4.2	6.7	15.8	33.5
2A	7.3	8.4	12.4	19.4	46.5	98.5
3A	6.1	7.1	11.1	18.5	50.5	120.7
MAV	32.9	39.3	67.8	127.7	434.6	1,254.1
Total Revenue	**81.7**	**97.2**	**164.7**	**306.6**	**1,042.7**	**2,987.5**

Source: Steer analysis

Table 6.18: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Pundag

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	22.1%	16.4%	15.2%	14.7%	14.6%
Mini LCV	15.8%	10.2%	9.3%	9.1%	9.1%
Bus	15.5%	11.2%	10.4%	9.9%	10.1%
LCV	14.5%	10.1%	9.5%	9.0%	9.2%
2A	15.0%	10.1%	9.4%	9.1%	9.2%
3A	16.0%	11.8%	10.8%	10.6%	10.6%
MAV	19.5%	14.6%	13.5%	13.0%	13.2%
Total	**19.0%**	**14.1%**	**13.2%**	**13.0%**	**13.0%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.32 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.33 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.19: Traffic forecast (With Downside Impacts) for TP1: Pundag

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	8,664	9,176	11,634	15,456	25,550	37,877
Mini LCV	954	976	1,076	1,207	1,481	1,730
Bus	570	587	662	764	986	1,196
LCV	511	523	576	647	793	927
2A	629	643	709	796	976	1,146
3A	460	475	541	629	830	1,045
MAV	1,639	1,720	2,087	2,612	3,945	5,537
AADT	**13,426**	**14,100**	**17,284**	**22,111**	**34,561**	**49,459**

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
PCU's	**21,540**	**22,536**	**27,178**	**34,049**	**51,471**	**72,037**

Source: Steer analysis

Table 6.20: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Pundag

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	5.9%	6.1%	5.8%	5.2%	5.2%
Mini LCV	2.4%	2.4%	2.3%	2.1%	2.1%
Bus	3.0%	3.1%	2.9%	2.6%	2.6%
LCV	2.4%	2.4%	2.3%	2.1%	2.1%
2A	2.4%	2.4%	2.3%	2.1%	2.1%
3A	3.3%	3.3%	3.1%	2.8%	2.9%
MAV	4.9%	5.0%	4.6%	4.2%	4.3%
AADT	**5.0%**	**5.2%**	**5.0%**	**4.6%**	**4.6%**
PCU's	**4.6%**	**4.8%**	**4.6%**	**4.2%**	**4.2%**

Source: Steer analysis

Table 6.21: Revenue forecast (With Downside Impacts) for TP1: Pundag (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	24.3	28.2	43.1	69.7	119.0	340.7
Mini LCV	2.7	3.0	4.0	5.4	6.8	15.4
Bus	5.8	6.5	8.9	12.5	16.8	39.0
LCV	2.5	2.8	3.7	5.1	6.5	14.6
2A	7.3	8.2	10.9	14.9	19.0	42.7
3A	6.1	6.9	9.4	13.4	18.3	44.2
MAV	32.9	37.9	55.3	84.3	132.6	355.4
Total Revenue	**81.7**	**93.5**	**135.3**	**205.4**	**319.1**	**852.1**

Source: Steer analysis

Table 6.22: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Pundag

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	15.9%	11.2%	10.1%	5.5%	9.3%
Mini LCV	12.0%	7.4%	6.5%	2.4%	6.1%
Bus	12.6%	7.9%	7.1%	3.0%	6.6%
LCV	11.6%	7.3%	6.6%	2.4%	6.1%
2A	12.2%	7.3%	6.4%	2.5%	6.1%
3A	12.5%	8.1%	7.3%	3.2%	6.9%
MAV	15.1%	9.9%	8.8%	4.6%	8.3%
Total	**14.5%**	**9.7%**	**8.7%**	**4.5%**	**8.2%**

Source: Steer analysis

Target revenues and modification of concession period

6.34 As per the concession agreement, the target revenue should be 15.8 Cr for the month of March 2030 first calculation of target revenue and 38.0 Cr for the month of March 2040 for the second calculation of target revenue. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual revenue.' If the target revenue for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6.23: Target Revenues for Extension 1

Asset	Target Month	Target Revenue INR Cr	Estimated Revenue			Average Revenue	Variation (%)
			2029	2030	2031		
HR	Mar-30	15.8	16.31	17.99	19.95	18.08	14.0%

Source: Steer analysis

Table 6.24: Target Revenues for Extension 2

Asset	Target Month	Target Revenue INR Cr	Estimated Revenue			Average Revenue	Variation (%)
			2039	2040	2041		
HR	Mar-40	38.0	31.25	32.92	53.65	39.3	3.3%

Source: Steer analysis

6.35 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have forecast seasonality of March month to adjust for seasonal trends and arrive at March traffic from AADT traffic, which is then segmented according to the forecast toll segmentation and trip factors and multiplied with respective estimated toll rates to get to a monthly revenue collection.

6.36 As seen from the table above, the difference lies within the 20% threshold excess, no modification of concession period is expected on the Asset.

Summary outlook

6.37 Passenger movement on the Asset is largely local in nature, connecting the cities of Ranchi to Patratu, Ramgarh, Hazaribagh over the short distance and northern regions of Delhi NCR, Uttar Pradesh, Patna, Gaya and Barhi to Jamshedpur, Rourkela, and further southern cities. Cars, the dominating vehicle category on the Asset, are expected to see a healthy growth on the Asset following the overall behavioural shift of users away from public transport.

6.38 Groceries, agricultural and manufacturing goods being transported form a part of essential commodities and are expected to show a healthy growth in the future years as well. Since the Asset is located in mineral and steel rich state of Jharkhand with numerous mines in the vicinity, the Asset is bound to grow with the growth of industrial sector as well as the overall growth of the country.

6.39 We expect that the implementation of FASTag rules, will also help in improving the operational efficiency and overall compliance levels on the Asset and overall corridor as a whole which should result in an improved level of service, thereby resulting in an improved level of service for all users.

6.40 The strategic importance and geographic location of this Asset, connecting the key movement between north India and Bihar to the Jharkhand, Odisha, and West Bengal, is expected to continue driving a healthy traffic growth rate in the forecast years.

6.41 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.42 With regards to the short-term background growth, we see the following risk:

- It was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. It can be seen from the FY22 traffic data that the traffic is following the similar trends as seen in the Q3 and Q4FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like mining and industrial sectors in Jharkhand region has seen a major comeback in the second part of FY22 resulting in increased activity in the corridor.

6.43 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Ranchi, Jamshedpur, Bokaro, Patna, Bhubaneswar, and Rourkela. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth driven by the industrial growth in the state backed by the potential of significant mining and mineral resources in the region.

Appendices

A Top 10 OD pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Pundag

Table A.1: CJV top 10 OD pair shares at TP1 Pundag

	OD Pair	Share
1.	Ranchi-Ramgarh	25%
2.	Hazaribagh-Ranchi	23%
3.	Ranchi-Patna	10%
4.	Ranchi-Kodarma	4%
5.	Ranchi-Giridih	4%
6.	Ormanjhi-Ramgarh	3%
7.	Ranchi-Dhanbad	2%
8.	Barhi-Ranchi	2%
9.	Ramgarh-Khunti	2%
10.	Hazaribagh-Bokaro Steel City	2%

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Pundag

	OD Pair	Share
1.	Ranchi-Ramgarh	6%
2.	Ranchi-Patna	5%
3.	Hazaribagh-Ranchi	4%
4.	Uttar Pradesh-Odisha	3%
5.	Ranchi-Bokaro	2%
6.	Patna-Odisha	2%
7.	Ranchi-NCT of Delhi	2%
8.	Patna-Andhra Pradesh	2%
9.	Bokaro Steel City-Patna	2%
10.	Ranchi-Uttar Pradesh	2%

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY31, year of expected close of the concession. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Traffic Forecast (with impacts) over horizon years at TP1 Pundag

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY21	8,275	911	672	859	490	516	1,594	**13,318**	**21,521**
FY22	8,664	954	570	511	629	460	1,639	**13,426**	**21,540**
FY23	9,319	983	591	526	648	480	1,743	**14,290**	**22,821**
FY24	10,043	1,013	614	543	668	501	1,856	**15,238**	**24,217**
FY25	10,830	1,045	638	560	689	522	1,976	**16,260**	**25,714**
FY26	11,683	1,078	664	577	710	545	2,104	**17,361**	**27,317**
FY27	12,581	1,111	689	595	732	567	2,235	**18,512**	**28,979**
FY28	13,545	1,145	716	613	755	591	2,373	**19,737**	**30,738**
FY29	14,579	1,180	743	632	778	614	2,516	**21,043**	**32,600**
FY30	15,672	1,216	771	651	801	639	2,667	**22,417**	**34,552**
FY31	16,832	1,252	799	670	825	664	2,825	**23,867**	**36,605**
FY32	18,059	1,288	828	690	849	690	2,991	**25,395**	**38,761**
FY33	19,357	1,325	858	710	873	717	3,165	**27,005**	**41,025**
FY34	20,728	1,363	889	730	898	744	3,348	**28,699**	**43,400**
FY35	22,175	1,401	920	750	923	773	3,539	**30,480**	**45,890**
FY36	23,699	1,439	951	771	948	802	3,739	**32,349**	**48,497**
FY37	25,303	1,478	983	792	974	832	3,949	**34,311**	**51,225**
FY38	26,989	1,518	1,016	813	1,000	863	4,168	**36,366**	**54,077**
FY39	28,759	1,557	1,049	834	1,026	894	4,397	**38,518**	**57,057**
FY40	30,628	1,598	1,084	856	1,053	927	4,637	**40,782**	**60,181**
FY41	33,315	1,645	1,123	881	1,091	970	4,933	**43,959**	**64,434**
FY42	35,407	1,687	1,158	903	1,119	1,004	5,196	**46,475**	**67,884**
FY43	37,592	1,728	1,194	926	1,146	1,040	5,471	**49,096**	**71,475**
FY44	39,870	1,770	1,230	948	1,174	1,076	5,757	**51,825**	**75,208**
FY45	42,242	1,812	1,266	971	1,202	1,113	6,055	**54,661**	**79,084**
FY46	44,709	1,855	1,303	993	1,230	1,151	6,365	**57,607**	**83,106**
FY47	47,271	1,897	1,341	1,016	1,258	1,190	6,687	**60,661**	**87,274**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY48	49,928	1,940	1,378	1,039	1,287	1,230	7,023	**63,825**	**91,590**
FY49	52,680	1,983	1,416	1,062	1,315	1,271	7,371	**67,097**	**96,053**
FY50	55,552	2,026	1,455	1,085	1,344	1,312	7,732	**70,506**	**100,692**
FY51	58,580	2,070	1,495	1,109	1,373	1,355	8,112	**74,093**	**105,566**

Source: Steer analysis

Table B.2: Forecasts (with impacts) for AADT growth rates (%) at TP1 Pundag

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	4.7%	4.7%	(15.1%)	(40.6%)	28.2%	(10.8%)	2.8%	**0.8%**	**0.1%**
FY23	7.6%	3.0%	3.8%	3.0%	3.0%	4.2%	6.4%	**6.4%**	**5.9%**
FY24	7.8%	3.1%	3.9%	3.1%	3.1%	4.3%	6.5%	**6.6%**	**6.1%**
FY25	7.8%	3.1%	3.9%	3.1%	3.1%	4.3%	6.5%	**6.7%**	**6.2%**
FY26	7.9%	3.2%	3.9%	3.2%	3.2%	4.3%	6.5%	**6.8%**	**6.2%**
FY27	7.7%	3.1%	3.8%	3.1%	3.1%	4.2%	6.2%	**6.6%**	**6.1%**
FY28	7.7%	3.1%	3.8%	3.1%	3.1%	4.1%	6.1%	**6.6%**	**6.1%**
FY29	7.6%	3.1%	3.8%	3.1%	3.1%	4.0%	6.1%	**6.6%**	**6.1%**
FY30	7.5%	3.0%	3.7%	3.0%	3.0%	4.0%	6.0%	**6.5%**	**6.0%**
FY31	7.4%	3.0%	3.7%	3.0%	3.0%	4.0%	5.9%	**6.5%**	**5.9%**
FY32	7.3%	2.9%	3.6%	2.9%	2.9%	3.9%	5.9%	**6.4%**	**5.9%**
FY33	7.2%	2.9%	3.6%	2.9%	2.9%	3.9%	5.8%	**6.3%**	**5.8%**
FY34	7.1%	2.8%	3.5%	2.8%	2.8%	3.8%	5.8%	**6.3%**	**5.8%**
FY35	7.0%	2.8%	3.5%	2.8%	2.8%	3.8%	5.7%	**6.2%**	**5.7%**
FY36	6.9%	2.7%	3.4%	2.7%	2.7%	3.8%	5.7%	**6.1%**	**5.7%**
FY37	6.8%	2.7%	3.4%	2.7%	2.7%	3.7%	5.6%	**6.1%**	**5.6%**
FY38	6.7%	2.7%	3.3%	2.7%	2.7%	3.7%	5.6%	**6.0%**	**5.6%**
FY39	6.6%	2.6%	3.3%	2.6%	2.6%	3.7%	5.5%	**5.9%**	**5.5%**
FY40	6.5%	2.6%	3.2%	2.6%	2.6%	3.6%	5.4%	**5.9%**	**5.5%**
FY41	8.8%	3.0%	3.6%	3.0%	3.7%	4.7%	6.4%	**7.8%**	**7.1%**
FY42	6.3%	2.5%	3.1%	2.5%	2.5%	3.6%	5.3%	**5.7%**	**5.4%**
FY43	6.2%	2.5%	3.1%	2.5%	2.5%	3.5%	5.3%	**5.6%**	**5.3%**
FY44	6.1%	2.4%	3.0%	2.4%	2.4%	3.5%	5.2%	**5.6%**	**5.2%**
FY45	6.0%	2.4%	3.0%	2.4%	2.4%	3.5%	5.2%	**5.5%**	**5.2%**
FY46	5.8%	2.3%	2.9%	2.3%	2.3%	3.4%	5.1%	**5.4%**	**5.1%**
FY47	5.7%	2.3%	2.9%	2.3%	2.3%	3.4%	5.1%	**5.3%**	**5.0%**
FY48	5.6%	2.2%	2.8%	2.2%	2.2%	3.3%	5.0%	**5.2%**	**4.9%**
FY49	5.5%	2.2%	2.8%	2.2%	2.2%	3.3%	5.0%	**5.1%**	**4.9%**
FY50	5.5%	2.2%	2.7%	2.2%	2.2%	3.3%	4.9%	**5.1%**	**4.8%**
FY51	5.5%	2.2%	2.7%	2.2%	2.2%	3.3%	4.9%	**5.1%**	**4.8%**

Source: Steer analysis

Revenue forecasts

Table B.3: Revenue forecast (INR Crores), for TP1 Pundag

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY21	22.7	2.7	7.2	3.8	4.9	6.6	30.7	**78.7**
FY22	24.3	2.7	5.8	2.5	7.3	6.1	32.9	**81.7**
FY23	28.6	3.0	6.6	2.9	8.3	7.0	38.4	**94.8**
FY24	33.0	3.3	7.3	3.1	9.1	7.7	43.4	**106.9**
FY25	37.3	3.6	8.0	3.4	9.8	8.5	48.5	**118.9**
FY26	42.0	3.8	8.7	3.6	10.7	9.3	54.3	**132.5**
FY27	47.9	4.2	9.5	4.0	11.6	10.2	60.8	**148.3**
FY28	53.9	4.5	10.4	4.3	12.6	11.2	68.1	**165.1**
FY29	61.7	5.0	11.3	4.6	13.5	12.1	75.6	**183.8**
FY30	68.8	5.3	12.3	5.0	14.6	13.2	83.5	**202.8**
FY31	77.5	5.7	13.4	5.4	15.8	14.3	92.9	**225.0**
FY32	87.1	6.2	14.5	5.8	17.0	15.6	102.9	**249.1**
FY33	97.3	6.6	15.6	6.2	18.2	16.9	113.7	**274.7**
FY34	109.7	7.2	16.9	6.7	19.5	18.4	125.6	**304.0**
FY35	122.1	7.7	18.3	7.2	21.1	19.9	138.5	**334.8**
FY36	135.8	8.2	19.8	7.8	22.6	21.7	153.4	**369.3**
FY37	151.3	8.8	21.4	8.3	24.3	23.5	169.2	**406.8**
FY38	125.7	7.0	17.4	6.7	19.6	19.1	140.1	**335.5**
FY39	133.9	7.2	17.9	6.9	20.1	19.8	147.8	**353.6**
FY40	143.0	7.4	18.6	7.1	20.7	20.5	156.3	**373.6**
FY41	238.0	11.7	29.2	11.1	32.5	32.7	252.6	**607.8**
FY42	266.1	12.6	31.5	11.9	34.8	35.4	278.1	**670.3**
FY43	294.4	13.4	33.9	12.7	37.3	38.4	306.4	**736.6**
FY44	327.9	14.4	36.7	13.6	40.0	41.6	337.7	**812.1**
FY45	362.2	15.4	39.3	14.6	42.6	44.9	370.4	**889.4**
FY46	402.2	16.6	42.4	15.6	45.8	48.5	407.5	**978.5**
FY47	442.8	17.6	45.6	16.7	48.9	52.6	447.2	**1,071.4**
FY48	490.2	18.9	49.2	17.9	52.4	57.0	493.4	**1,179.0**
FY49	541.1	20.2	52.7	19.1	56.0	61.5	540.0	**1,290.5**
FY50	596.7	21.6	56.6	20.4	59.8	66.4	592.6	**1,414.1**
FY51	657.3	23.1	60.8	21.8	63.8	71.7	650.5	**1,549.0**

Source: Steer analysis

C Data collection exercise

C.1 In order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7-day TVC counts

Table B.1: TVC counts at TP1

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	Total
27-01-2021	8,019	798	1,001	777	446	496	1,707	13,244
28-01-2021	7,354	903	1,162	776	457	551	1,698	12,901
29-01-2021	7,584	803	1,219	747	432	602	1,696	13,083
30-01-2021	7,910	927	1,204	757	479	606	1,720	13,603
31-01-2021	8,482	847	1,067	729	431	579	1,776	13,911
01-02-2021	7,901	849	1,081	759	387	523	1,725	13,225
02-02-2021	7,568	909	1,218	750	397	526	1,695	13,063

Source: Steer analysis

TVC vs TMS comparison

Table B.1: TVC and TMS WADT

Toll Plaza	Source	CJV+ Mini LCV	LCV	Bus	2 Axle	3 Axle+ MAV	OSV	Total
TP1	TVC	8,693	2,158	756	433	2,271	-	26,319
	TMS	8,593	2,996	632	563	2,259	5	25,646

Source: Steer analysis

Zone list

Table B.1: Zone list for TP1

Zone No	Zone name	State
1	Hazaribagh	Jharkhand
2	Babanbhai	Jharkhand

Zone No	Zone name	State
3	Morangi	Jharkhand
4	Barhi	Jharkhand
5	Chapwa	Jharkhand
6	Barasi	Jharkhand
7	Charhi	Jharkhand
8	Mandu	Jharkhand
9	Rewali	Jharkhand
10	Banadag	Jharkhand
11	Sakhiya	Jharkhand
12	Juljul	Jharkhand
13	Singhani	Jharkhand
14	Marai	Jharkhand
15	Chotha	Jharkhand
16	Huwag	Jharkhand
17	Topa	Jharkhand
18	Arka	Jharkhand
19	Sirka	Jharkhand
20	Orla	Jharkhand
21	Hazaribagh	Jharkhand
22	Ranchi	Jharkhand
23	Mesra	Jharkhand
24	Getlatu	Jharkhand
25	Irba	Jharkhand
26	Dumardaga	Jharkhand
27	Lalpur	Jharkhand
28	Buti	Jharkhand
29	Ormanjhi	Jharkhand
30	Dardag	Jharkhand
31	Piska	Jharkhand
32	Chetar	Jharkhand
33	Chaha	Jharkhand
34	Gurgain	Jharkhand
35	Hujir	Jharkhand
36	Oyna	Jharkhand
37	Chuttu	Jharkhand
38	Hutup	Jharkhand

Zone No	Zone name	State
39	Boreya	Jharkhand
40	Turup	Jharkhand
41	Tatisilwai	Jharkhand
42	Ranchi	Jharkhand
43	Ramgarh	Jharkhand
44	Kujju	Jharkhand
45	Kaitha	Jharkhand
46	Kankebar	Jharkhand
47	Seota	Jharkhand
48	Argada	Jharkhand
49	Huhua	Jharkhand
50	Barkakana	Jharkhand
51	Siur	Jharkhand
52	Kulhi	Jharkhand
53	Gola	Jharkhand
54	Ramgarh	Jharkhand
55	Bokaro	Jharkhand
56	Bokaro Steel City	Jharkhand
57	Phusro	Jharkhand
58	Gumia	Jharkhand
59	Chatra	Jharkhand
60	Deoghar	Jharkhand
61	Dhanbad	Jharkhand
62	Dhanbad	Jharkhand
63	Dumka	Jharkhand
64	Garhwa	Jharkhand
65	Bagodar	Jharkhand
66	Giridih	Jharkhand
67	Godda	Jharkhand
68	Gumla	Jharkhand
69	Jamtara	Jharkhand
70	Khunti	Jharkhand
71	Kodarma	Jharkhand
72	Jhumri Teleya	Jharkhand
73	Kolkata	West Bengal
74	Latehar	Jharkhand

Zone No	Zone name	State
75	Lohardaga	Jharkhand
76	Pakur	Jharkhand
77	Palamu	Jharkhand
78	Asansol	West Bengal
79	Pashchimi Singhbhum	Jharkhand
80	Patna	Bihar
81	Bihar	Bihar
82	Jamshedpur	Jharkhand
83	Purbi Singhbhum	Jharkhand
84	Sahibganj	Jharkhand
85	Saraikela-kharsawan	Jharkhand
86	Simdega	Jharkhand
87	Rourkela	Odisha
88	Andaman & Nicobar Island	Andaman & Nicobar Island
89	Andhra Pradesh	Andhra Pradesh
90	Arunanchal Pradesh	Arunanchal Pradesh
91	Assam	Assam
92	Chandigarh	Chandigarh
93	Chhattisgarh	Chhattisgarh
94	Dadara & Nagar Havelli	Dadara & Nagar Havelli
95	Daman & Diu	Daman & Diu
96	Goa	Goa
97	Gujarat	Gujarat
98	Haryana	Haryana
99	Himachal Pradesh	Himachal Pradesh
100	Jammu & Kashmir	Jammu & Kashmir
101	Leh	Leh
102	Karnataka	Karnataka
103	Kerala	Kerala
104	Lakshadweep	Lakshadweep
105	Madhya Pradesh	Madhya Pradesh
106	Maharashtra	Maharashtra
107	Manipur	Manipur
108	Meghalaya	Meghalaya
109	Mizoram	Mizoram
110	Nagaland	Nagaland

Zone No	Zone name	State
111	NCT of Delhi	NCT of Delhi
112	Puducherry	Puducherry
113	Punjab	Punjab
114	Rajasthan	Rajasthan
115	Sikkim	Sikkim
116	Tamil Nadu	Tamil Nadu
117	Telangana	Telangana
118	Tripura	Tripura
119	Uttar Pradesh	Uttar Pradesh
120	Uttarakhand	Uttarakhand
121	West Bengal	West Bengal
122	Odisha	Odisha

Direction wise commodity distribution

Table B.1: Commodity distribution (towards Ranchi) at TP1

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	13%	4%	10%	5%
Construction	8%	9%	7%	12%
Stone	-	-	-	-
Groceries	4%	5%	21%	20%
Minerals	6%	6%	5%	19%
Manufacturing	22%	15%	16%	17%
Petroleum	1%	9%	13%	4%
Chemical	-	-	-	-
Miscellaneous	11%	15%	13%	8%
Machinery	-	-	-	-
Container	-	-	-	-
Empty	33%	38%	14%	12%
Sand	-	-	-	-
Cement	2%	0%	2%	2%

Source: Steer analysis of OD data

Table B.1: Commodity distribution (towards Hazaribagh) at TP1

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	6%	13%	13%	11%
Construction	-	2%	4%	2%

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Stone	-	-	-	-
Groceries	20%	9%	7%	7%
Minerals	6%	9%	10%	27%
Manufacturing	17%	15%	16%	17%
Petroleum	-	10%	12%	3%
Chemical	-	-	-	-
Miscellaneous	11%	6%	4%	7%
Machinery	-	-	-	-
Container	-	-	-	-
Empty	39%	35%	33%	24%
Sand	-	-	-	-
Cement	2%	1%	1%	2%

Source: Steer analysis of OD data

Trip length frequency

Table B.1: Trip length frequency at TP1

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	35%	10%	47%	30%	15%	16%
65-300 km	50%	65%	22%	34%	32%	20%
300-500 km	11%	21%	12%	11%	12%	12%
500-1000 km	2%	3%	11%	8%	12%	18%
>1000 km	2%	1%	9%	16%	30%	33%

Source: Steer analysis of OD data

D Impact analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the Asset.

D.2 Please find below the table for improvement in level of service due to six-laning on the Asset

Table D.1: GJC comparison for level of service improvement

	Asset		
	CJV	2A	MAV
Existing Toll rates	105	350	545
Length	74	74	74
Existing GJC	646	2,030	4,267
GJC post improvement	605	1,889	3,829

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

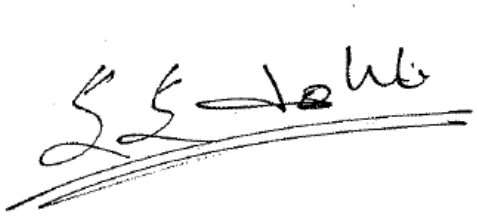
Client contract/project number

Transit

Author/originator

Vaibhav Gupta

Reviewer/approver



Serbjeet Kohli

Other contributors

Akshat Arya, Aditya Karan, Chanda Malhotra

Distribution

Client: Steer:

Version control/issue number

V1.0

Date

April 2022

steergroup.com

steer

Final Report

April 2022

Project Transit: Traffic Due Diligence of Jhansi-Lalitpur Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence of Jhansi-Lalitpur Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit 4.0
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer i

Glossary Items iii

1 Introduction 5

The assignment 5

Our Approach 6

Evolution of COVID-19 pandemic in India in FY21 and FY22 7

Contents of this report 9

2 The Assets 10

Introduction 10

Strategic network 10

Concession and tolling details 12

Key economic activities 13

Alternate Routes 14

3 Traffic Description 15

Introduction 15

PCU Factor assumption for reporting 15

Historical trends 16

Key findings of the TVC data analysis 24

Key findings of origin-destination analysis 26

Conclusions 35

4 Socio economic context and traffic growth 37

Introduction 37

Population growth 37

Economic growth 38

5 Traffic Growth Analysis 41

Introduction 41

Estimation of background elasticities 41

Overview 41

Forecasts for growth drivers 43

6 Forecast: Base year AADT and Impacts 45

Introduction 45

Base year FY22 AADT estimates 46

Analysis of potential network/developmental impacts 47

Revenue forecasting assumptions 48

Traffic and Revenue forecasts 51

Upside and Downside Cases 55

Traffic and Revenue Forecasts-Upside case 56

Traffic and Revenue Forecasts-Downside case 59

Target revenues and modification of concession period 62

Summary outlook 63

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 8

Figure 2.1: Location of Jhansi-Lalitpur and corresponding toll plazas 10

Figure 2.2: Asset context 11

Figure 2.3: Road cross section 12

Figure.1: Vehicle share at TP1 Babina 17

Figure 3.2: Vehicle share at TP2 Vigakhet 18

Figure 3.3: Ticket segmentation for CJV at TP1 Babina 21

Figure 3.4: Ticket segmentation for MAV at TP1 Babina 21

Figure 3.5: Ticket segmentation for CJV at TP2 Vigakhet 22

Figure 3.6: Ticket segmentation for MAV at TP2 Vigakhet 22

Figure 3.7: Comparison between vehicle shares from TVC and TMS WADTs 25

Figure 3.8: Zonal influence at TP1 Babina 28

Figure 3.9: Zonal influence at TP2 Vigakhet 28

Figure 3.10 Internal-external distribution at TP1 Babina 29

Figure 3.11 Internal-external distribution at TP2 Vigakhet 30

Figure 3.12: Commodity distribution at TP1 Babina 31

Figure 3.13: Commodity distribution at TP2 Vigakhet 32

Figure 3.14: Commodity distribution at TP1 Babina (Towards Lalitpur) 32

Figure 3.15: Commodity distribution at TP1 Babina (Towards Jhansi) 33

Figure 3.16: Commodity distribution at TP2 Vigakhet (Towards Lalitpur) 33
Figure 3.17: Commodity distribution at TP2 Vigakhet (Towards Lalitpur) 34
Figure 3.18: Trip length distribution at TP2 Vigakhet 35
Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP 39
Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP 40
Figure 5.1: GDP-GSDP forecast 44
Figure 6.1: SCF values for JLTL 45
Figure 6.2: Forecast PCUs and growth rates at TP1 Babina 54
Figure 6.3: Forecast PCUs and growth rates at TP2 Vigakhet 55

Tables

Table 1.1: Scope of work and sources of data 5
Table 2.1: Summary of concession 12
Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022 13
Table 3.1: PCU factors 15
Table 3.2: Reported Average Daily Traffic data of TP1 Babina 16
Table 3.3: Traffic level at TP2 Vigakhet 16
Table 3.4: Total Revenue (in INR crore) at TP1 Babina, and AADC (average annual daily collection) 18
Table 3.5: Total Revenue (in INR lakhs) at TP2 Vigakhet and AADC (average annual daily collection) 18
Table 3.6: Typical ticket types sold at NHAI plazas 19
Table 3.7: Timeline of national ETC implementation 19
Table 3.8: Percentage of Transactions via Fast Tag, Mar 2022 20
Table 3.9: Ticket segmentation for LCV, Bus and 2A at TP1 Babina 23
Table 3.10: Ticket segmentation for LCV, Bus and 2A at TP2 Vigakhet 23
Table 3.11: Data collection exercise 23
Table 3.12: Sample rates for OD data 26
Table 3.3.13: Zone aggregations for zonal influence analysis 27
Table 3.14: Aggregate commodity categories 30
Table 4.1: CAGR of population in India 37
Table 4.2: Population Growth in India (2001 – 2011) 38

Table 5.1: Identified growth drivers to model traffic growth 42
Table 5.2: Elasticity recommendations for the Asset (Jhansi-Lalitpur section) 42
Table 6.1: Monthly MADT and Adopted AADT for FY22, TP1 (Oct-21 to Mar-22) 46
Table 6.2: Monthly MADT and Adopted AADT for FY22, TP2 (Oct-21 to Mar-22) 46
Table 6.3: Impact of DME Impact on Delhi-Bangalore traffic 48
Table 6.4: Trip factors at TP1 Babina 48
Table 6.5: Trip factors at TP2 Vigakhet 49
Table 6.6: Toll segmentation for FY22, TP1 Babina 49
Table 6.7: Toll segmentation for FY22, TP2 Vigakhet 49
Table 6.8: WPI growth forecast assumptions 50
Table 6.9: FY22 Revenue reconciliation summary TP Babina (INR Crore) 51
Table 6.10: FY22 Revenue reconciliation summary TP Vigakhet (INR Crore) 51
Table 6.11: Forecast traffic for TP1 Babina 51
Table 6.12: Forecast Traffic CAGR (%) for TP1 Babina 51
Table 6.13: Forecast Revenue for TP1 Babina (INR crores) 52
Table 6.14: Forecast Revenue growth CAGR (%) for TP1 Babina 52
Table 6.15: Forecast traffic for TP2 Vigakhet 52
Table 6.16: Forecast Traffic CAGR (%) for TP2 Vigakhet 53
Table 6.17: Revenue Forecast for TP2 Vigakhet (INR crores) 53
Table 6.18: Forecast Revenue growth CAGR (%) for TP2 Vigakhet 53
Table 6.19: Summary of Macro Assumptions for upside and downside cases 55
Table 6.20: Summary of impacts on the Assets 56
Table 6.21: Summary of impacts on the Assets 56
Table 6.22: Traffic forecast (With Upside Impacts) for TP1: Babina 56
Table 6.23: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Babina 57
Table 6.24: Revenue forecast (With Upside Impacts) for TP1: Babina (In Cr) 57
Table 6.25: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Babina 57
Table 6.26: Traffic forecast (With Upside Impacts) for TP2: Vighakhet 58
Table 6.27: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Vighakhet 58
Table 6.28: Revenue forecast (With Upside Impacts) for TP2: Vighakhet (In Cr) 58
Table 6.29: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Vighakhet 59
Table 6.30: Traffic forecast (With Dowside Impacts) for TP1: Babina 59

Table 6.31: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Babina 60
Table 6.32: Revenue forecast (With Downside Impacts) for TP1: Babina (In Cr) 60
Table 6.33: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Babina 60
Table 6.34: Traffic forecast (With Downside Impacts) for TP2: Vighakhet 61
Table 6.35: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Vighakhet 61
Table 6.36: Revenue forecast (With Downside Impacts) for TP2: Vighakhet (In Cr) 61
Table 6.37: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Vighakhet 62
Table 6.38: Target Revenues for Extension 1 62
Table 6.39: Target Revenues for Extension 2 62

Appendices

A Top 10 OD Pairs

B Data Collection Exercise

C Detailed Forecasts

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID- 19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Oversized vehicles
PCU	Passenger Car Unit: it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on the Jhansi-Lalitpur Section of NH44 ("Assets" or "Asset").

1.2 Our scope of work for the traffic and revenue forecasts process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
Review of historical Traffic Management System (TMS) data, Origin-Destination (OD) data, Vendor reports and documents	Provided by client
Historical analysis and forecasts for baseline growth, including Background growth, Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
Validation of TMS data using independent Traffic Volume Counts (TVC) counts Validation of Revenue reported in FY22	TMS data provided by Client TVC counts independently undertaken by Steer Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
OD analysis to understand growth drivers Zonal influence and top OD pairs Commodity distribution Trip length distribution	Origin Destination surveys undertaken by Steer
Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
Historical revenue analysis and forecasts for revenue estimation, including Toll segmentation and trip factors, Overloading shares,	Calculated from historical data provided by Client
Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset
Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line as shared by the client

1.3 This report presents our draft T&R forecasts.

Our Approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and toll plaza data made available by client. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - Toll Plaza (TMS data) from October 2020 to March 2022
  - Concession agreement and toll notifications
  - Previous studies
  - Bid and Lender studies
- Steer-commissioned TVC counts from 27th January to 3rd February 2021
- OD data collected from Steer-commissioned surveys which were conducted from 27th January to 28th January 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the Annual Average Daily Traffic (AADT) reported for each of the toll plaza.

1.7 The estimation of future traffic demand on the Asset was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset

against our Steer knowledge base (e.g., similar Asset types in the same state or on the same corridor), to derive appropriate elasticities.
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.8 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until 03rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery etc.

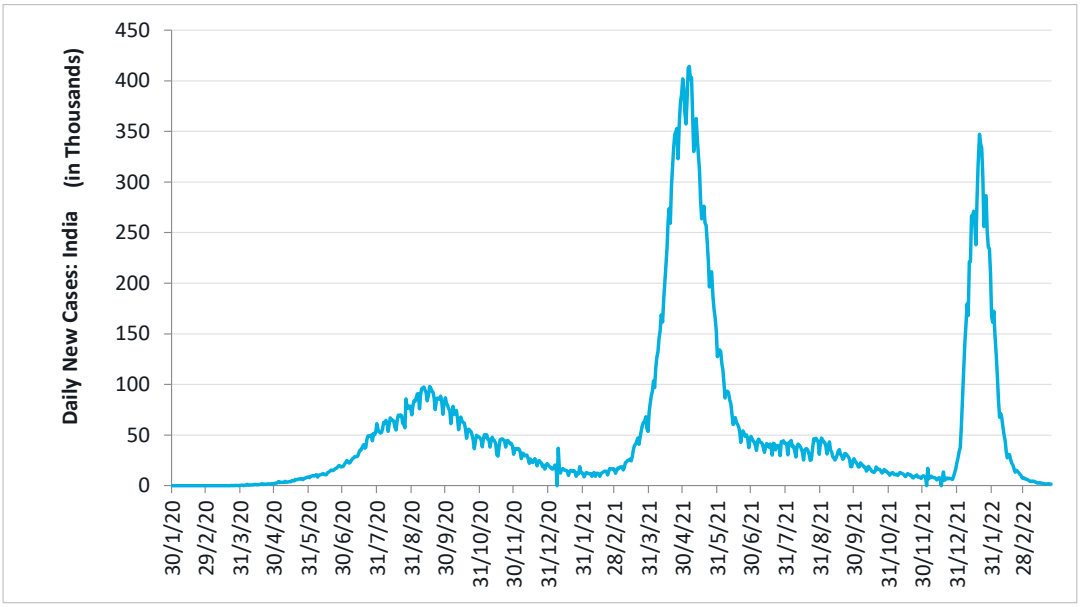
1.9 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

1.10 As the TMS data for the Asset is available from Oct 2020, the observation is that the traffic volumes have ramped up in the Q3FY21 and Q4FY21, which can be driven by following factors - a release of pent-up demand in certain vehicle categories, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network as well as the stabilization of the tolling systems on the Asset. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to Feb-2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, **https://data.COVID19india.org/**

1.13 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for first quarter. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but the fatality rate experienced in the third wave was lesser as compared to the former two, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.15 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus services. This considerable shift in mode choice is expected to sustain for longer periods. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely

that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this report

1.16 The report has been divided into 6 chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence ;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 summarises our approach and results on estimating background traffic demand growth along with our key forecasting assumptions, assessment of network impacts,
- Chapter 6 presents our traffic and revenue forecasts for the Asset.

2 The Assets

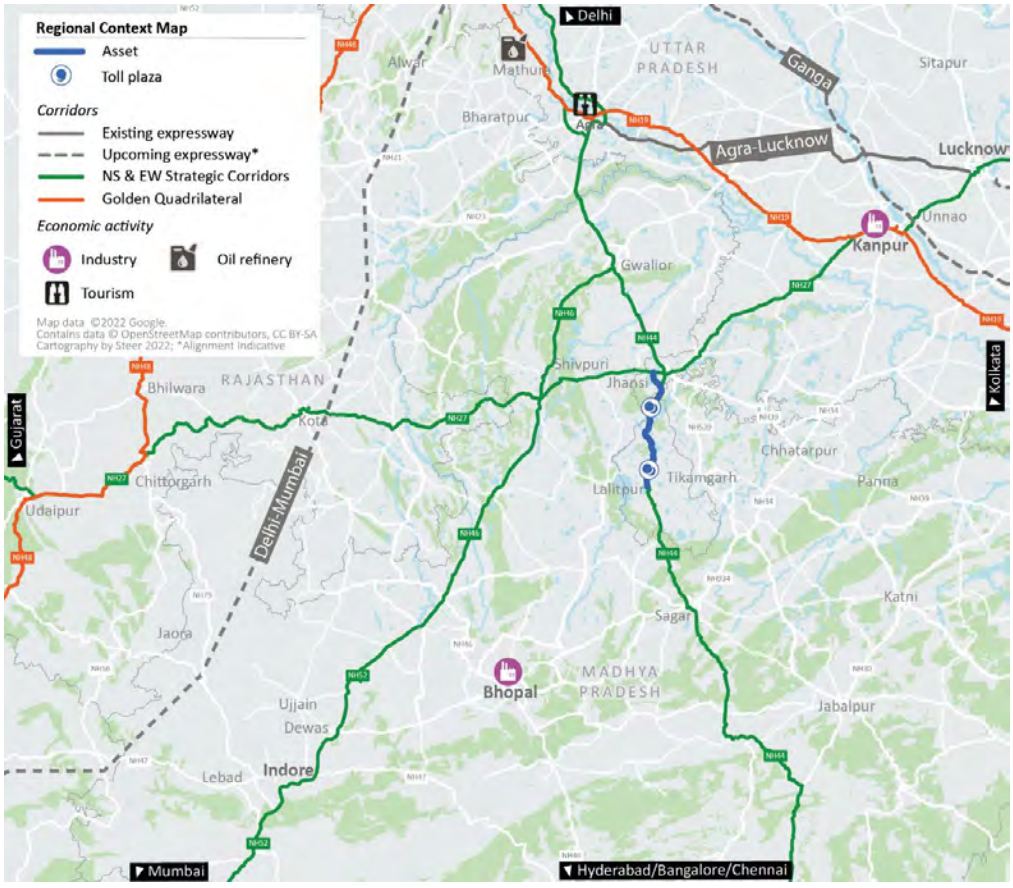
Introduction

2.1 This chapter provides a description of the Assets, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Assets.

Strategic network

2.2 The Assets are located in the state of Uttar Pradesh, connecting Jhansi and Lalitpur, on the NH 44 (old NH 25 and 26). NH44 caters to the North South movement between Jammu and Kashmir, and Kanyakumari, connecting major centers of economic activity such as Delhi, Nagpur, Hyderabad, Bangalore and Chennai. The following figure shows the regional road network in which the Assets is located.

Figure 2.1: Location of Jhansi-Lalitpur and corresponding toll plazas



Source: Steer Cartography

2.3 The Assets primarily cater to three different types of strategic movements:

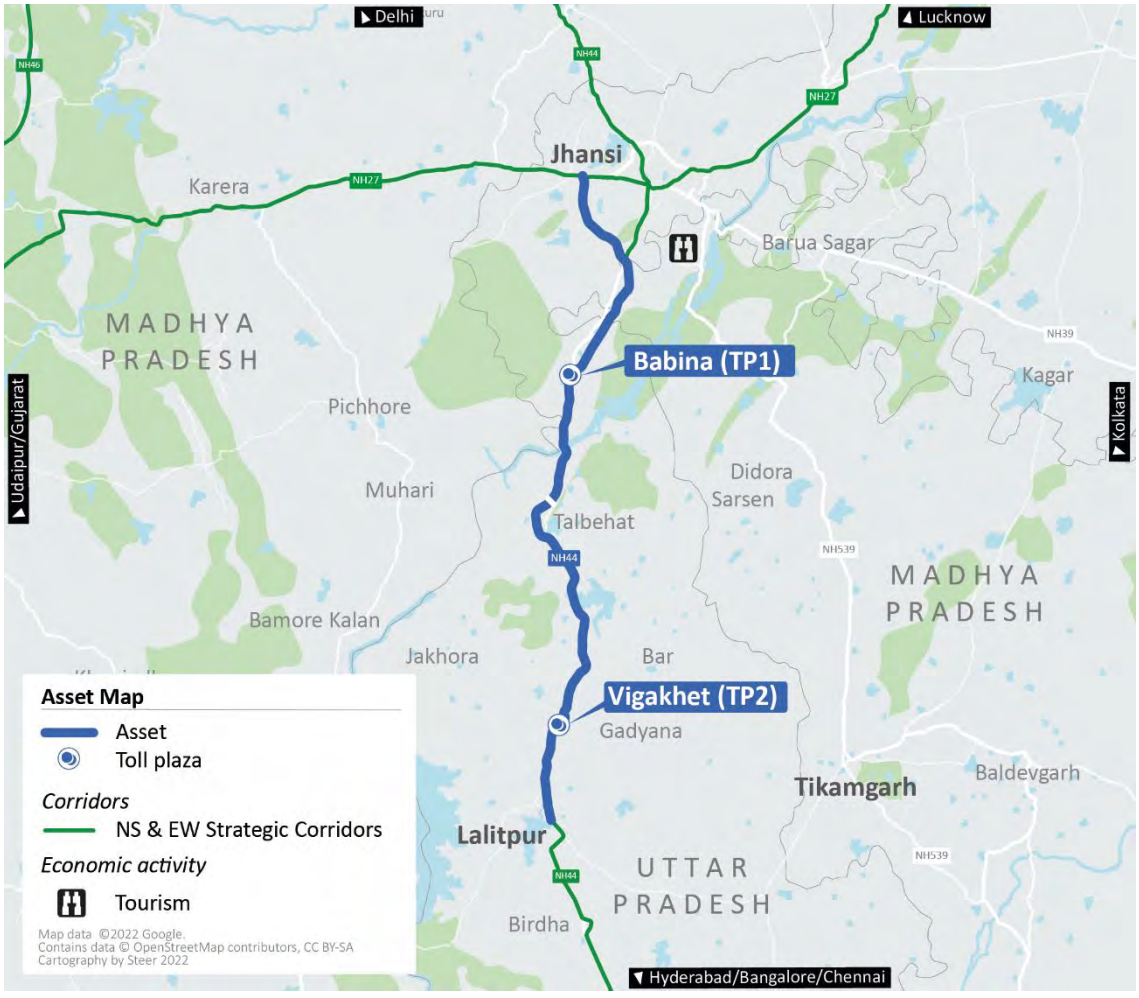
Short-distance trips including leisure and business travel trips between some of the key tourist towns/cities around the Asset. Many CJV trips are either local or run between Jhansi, Orchha, Talbehat, and Lalitpur.
Medium-distance trips and Long-distance trips connecting Gwalior, Delhi-NCR as well as northern regions with Nagpur, Hyderabad, Bangalore, and further southern regions.

2.4 The Assets form a 100.0 Km long contiguous section of toll roads which forms a part of NH 44 (old NH 25 and 26) in Uttar Pradesh. Both the Assets are four-lane divided road with one toll plaza each namely,

- Babina (TP1) at km 32.100 and
- Vigakhet (TP2) at km 85.280.

2.5 TP1 is near Jhansi end whereas TP2 is near Lalitpur end. The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



2.6 About 40% of vehicles on the Asset are CJVs, which predominantly commute between Jhansi, Orchha, Talbehat, Lalitpur, and other local destinations along the Asset. The commercial vehicles on the Asset cover generally long distances. Trucks from Uttar Pradesh and Madhya Pradesh are observed, as well as those from farther states like Delhi, Haryana, Maharashtra,

and Andhra Pradesh. CJVs contribute around 10% and 3A/MAVs contribute around 69% revenue to each of the plaza.

Concession and tolling details

2.7 TP1 on the Asset has been operating since November 2014 whereas TP2 has been operating since March 2012 and the Client took over the operations in October 2020. There is still 29 years left in the concession period which ends in FY51. The following table presents a summary of the concession.

Table 2.1: Summary of concession

	Particulars
State	Uttar Pradesh
Highway and lane configuration	NH 44 (old NH 25 and 26), 4-lane divided
Toll plaza	TP1: Babina TP2: Vigakhet
Length (km) as per concession agreement, applicable	TP1: 49.7 km TP2: 49.30 km
Commencement of operations	TP1: November 2014 TP2: March 2012
Operated by Client since	20th October 2020
Concession period	30 years
Last year of concession	2051

Source: Client data

2.8 Following pictures show typical cross section of the Asset and toll plazas.

Figure 2.3: Road cross section

Source: Steer site visit

2.9 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling. There is a difference in toll rates of both the toll plazas since the structure length and bypass length are shorter of Vigakhet toll plaza in comparison to Babina toll plaza.

Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022

Type of Vehicle	Single Journey Fee	
	TP1 Babina	TP2 Vigakhet
CJV	100	75
LCV	165	120
Bus/Truck	340	250
3A	375	275
MAV	535	395
HCM/EME/OSV	655	480

Source: NHAI Revision of User fee Rate w.e.f 01.04.2022

Key economic activities

2.10 The Asset is situated in Uttar Pradesh. Uttar Pradesh is the third largest economy and the most populous state in the country, accounting for 16% of India's total population which also makes its high consumer base a key factor that contributes to the GDP. Agriculture is the most important and the biggest sector in the state economy followed by the service sector comprising of travel, tourism, real estate, insurance, and the finance industry. The state's GSDP grew by a CAGR of 6.29% between 2011-12 and 2018-19, almost in line with the overall GDP growth of India during the same time-period and even after accounting for the economic slowdown caused by the pandemic, UP's GSDP was the second highest in the country reflecting economic revival in the state.

2.11 The northern end of the Asset, Jhansi is a city of historical relevance in the Bundelkhand region. Being the only city with presence of both, East-West highway corridor (NH27) and North-South highway corridor (NH44), Jhansi has observed development in infrastructure and real estate sectors over the years. Jhansi is also one of six nodes identified as defence corridors where industries will be set up to meet the needs and requirements of the country's defence sector. A Defence Park is planned to be established in Jhansi for automobiles manufacturing for military, police modernization, forensics centres, aircraft/helicopter manufacturing/ assembling units, testing facilities for military equipment, drone manufacturing and testing facilities.

2.12 Concrete and granite stone mines are present throughout the state and are used for construction. Stone crusher plants are present at Bijoli, 12 km from Jhansi along the Asset, which produce aggregate for construction. The same is transported to the rest of the state. Bijoli is also home to cement bricks and pipe as well as machine part industries.

2.13 There are two thermal power plants present near the Asset namely, Parichha Thermal Power Plant (near Jhansi) and Lalitpur Power Plant (near Lalitpur).

2.14 Diamond Cement Factory has a grinding unit at Jhansi where one of the raw materials, fly ash, is transported from Lailitpur power plant using the Asset.

2.15 Since the economy of Uttar Pradesh is mainly based on agriculture and around 65% of the population is dependent on agriculture, the Asset observes agri-products as a key commodity transported. Agriculture related Pradeshik Co-operative Federation godown is also located near TP2 which is further expected to generate agri-related traffic on the Asset.

2.16 Key commodities moving on the Assets include tomato, rice, potato, parcels, and a small proportion of automobile traffic.

Alternate Routes

2.17 For long distance Delhi-Bangalore movement, there are two major routes present. The first route connects Delhi-Agra-Gwalior-Jhansi-Lalitpur-Nagpur-Hyderabad-Bangalore via the Asset, following NH7/44 route whereas the second route connects Delhi-Agra-Gwalior-Indore-Aurangabad-Bangalore, following NH52 and NH50. Presently, the former route (via the Asset) is preferred by the Delhi-Bangalore traffic as it is shorter and is of better pavement quality. Although, the Asset route is preferred currently, the Delhi-Mumbai Expressway (DME) can develop as an alternate once the construction is complete. The DME will provide seamless expressway connection between Delhi and Mumbai post which the truckers can follow the route connecting Pune-Kolhapur-Hubli to reach Bangalore or via Ratlam-Indore thereby bypassing Agra and Gwalior as intermediate cities. We have discussed these routes further in Chapter5/6

2.18 An alternate route between Jhansi and Sagar via Tikamgarh is also present and bypasses the toll plazas. The route is 32 km longer than the Asset route. Also, the route is an intermediate lane to two lanes in major portion and is closed during the rainy season as water flows over the low-level bridge near Orchha and hence, the route isn't preferred by general traffic.

2.19 A local bypass is present near Babina Toll Plaza which is an intermediate lane passing through settlement areas with speed breakers. The alternate route is 5.2 km long and can only be used by CJV traffic.

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

PCU Factor assumption for reporting

3.4 In addition, please see the PCU factors considered in the table below as per IRC64 1990. For MAV, based on the discussion with the Client. For forecasting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5.

Table 3.1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV*	3.3
OSV	4.5

Source: Steer analysis and IRC64,1990, * Rigid-Trailer combined PCU

Historical trends

3.5 The following table explains the quarterly recorded MADT by vehicle class, at the Asset's toll plaza over the period of 17 months from October 2020 to March 2022 (as provided by the client).

Table 3.2: Reported Average Daily Traffic data of TP1 Babina

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22*	FY22* vs FY21
CJV	2,917	2,797	2,899	2,523	2,897	2,910	2,973	3,085	2,937	1.3%
LCV	314	232	259	191	226	236	220	239	228	(11.7%)
Bus	527	143	255	136	148	166	166	168	166	(35.1%)
2A	462	906	759	745	926	998	980	996	989	30.4%
3A	1,204	1,353	1,285	1,107	1,300	1,368	1,270	1,378	1,319	2.7%
MAV	1,546	1,646	1,595	1,407	1,531	1,743	1,663	1,733	1,703	6.8%
Total	**6,971**	**7,077**	**7,051**	**6,110**	**7,027**	**7,421**	**7,272**	**7,598**	**7,345**	**4.2%**
PCU	**15,090**	**15,802**	**15,465**	**13,434**	**15,425**	**16,632**	**16,058**	**16,806**	**16,341**	**5.7%**

Source: Steer analysis of Client data, (*12 days of data was available for Oct'20, FY22* is based on Oct-21 to Mar-22)

3.6 There is lack of long-term historical data on the asset since client started operating the Assets only in October 2020. Both FY21 and FY22 have been impacted by waves of COVID-19 related restrictions on travel. As per the reported data, it can be inferred that the Asset witnesses a healthy blend of passenger and good vehicles. In FY22, CJV make up for 41% of total share as most of these trips are local trips from Jhansi city and 3A and MAV account for a total of 40% as the Asset is part of the North South long distance corridor and as result it caters to a large number of goods vehicles traveling from Delhi-NCR to the southern states of India.

3.7 3A and MAV truck volumes are in the 2,800-3,000 MADT range with peak achieved in Q3 and Q4FY22, these high volumes can be explained by the shift in travel patterns for 3A and MAV's which are destined to cities such as Nagpur, Bangalore and originating from Gwalior and North and vice versa. This shift towards NH7/44 from NH3/52 and NH8/48 corridor is one of the prime reasons for the gain in truck volumes on the Asset. Bus volumes are yet to regain the pre-COVID-19 levels however since 2A and Buses are tolled under same category, there has been some reclassification post implementation of FASTag as evident in the switch in volumes starting Q4FY21 when FASTag was mandated for use.

3.8 Traffic volumes observed at Vigakhet toll plaza are presented below.

Table 3.3: Traffic level at TP2 Vigakhet

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22*	FY22 vs FY21
CJV	2,408	2,263	2,367	2,099	2,200	2,292	2,393	2,242	2,337	(1.3%)
LCV	272	229	244	181	208	213	203	201	208	(14.7%)
Bus	156	136	145	93	135	152	150	132	151	3.7%
2A	779	865	819	701	890	958	938	871	948	15.8%

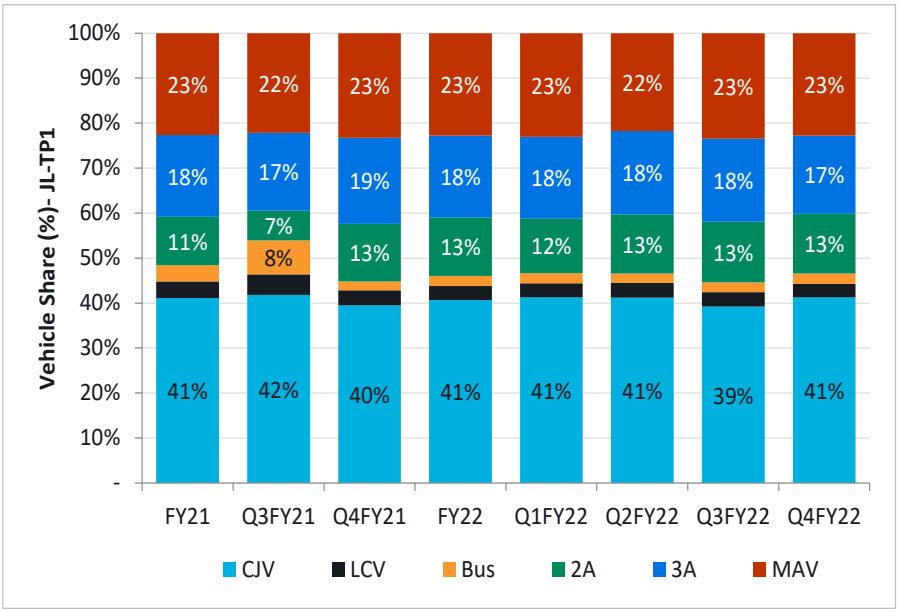
Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22*	FY22 vs FY21
3A	1,197	1,340	1,275	1,085	1,294	1,330	1,270	1,244	1,300	2.0%
MAV	1,487	1,583	1,530	1,372	1,490	1,667	1,592	1,530	1,630	6.5%
Total	**6,300**	**6,416**	**6,381**	**5,532**	**6,216**	**6,612**	**6,546**	**6,221**	**6,573**	**3.0%**
PCU	**14,139**	**14,871**	**14,518**	**12,553**	**14,402**	**15,451**	**15,043**	**14,353**	**15,241**	**5.0%**

Source: Steer analysis of Client data, (*12 days of data was available for Oct'20, FY22* is based on Oct-21 to Mar-22)

3.9 TP2 Vigakhet plaza lies south of Babina toll plaza and is a connecting section. Therefore, the Asset also shows a very similar behaviour in the evolution of traffic since October 2020. The 3A and MAV trucks volumes are in the 3,000 MADT range. with peak achieved in Q3 and Q4FY22. CJV's are trending at 2000+ MADT across the quarters.

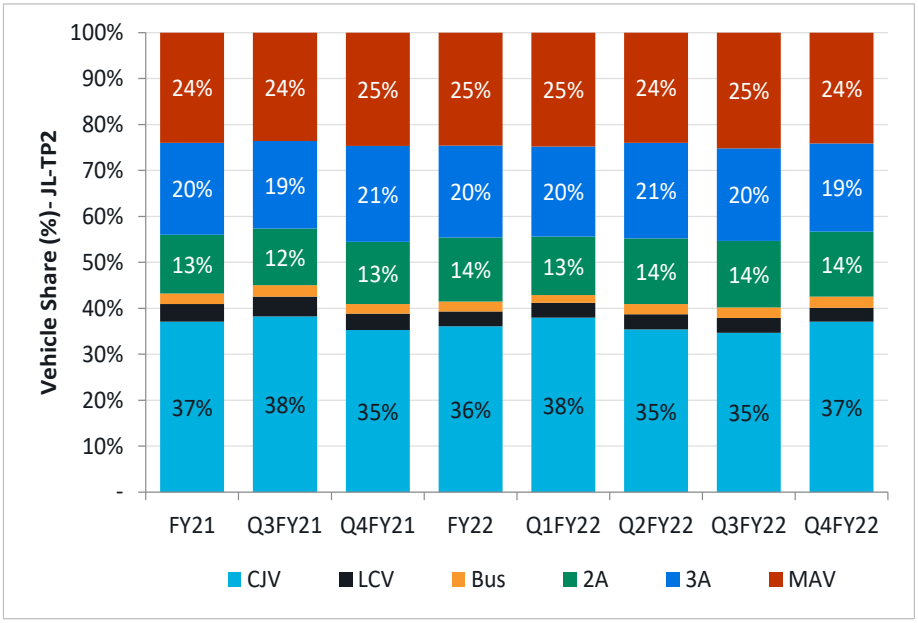
3.10 The figures below show the category-wise share of traffic at the toll plazas in from October 2020 to February 2021. It can be inferred that although CJVs make up the highest proportion of vehicle share with an average 41% of total vehicles every month at TP1 and 37% of total vehicles every month at TP2, MAVs derive the highest proportion of revenue with an average 44% of total revenue every month at both the toll plazas.

Figure.1: Vehicle share at TP1 Babina



Source: Steer analysis of Client data *Vehicle Share of FY21 is based on data for Oct-20 to Mar-21

Figure 3.2: Vehicle share at TP2 Vigakhet



Source: Steer analysis of Client data *Vehicle share for FY21 is based on data for Oct-20 to Mar-21

3.11 The following table shows the revenue by vehicle type at each toll plaza for FY21 and FY22.

Table 3.4: Total Revenue (in INR crore) at TP1 Babina, and AADC (average annual daily collection)

Month	Total Revenue (INR Crore)	AADC (INR lakhs)
FY21	**29.34**	**18.07**
FY22	**66.98**	**18.34**

Source: Steer analysis of Client data, * FY21 collection started 12th Oct 2020 onwards

Table 3.5: Total Revenue (in INR lakhs) at TP2 Vigakhet and AADC (average annual daily collection)

Month	Total Revenue (INR Lakhs)	AADC (INR lakhs)
FY21	**20.58**	**12.69**
FY22	**47.21**	**12.93**

Source: Steer analysis of Client data, *FY21 collection started 12th Oct 2020 onwards

3.12 Babina toll plaza reported an AADC of INR 18.34 Lakhs in FY22 as compared to Vigakhet toll plaza which reported an AADC of INR 12.93 lakhs in FY22. Since, both Assets carry similar traffic volumes, most of the revenue differences can be explained by the difference in toll rates charged at each of the toll plaza, which in turn is due to the difference in tollable lengths. This is discussed further in chapter 6.

Toll Frequencies

3.13 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for

these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.14 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this varies from asset to asset or even toll plaza to toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.15 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.6: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows the vehicle to cross the plaza twice in a day at discounted rates.
Monthly Pass	Discounted single entry ticket for users undertaking more frequent trips via the toll plaza.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.16 Further, the toll plazas also record violations which are non-paying users, who are not officially allowed under exemptions category but are forced exemptions. For the Asset, the segmentation discussed below reports Exemption and violations together.

3.17 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

Impact of FASTag implementation

3.18 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.7: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.19 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

3.20 With the FASTag implementation in December 2019, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls.

3.21 On both toll plazas, the FASTag penetration has increased to around 87% overall by March FY22 from 38% in October 2021 for CJVs and has reached almost 100% for MAV vehicle category. As for buses, it has increased to 96% by the end of March 2022. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time.

Table 3.8: Percentage of Transactions via Fast Tag, Mar 2022

Toll Plaza	CJV	LCV	Bus	MAV
Babina toll plaza	87%	95%	96%	100%
Vigakhet toll plaza	86%	98%	99%	100%

Source: Steer Analysis

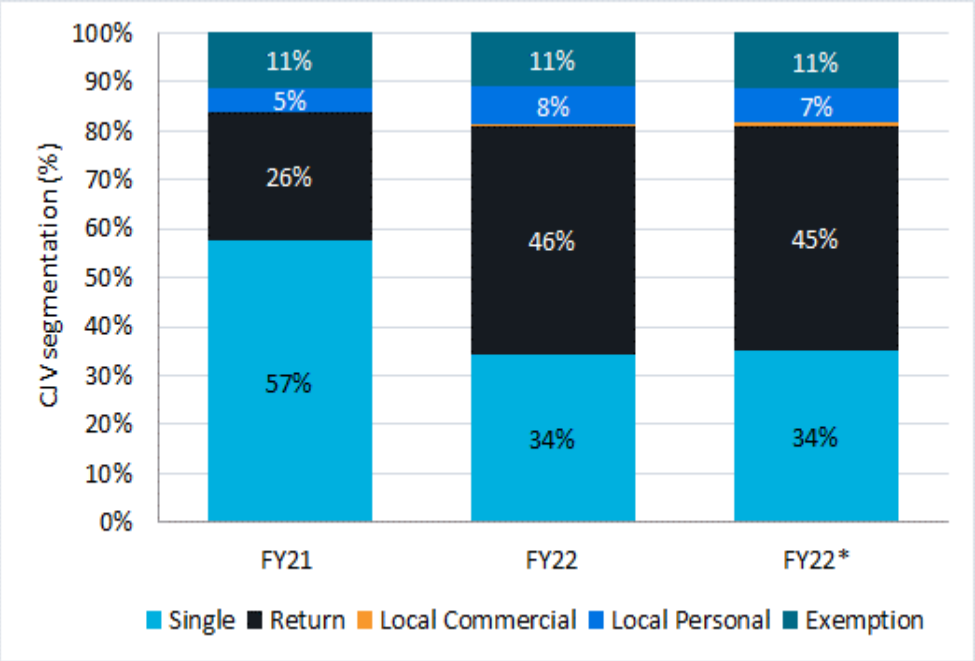
3.22 As we can see from the above table, for almost all categories except CJV's the number of transactions via FASTag have stabilised at more than 95%. CJV's are also trending at 85%+. It is expected that these penetration levels may increase a bit more to cross 90-95% across all categories however, these levels are not expected to reach 100% due to local users among other reasons.

Share of traffic by payment type

3.23 FY21 was a partial year in terms of operation of the toll plaza. Further, there was a change in ticket patterns due to the mandatory implementation of FASTag as a mode of payment (share of single tickets increased in FY21). FY22 was also impacted by 2nd wave of COVID-19 in Q1 and Q2 of FY22. Hence during this period travel patterns were also disrupted, with more shorter trips being undertaken since several states implemented state entry barriers, resulting in an increase in the proportion of short distance trips. By Q3FY22 travel patterns returned to normal levels and hence segmentation Oct-21 onwards can be following normal travel behaviour on the Asset. Hence the resultant segmentation has been assumed as the forecast segmentation as well.

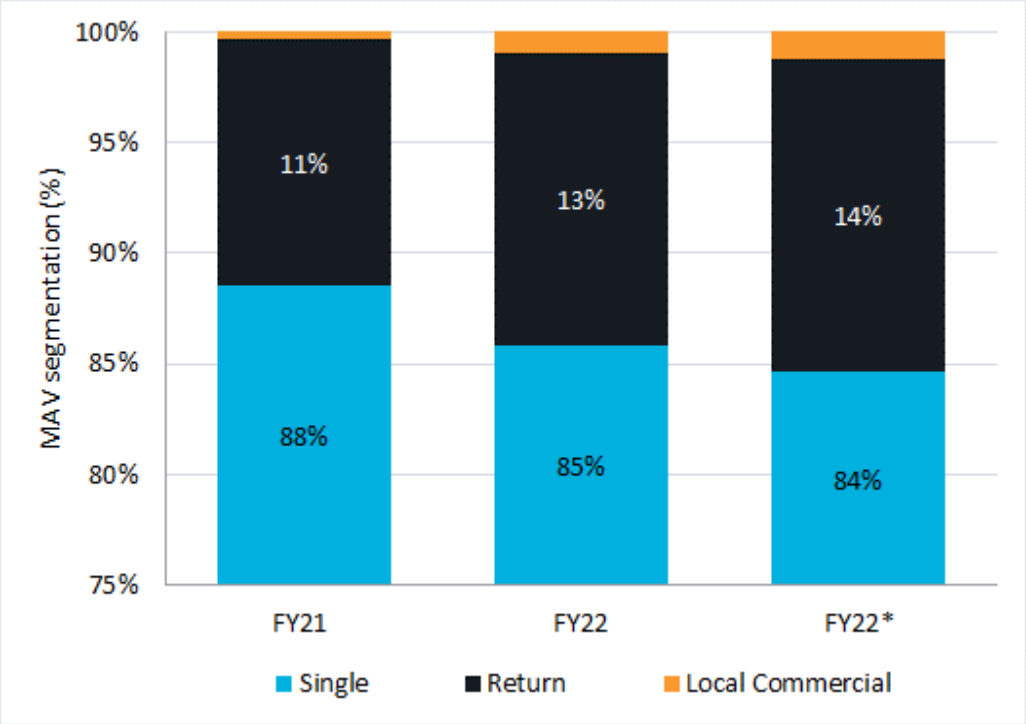
3.24 The figures below show ticket segmentation for CJV and MAV categories.

Figure 3.3: Ticket segmentation for CJV at TP1 Babina



Source: Steer analysis of Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

Figure 3.4: Ticket segmentation for MAV at TP1 Babina



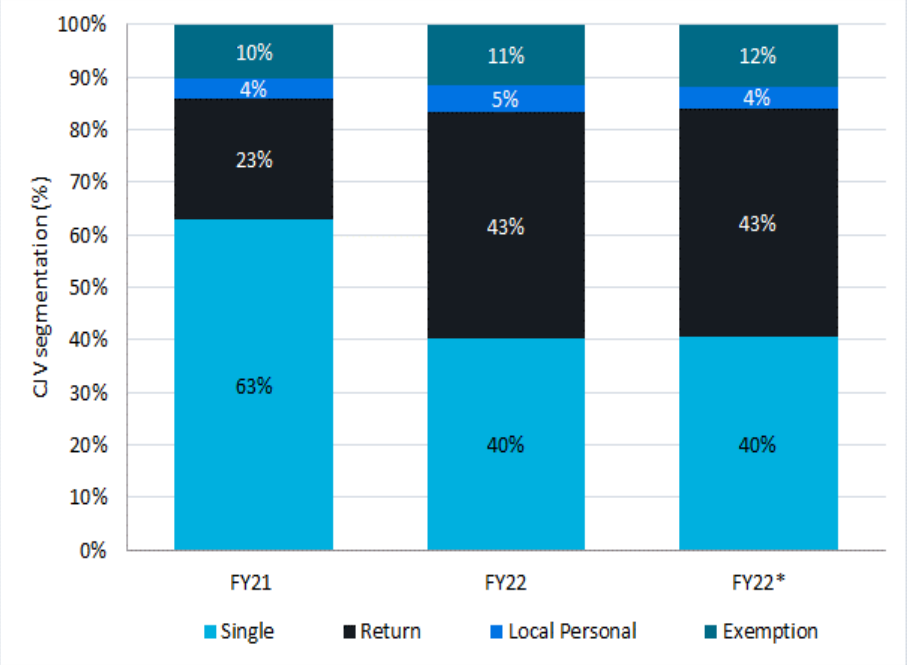
Source: Steer analysis of Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

3.25 On TP1 Babina, the CJV segmentation has reduced for single ticket type from FY21 to FY22 by 23%. This shift was primarily driven by higher adoption of FastTAG starting Feb-21 as per the NHAI guidelines. The increase in Return ticket type by 20% and 3% increase in Local Personal category is indicative of the shift from Single ticket type, when the implementation FASTag was completed. Exemptions have remained at 11% levels in FY22.

3.26 The MAV segmentation for TP1 Babina, is similar to CJVs. There is a 3% decline in Single ticket type and a 3% increase in Return ticket type due to the mandatory usage guidelines. Additionally, the FASTag implementation has reduced the waiting time for vehicles at the toll plaza and that ensures an efficient and faster movement because of which the shift to FASTag happened quickly across all vehicle types.

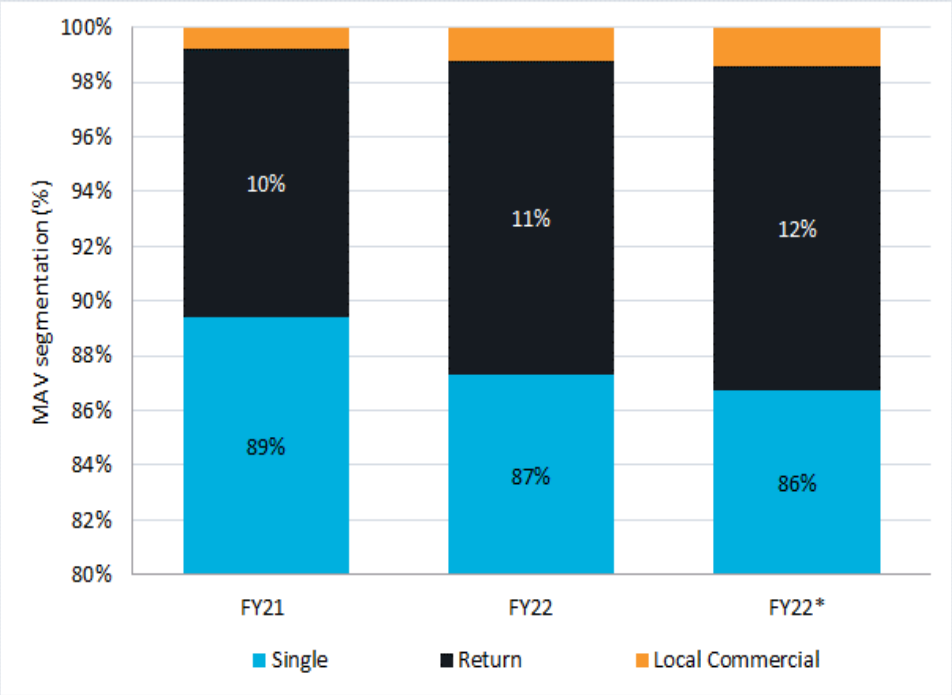
3.27 The segmentation for TP2, Vigakhet toll plaza is presented below:

Figure 3.5: Ticket segmentation for CJV at TP2 Vigakhet



Source: Steer analysis of Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

Figure 3.6: Ticket segmentation for MAV at TP2 Vigakhet



Source: Steer analysis of Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

3.28 On TP2 Vigakhet, the CJV share of single ticket type declined from 63% in FY21 to 40% in FY22 and the return ticket type share increased from to 43%. Similar to CJVs, between FY21 and FY22 it is observed that the single ticket shares have substantially decreased across MAV vehicle type. A difference of around 3% is observed. As for the return ticket category, there is an increase of 1% and in local commercial no increase is reported. The loss in single tickets sold is made up by the increase in return ticket type.

3.29 Refer below to the table for FY22 segmentation for LCV, Bus and 2A category for both toll plazas:

Table 3.9: Ticket segmentation for LCV, Bus and 2A at TP1 Babina

Ticket Category	LCV	Bus	2A
Single	79%	36%	87%
Return	15%	30%	9%
Local commercial	-	32%	1%
Exemption	5%	2%	3%

Source: Steer analysis of Client data

Table 3.10: Ticket segmentation for LCV, Bus and 2A at TP2 Vigakhet

Ticket Category	LCV	Bus	2A
Single	83%	34%	89%
Return	13%	56%	7%
Local commercial	-	9%	2%
Exemption	3%	1%	2%

Source: Steer analysis of Client data

Data Collection exercise

3.30 As mentioned previously, to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. Both OD surveys and TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.11: Data collection exercise

Toll Plaza	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	Start time
TP1 Babina	18 Jan 2021	24 Jan 2021	0000-2359	18 Jan 2021	0900 hours
TP2 Vigakhet	18 Jan 2021	24 Jan 2021	0000-2359	19 Jan 2021	0900 hours

Source: Steer analysis of TVC data

3.31 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally

recommended, and hence, to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.32 Taking an average of the seven-day TVC counts (27th Jan – 2nd Feb 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Table 3.10: WADT from TVC counts

Toll Plaza	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
TP1 Babina	2,617	421	336	135	835	1,343	1,591	**7,278**
TP2 Vigahet	2,156	289	306	126	814	1,337	1,508	**6,536**

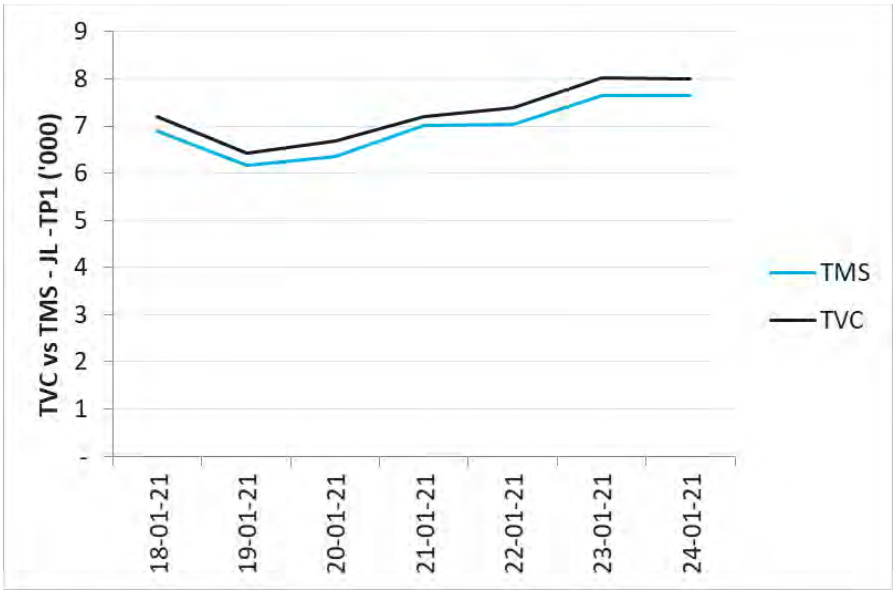
Source: Steer analysis of TVC data5

TVC v/s TMS analysis

3.33 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those days, as provided by the Client.

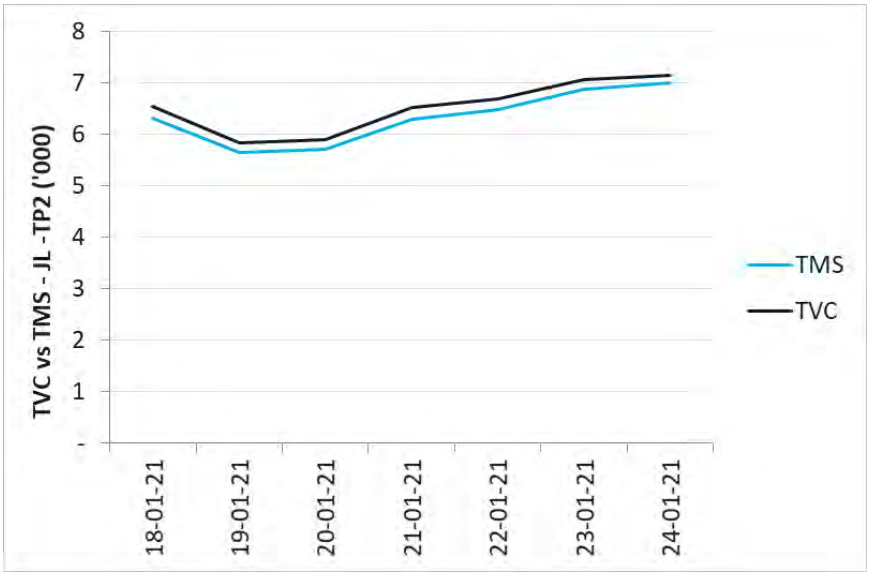
3.34 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas.

Figure 3.2: Comparison between TVC and TMS daily traffic data on TP1 Babina



Source: Steer analysis of TVC and Client TMS data

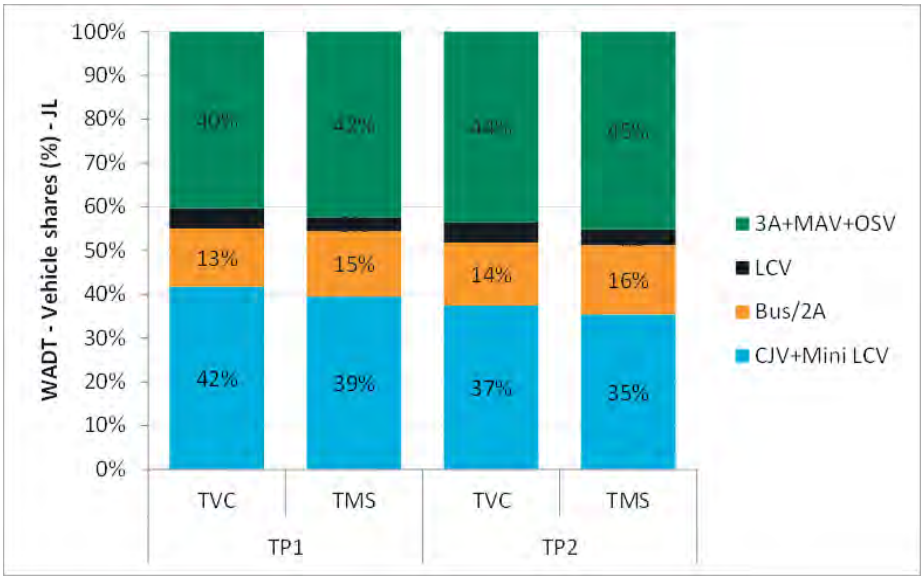
Figure 3.2: Comparison between TVC and TMS daily traffic data on TP2 Vigakhet



Source: Steer analysis of TVC and Client TMS data

3.35 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. As can be seen, whilst the share of CJVs and 3A+MAV+OSV is marginally higher for TMS compared to TVC, it is equal for bus/2A and lower for LCV category. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.7: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.36 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.37 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. As mentioned previously, the OD analysis presented here has been based on the data collected on 27th-28th January 2021.

3.38 As part of our previous assignment, we have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.39 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TMS data) during the same time period. The Table 3.12 below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.12: Sample rates for OD data

Vehicle type	TP1 Babina	TP2 Vigakhet
CJV	17%	13%
Mini Bus + Bus	67%	40%
Mini LCV + LCV	47%	35%
2A	66%	58%
3A	65%	61%
MAV + OSV	65%	81%
Total	**44%**	**44%**

Source: Steer analysis of OD data

Zone categories

3.40 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states, and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.3.13: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Uttar Pradesh	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Madhya Pradesh	Madhya Pradesh state
Delhi	Delhi State, including New Delhi
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
West India	Rajasthan, Gujarat
Central India	Chhattisgarh
East and North-eastern India	West Bengal, Jharkhand, and Northeast Indian states
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh

Source: Steer analysis

Zonal influence

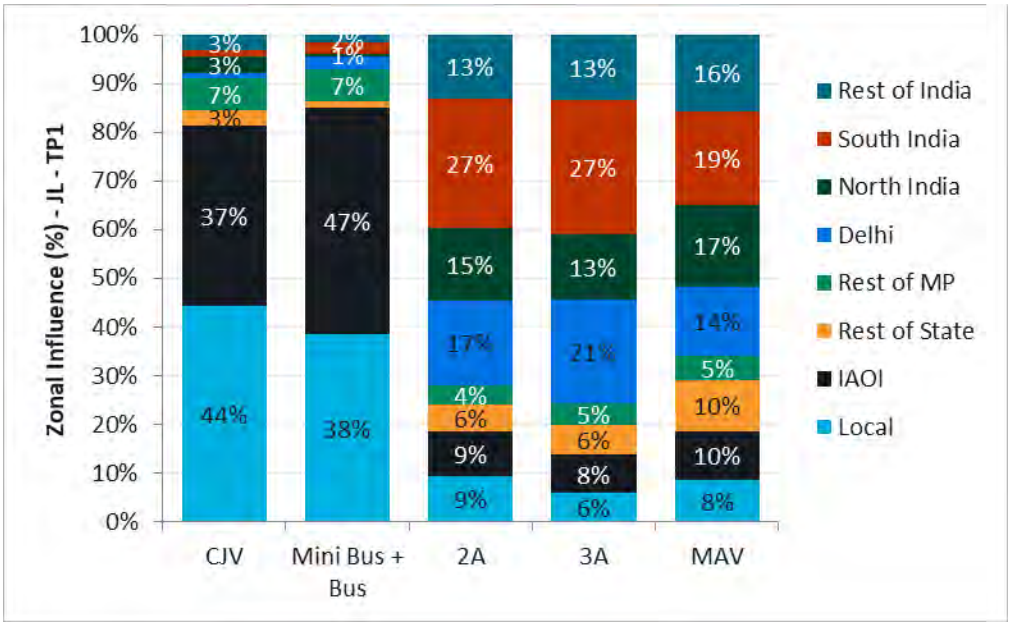
3.41 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence1 at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.42 It can be seen from the figures below that CJV and Mini Bus/Bus categories are dominated by local and IAOI trips on both the toll plazas. The share of local trips for CJVs is more on TP1 as it is in close vicinity of Jhansi whereas Vigakhet is comparably distant from Lalitpur. Moreover, Babina itself is economically more developed when compared to Vigakhet. Similarly, since Lalitpur is near Madhya Pradesh, significant number of Madhya Pradesh trips also get added on TP2.

3.43 Since the Asset lies on the preferred route for traffic commuting between Delhi-NCR and Bangalore, the southern India zones and the Delhi zones have the highest and the second highest proportion respectively on both the toll plazas across all goods categories. The shares of other zones are comparable across all the categories. Since TP1 is near NH27 (East-West corridor), the share of Northern India trips is higher than TP2. Similarly, since TP2 is near Madhya Pradesh, the zonal share of Madhya Pradesh is higher on TP2.

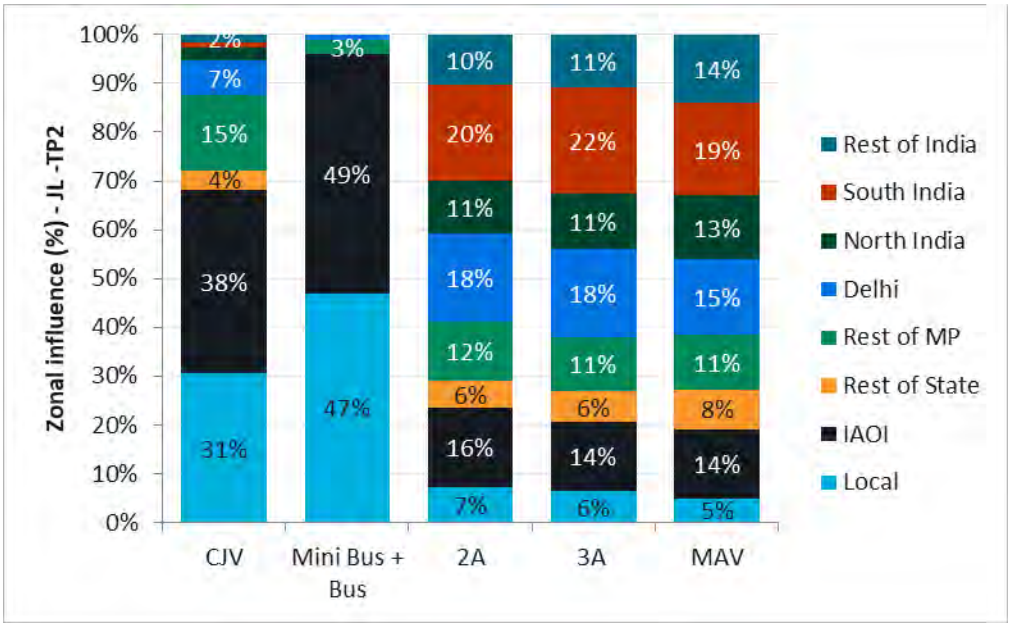
[1] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.8: Zonal influence at TP1 Babina



Source: Steer analysis of OD data

Figure 3.9: Zonal influence at TP2 Vigakhet



Source: Steer analysis of OD data

Internal External analysis

3.44 Internal-External analysis helps in identifying the trips which have both the origin and destination on the Asset (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e., through trips (External-External or E-E). 'Internal' zones are those that were analysed as 'local' in the zonal influence analysis, i.e., lying on the Asset, while 'External' zones are all other zones.

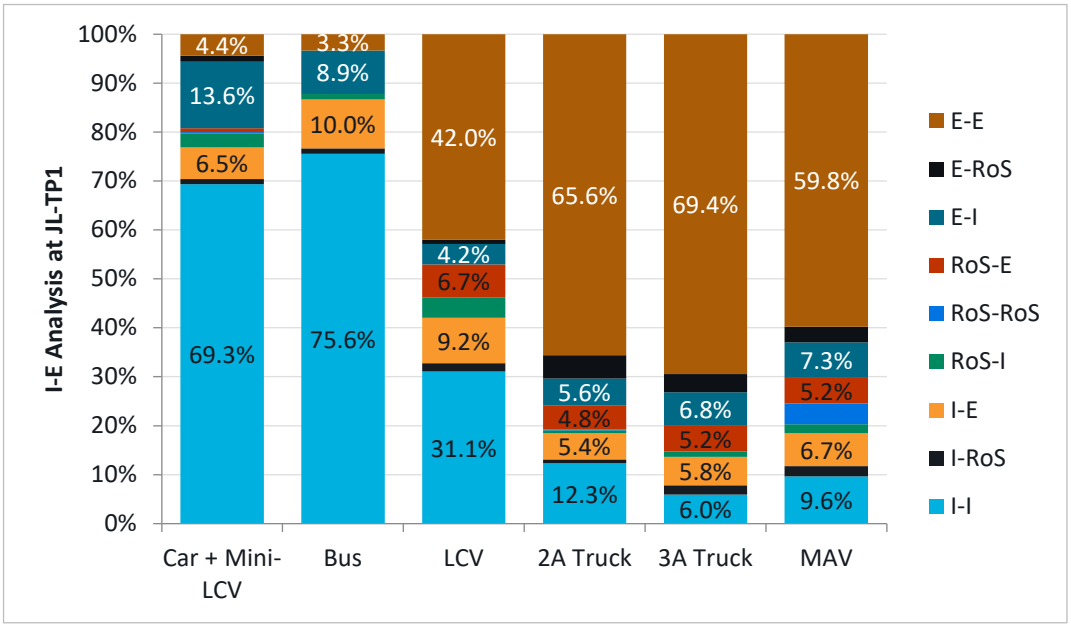
3.45 The figures below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

3.46 It can be observed that E-E trips dominate across all goods category vehicles on both the toll plazas. The high share of external trips infers the presence of majorly through traffic on the Asset.

3.47 The Asset is used by through traffic commuting between Madhya Pradesh/southern states and Uttar Pradesh/Delhi/northern states. Also, since the Asset lies on the preferred route for traffic commuting between Delhi-NCR and Bangalore, the Asset becomes more viable for through traffic.

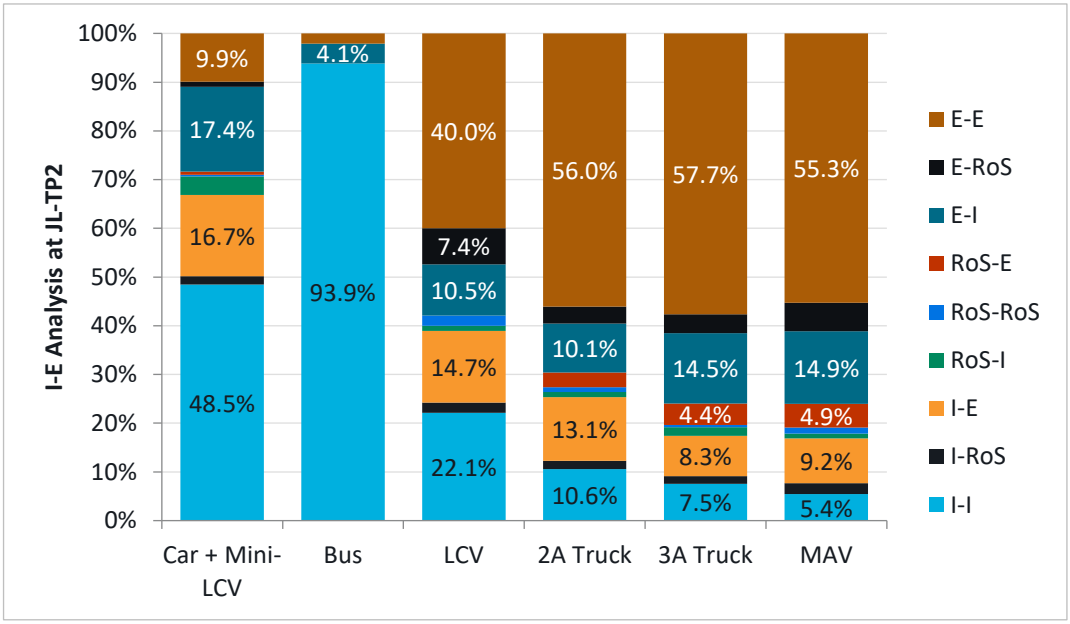
3.48 As expected, CJVs and Bus show much lower E-E trips and more trips in the I-E, I-RoS and I-I mix. On both the toll plazas, 2As show a higher proportion of E-E trips than LCVs as they are preferred for medium/long distance trips. Mini Bus/LCVs, being efficient in catering to the local demand, show higher proportion of I-I trips than 2As on both the toll plazas.

Figure 3.10 Internal-external distribution at TP1 Babina



Source: Steer analysis of OD data

Figure 3.11 Internal-external distribution at TP2 Vigakhet



Source: Steer analysis of OD data

Commodity distribution

3.49 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.14: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN

Commodity Description	Code	Combined codes used for charts
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

3.50 The following figures present the commodity distribution for goods vehicles at the toll plaza at the total level and split by direction, towards Jhansi and towards Lalitpur.

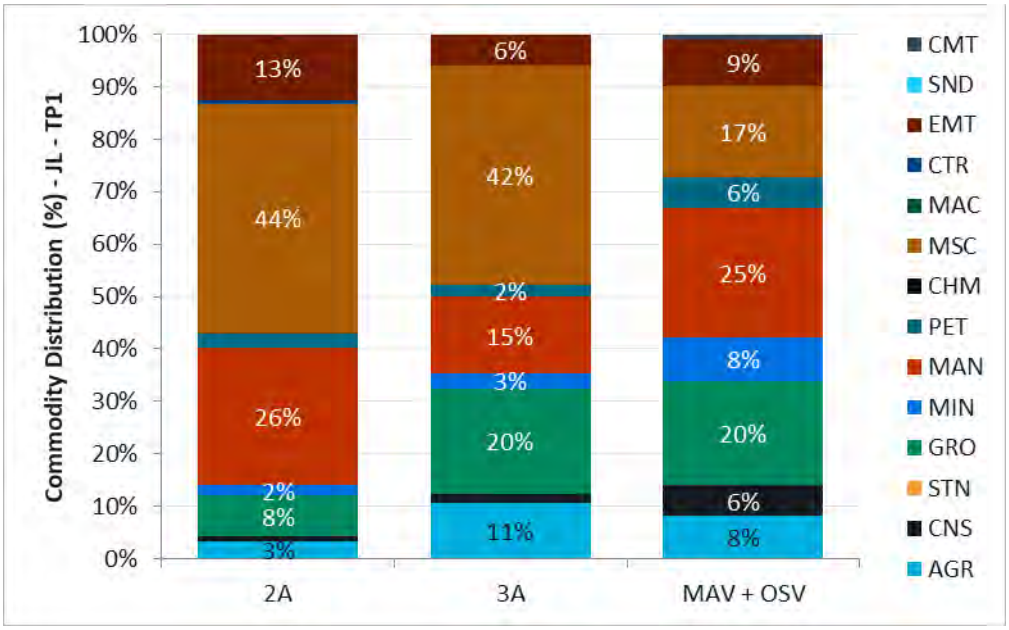
3.51 As observed during our site visit, majority of the 2As and 3As were carrying miscellaneous commodities (parcels, couriers, household items). This is due to the fact the Asset connects Delhi-NCR to the Central India (Nagpur) and the e-commerce hub in Chennai, Bangalore, and Hyderabad.

3.52 Manufactured items are the second most common commodity being transported using 2A/3A trucks whereas it is the top commodity for MAVs. According to the OD analysis, manufactured items are transported using this route as it connects major hubs like Delhi-NCR, Chandigarh, Nagpur, Bhopal, Raipur, Bangalore, Hyderabad, and Kolkata.

3.53 Groceries also account for significant proportion of commodities transported on the Asset. It accounts for 20% of goods using 3A/MAVs on TP1 and 15% of goods using 3A/MAVs on TP2. Since the asset links cities such as Jhansi, Gwalior, Agra, Sagar and other key cities in Uttar Pradesh and Madhya Pradesh, these daily consumption items are observed in high proportion.

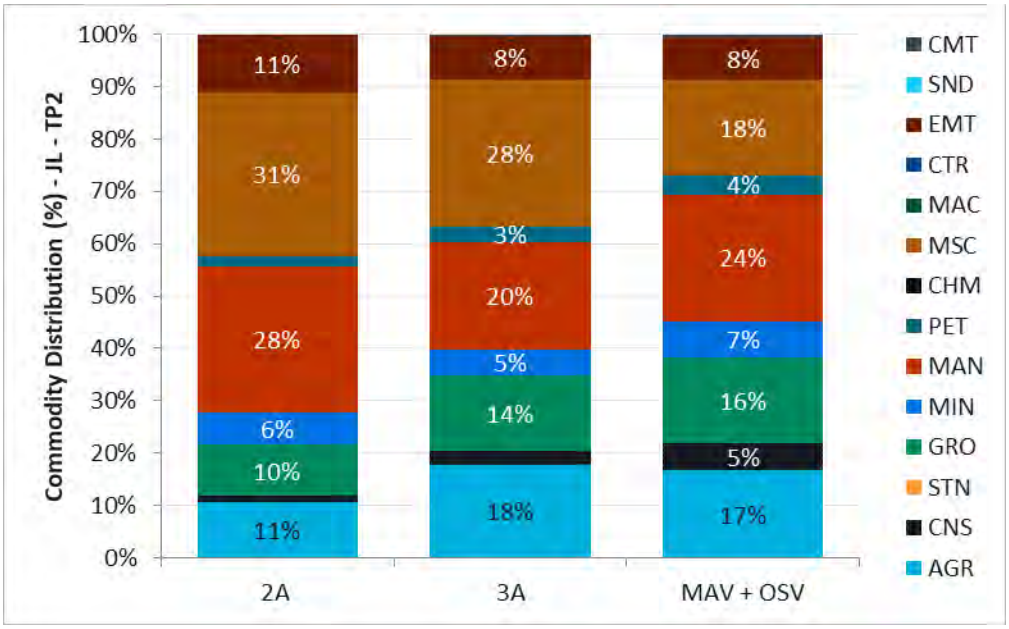
3.54 Commodities such as apples, wheat, potato and mango are carried from northern states such as Uttar Pradesh, Punjab, Himachal Pradesh for consumption in southern states of Karnataka, Tamil Nadu and Telangana. Whereas commodities such as rice and banana are carried from southern cities of Bangalore, Puducherry, and Chennai for consumption in norther states of Delhi, Uttar Pradesh, Punjab.

Figure 3.12: Commodity distribution at TP1 Babina



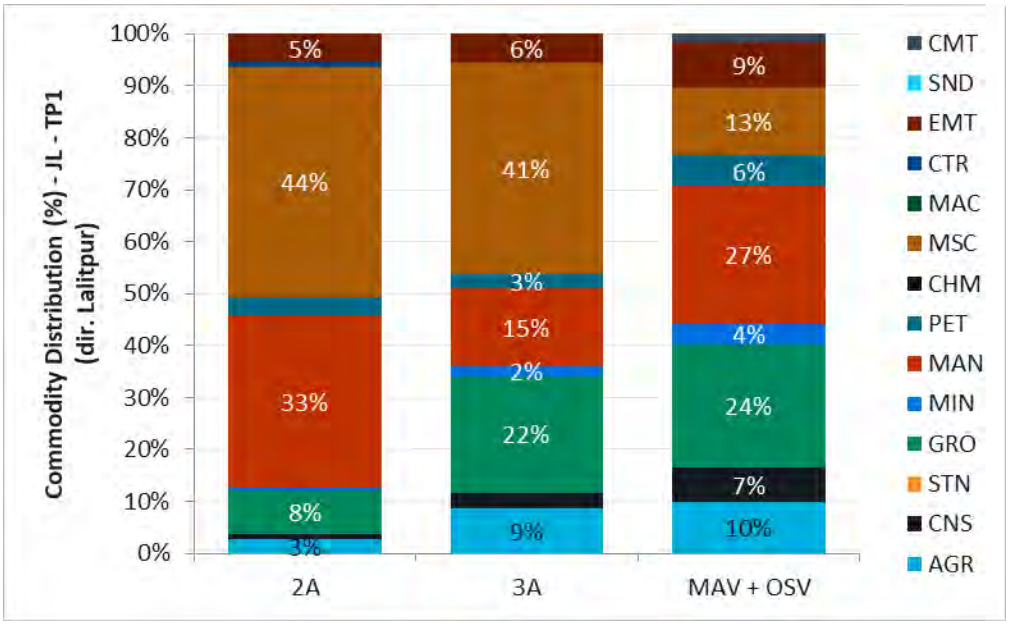
Source: Steer analysis of OD data

Figure 3.13: Commodity distribution at TP2 Vigakhet



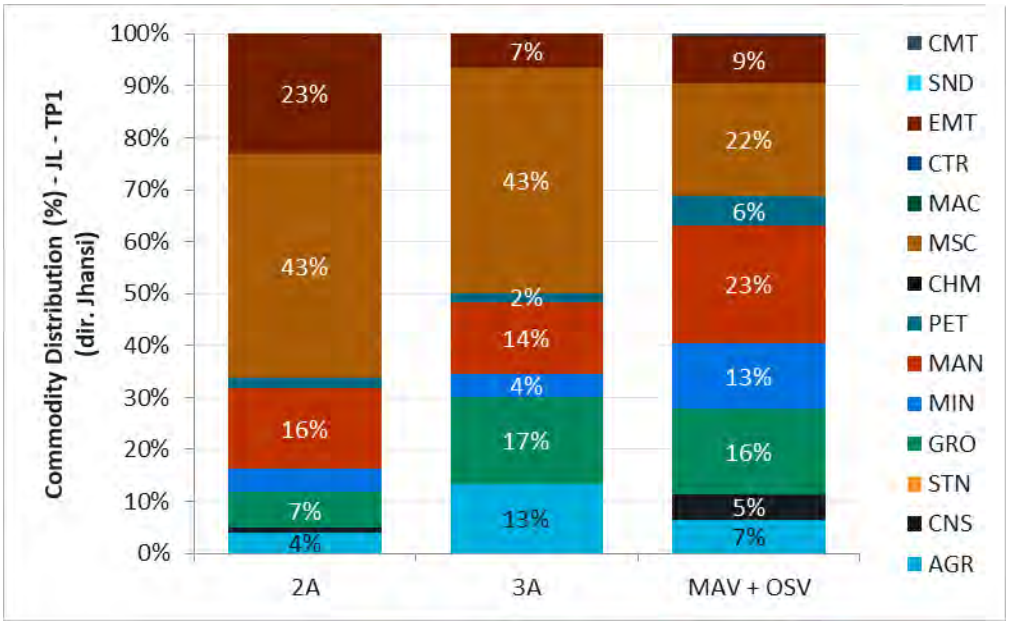
Source: Steer analysis of OD data

Figure 3.14: Commodity distribution at TP1 Babina (Towards Lalitpur)



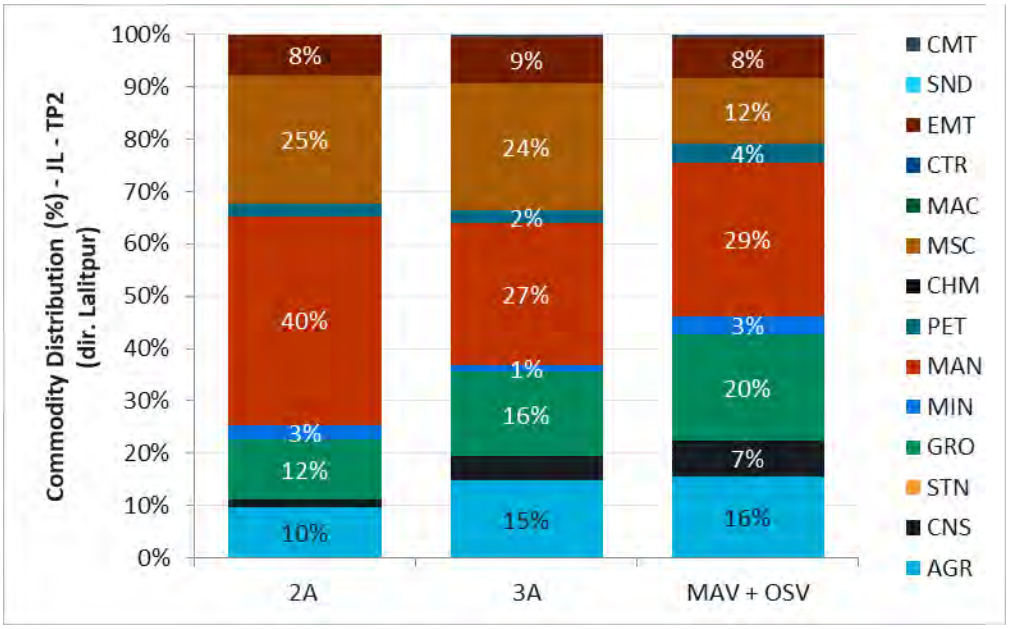
Source: Steer Analysis of OD data

Figure 3.15: Commodity distribution at TP1 Babina (Towards Jhansi)



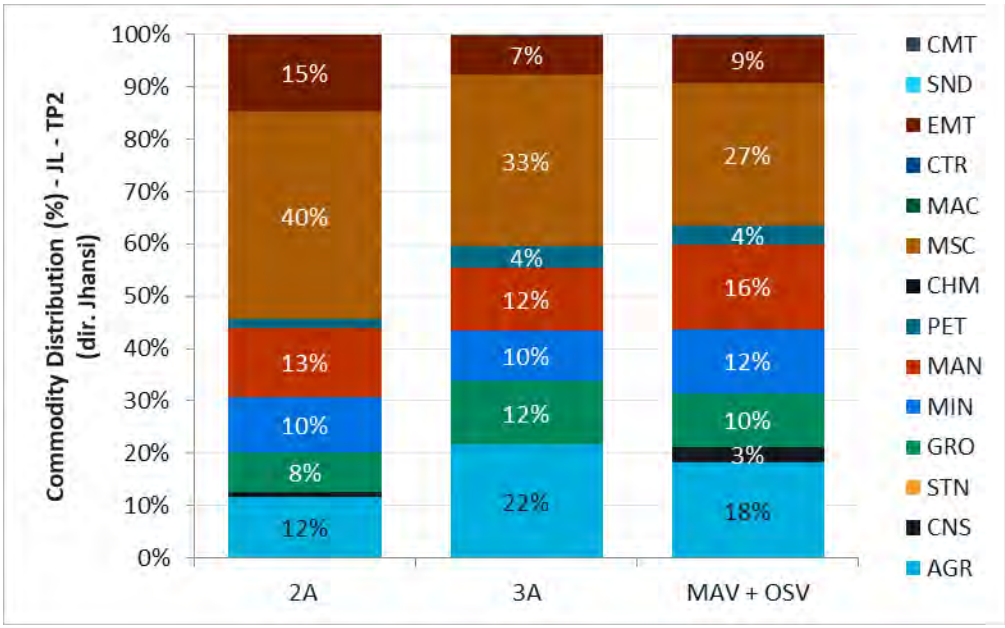
Source: Steer analysis of OD data

Figure 3.16: Commodity distribution at TP2 Vigakhet (Towards Lalitpur)



Source: Steer analysis of OD data

Figure 3.17: Commodity distribution at TP2 Vigakhet (Towards Lalitpur)



Source: Steer analysis of OD data

Trip length analysis

3.55 Trip-length distribution provides the distance-based profile of various vehicle types. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorized distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs. 2

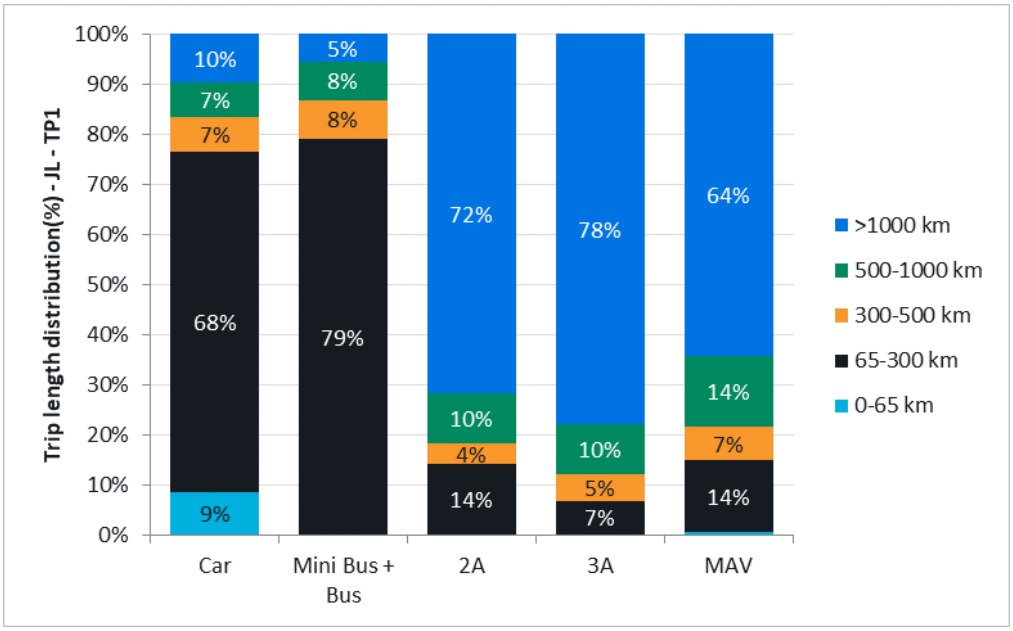
3.56 As observed in Internal-External analysis, the Asset was majorly being used by through traffic for goods vehicle categories. The same is validated by the figures below as for 2A/3A/MAV trucks, trips which cover greater than 1000 km distance have the highest proportion on both the toll plazas.

3.57 Since the Asset is neighbouring to Madhya Pradesh, a considerable number of trips are between local zones with respect to the Asset and major zones in Madhya Pradesh. Hence, TP2, being closer to Madhya Pradesh, has a greater share of trips with total distance ranging from 500-1000 km and lesser proportion of very-long-distance trips as compared to TP1.

3.58 Since TP1 is closer to the East-West highway corridor, buses with trips greater than 300 km are observed here. Approximately, 21% of bus trips are cover greater than 300 km out of which 25% trips cover greater than 1000 km.

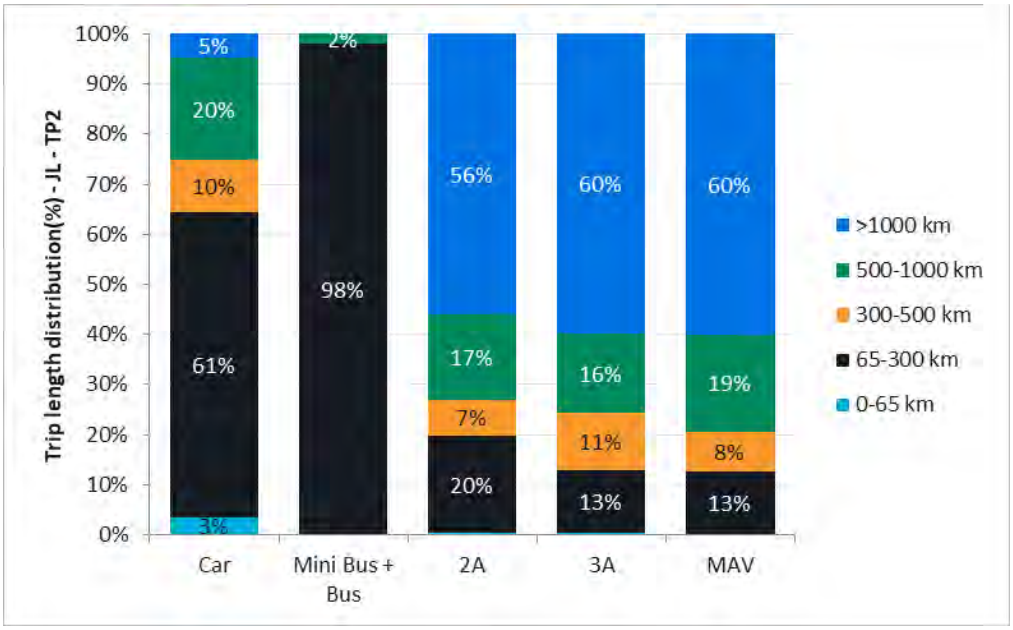
[2] **Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link:** https://developers.google.com/maps/documentation/distance-matrix/start**. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by Figure 3.using macro-enabled Excel, R, etc.**

Figure 3.26: Trip length distribution at TP1 Babina



Source: Steer analysis of OD data

Figure 3.18: Trip length distribution at TP2 Vigakhet



Source: Steer analysis of OD data

Conclusions

3.59 Traffic on the Asset is dominated by CJVs which make up approximately 38% of the total composition on both the toll plazas. 3A and MAVs, collectively, make up around 21% of the total composition on both the toll plazas. Apart from the mentioned categories, both the toll plazas observe around 14% 2A, 2% bus, and 3% LCV traffic.

3.60 Both, CJV and MAV category vehicles, predominantly buy single tickets. However, with the onset of strict FASTag implementation, the share of single journeys has reduced across the

categories as the share of return journey tickets increased. For MAVs Single tickets have remained dominant, holding a share of 85% across the months at both the plazas. The proportion of exemptions has remained constant whereas local commercial passes grew slightly over the months. The Asset observes almost negligible violations.

3.61 The Asset has observed growth in traffic which uses FastTAG/ETC as a mode of payment. The proportion of vehicles with active FASTag grew substantially in FY22. In Mar-22, CJVs recorded around 85% ETC levels on both toll plazas. As for MAVs, 100% ETC penetration has been achieved on both toll plazas.

3.62 The TVC data shows minor variation on the TMS data, where at the total level of TVC is approximately 3% higher than the TMS data. However, the difference is negligible for the larger revenue generating categories (3A, MAV, and OSV combined), 0.4% at a total level.

3.63 The OD analysis found that in terms of zonal influence, both TP1 and TP2 observe high share of local and IAOI trips for CJV and bus categories. On the other hand, maximum trips for goods vehicles are originated/destined out of the state and hence both the toll plazas have average 19% local and IAOI trips only for 2A/3A/MAV vehicles. The key commodities transported on the Asset includes parcels, couriers, and manufactured products, which when combined, make up around 42% of the commodity share for MAV traffic on both the toll plazas. Grocery products also hold a respectable share and has an average 17% share across 3A and AMV categories.

3.64 When considering the internal and external distribution, it is observed that E-E trips dominate for 3A and MAV categories suggesting rest of states as origin and destination of truck traffic. Since, majority of the traffic is attributed to external zones, it can be inferred that the traffic is greatly through in nature and the growth of traffic is directly proportional to the growth of other influencing state. The trip analysis supports these findings, with 3A traffic having 78% and 60% share and MAV traffic having 64% and 60% share of trips ending post 1000 km distance on TP1 and TP2 respectively.

4 Socio economic context and traffic growth

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the roads are in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the regions where the Assets are located and the country. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the relative competitive position of the Assets (and thus of the traffic capture they can achieve) derives from how the relative offer for the roads changes, i.e. the service offered, and the tolls charged on the project roads, in comparison to that on competing roads; and whether any competing road facilities are planned.

4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the regions surrounding the Assets.

Population growth

4.4 We have analysed the key socioeconomic drivers of the background traffic demand in the Uttar Pradesh state, where the Assets are located.

National level

4.5 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth.

State level

4.6 The following table shows the evolution of population in Utter Pradesh state compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, the state has grown at a higher rate than the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Uttar Pradesh	166	132	35	200	155	44	1.8%	1.7%	2.6%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: Ministry of Housing and Urban Affairs – Census Data, http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf

4.7 Due to the complexities of the patterns in which urbanisation takes place, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Assets. It has been included in this section simply to provide a socio-economic context of the state/trends in the regions in which the Assets are located.

Economic growth

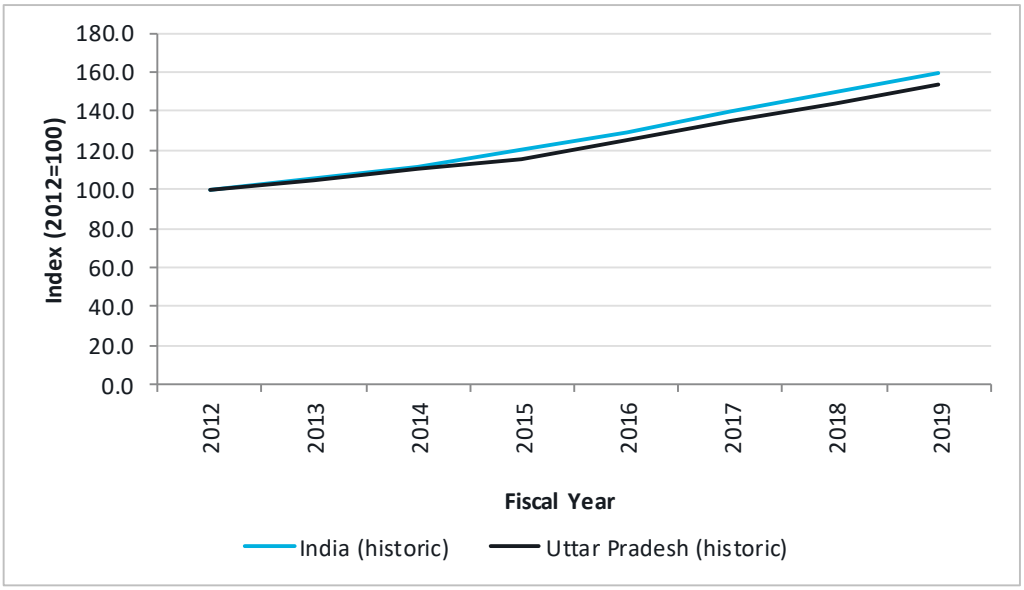
GDP and GSDP Growth

4.8 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.9 The economic performance of Uttar Pradesh has been weaker than the country as a whole. The state contributes approximately 8% to India's GDP. In terms of sectoral contribution to the state GDP, tertiary sector has the highest share (50%) followed by secondary (27%) and primary (24%), with the sectoral shares remaining stable over the last five years

4.10 The following figures illustrates the evolution of Uttar Pradesh's GSDP.

Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

4.11 Uttar Pradesh is the most populous state in India with a population of ~200 million people. The state has a large pool of skilled, semi-skilled and unskilled labour. Uttar Pradesh is also considered the largest consumer base in the country.

4.12 The tertiary sector has the highest sectoral contribution to the state GDP followed by the secondary and primary sectors, with shares remaining stable during the past five years.

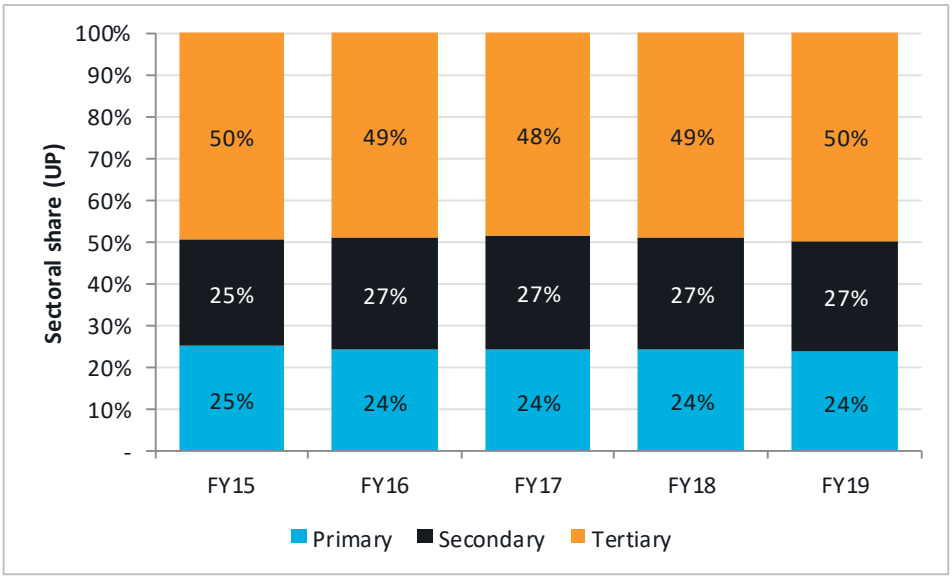
4.13 The tourism and transport sector constitute a majority of the state's tertiary sector. Uttar Pradesh is considered a favoured tourist destination in India, with key tourist attractions being Agra, Varanasi, Mathura and Prayagraj. In 2018, the state attracted the second highest domestic tourist arrivals in the country with 285 million visits. The state holds third position in the country in foreign tourist arrivals with over 3.78 million3.

4.14 In terms of secondary sector, the state has key industrial areas in Khurja (Ceramic); Moradabad (Metals); Meerut, Bareilly, Mirzapur and Lucknow (Handloom & Handicrafts); and Kanpur and Noida (Leather and tannery). The state also has an oil refinery in Mathura, operated by Indian Oil Corporation.

4.15 Uttar Pradesh has very fertile Gangetic land with a large share of population dependent upon agriculture sector for the livelihood. The key primary industries in the state include food processing, crop production and horticulture. The state is mainly known for production of wheat, sugarcane, potato and mango.

[3] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP



Source: Central Statistics Organisation

5 Traffic Growth Analysis

Introduction

5.1 In this chapter, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 In the absence of Historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

Overview

5.5 For brownfield Assets, where sufficient historical traffic evolution is available, it is common practice to use regression model analysis to determine the relationship, expressed as elasticity, between traffic growth and key socioeconomic drivers. This relationship is then applied to assumptions of future socio-economic evolution to estimate future traffic growth.

5.6 As for the Asset under consideration, a historical trend was not available since the Asset started tolling by the client in Oct-2020. Therefore, we undertook a benchmarking exercise in order to estimate our forecast elasticities, Sources used included our understanding of the Asset, outputs from the analysis of the OD data (refer chapter 3 for Commodity and trip length analysis) collected on the toll plaza, the elasticities used during the bid for TOT3 package by the client, and the subsequent lender study that was undertaken by the Client. We have also undertaken a regional benchmarking against Assets having similar traffic profiles, which give us reasonable confidence the relationships proposed.

5.7 In terms of selection of growth drivers for vehicle types, in general we have assumed state GDP as the key driving factor for the passenger traffic given this traffic is generally driven by the local economies of the cities and state containing the Asset. The heavier commercial

vehicles generally ply long-distance, and the underlying growth is governed by the general economies of several states or nation as whole.

5.8 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

5.9 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.1: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP Uttar Pradesh
Car		100%
LCV		100%
Bus		100%
2A		100%
3A	100%	
MAV	100%	

Source: Steer

5.10 The sections below detail out the reasoning for selection of respective growth driver(s) for each vehicle category.

Table 5.2: Elasticity recommendations for the Asset (Jhansi-Lalitpur section)

Vehicle Category	Proposed	Growth Driver	Comments
CJV	1.0	Uttar Pradesh GSDP	CJV traffic is predominantly catering to the local demand of towns of Jhansi and Lalitpur. Generally, we would expect that in fast-growing economies, car traffic growth rates are in line with growth in GSDP/GDP i.e., suggesting elasticities at or just above 1.0.
Buses	0.3	Uttar Pradesh GSDP	Buses tend to grow as the intercity connections improves. With Uttar Pradesh being a large state, buses tend to play an important role linking key cities in the state. Around 80-90% of trips are within 65-300 km.
LCV	0.6	Uttar Pradesh GSDP	As discussed in chapter 3, the trip lengths of LCV and 2A category (up to 72%) are predominantly long-distance trips. The origins and destinations re similar to those of 3A and MAVs on the Asset. These trucks are special trucks which carry commodities such as courier/parcel, and automobile and ancillary parts as well. In addition to long distance movement, they also made short distance local trips feeding into the local demand generated by the cities nearby. Therefore, considering the above observations, and our experience across other toll roads in the region, we believe that elasticities of 0.6 with respect to state GSDP are considered reasonable.
2A	0.6	Uttar Pradesh GSDP	

Vehicle Category	Proposed	Growth Driver	Comments
3A	0.7	GDP India	3A/MAV are primarily long-distance traffic carrying a healthy mix of commodities. Agriculture products and groceries are the key commodities moved on the asset. However, this Asset is becoming a key link between Delhi, Nagpur, Bangalore and Chennai as well for many of the trips as part of the strategic NH7/44 corridor. Trip lengths for almost 60% of the MAV are more than 1000km, signifying long distance nature of the movement. Therefore, a relation of 1 to GDP is considered reasonable for MAV. We believe 3A to grow slower as compared to MAV as there is an increasing preference to use MAVs for long-distance movements.
MAV	1.0	GDP India	

Source: Steer Analysis

Forecasts for growth drivers

5.11 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.12 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing assets, lower manufacturing outputs and lower rural consumption.

5.13 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in below figure.

5.14 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.15 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

State GSDP

5.16 As per Client projections, Uttar Pradesh's GSDP growth assumes to be in line with the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

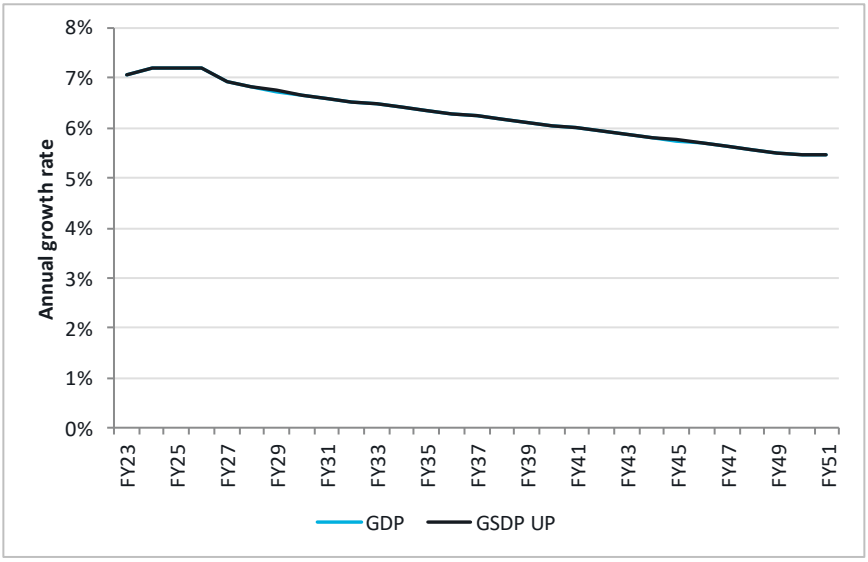
5.17 There are significant investments expected to take place as part of the state's plan and Uttar Pradesh is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher-than-expected GSDP growth rate across the

concession period could be achieved if such investments were realised as they are expected to give an additional boost to Uttar Pradesh's state economy.

5.18 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.19 The chart below shows the forecast growth lines for GDP and Uttar Pradesh GSDP.

Figure 5.1: GDP-GSDP forecast



Source: GDP forecast provided by Client and GSDP forecast based on the GDP forecast provided

6 Forecast: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of background growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years.

Seasonal Correction Factors

6.2 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.3 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.4 Historical traffic data was available for all toll vehicle categories starting October 2020 up-to March 2022. Therefore, in absence of longer-term historical data to arrive at the SCF, we have benchmarked our SCF from various sources:

- Assets in the vicinity, south or north of the Asset carrying very similar traffic profiles
- SCF assumptions assumed during the Bid by the Client, and
- Site observations and information provided by the toll plaza

6.5 The below table presents the assumptions in SCF used to estimate the AADT:

Figure 6.1: SCF values for JLTL

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	1.01	1.03	0.93	1.01	1.04	1.20	1.07	0.91	0.95	1.02	0.91	0.98
LCV	0.95	1.00	1.04	1.11	1.11	1.01	0.94	1.00	0.96	1.00	0.94	0.96

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Bus	1.01	0.98	1.02	1.07	1.08	0.98	0.95	0.97	1.02	1.05	0.94	0.95
2A	1.01	0.98	1.02	1.07	1.08	0.98	0.95	0.97	1.02	1.05	0.94	0.95
3A	1.01	1.02	1.07	1.17	1.11	1.00	0.98	0.96	0.93	0.97	0.90	0.93
MAV	1.01	1.02	1.07	1.17	1.11	1.00	0.98	0.96	0.93	0.97	0.90	0.93

Source: Steer analysis based on benchmarks

Base year FY22 AADT estimates

FY22 AADT estimation

6.6 As discussed earlier in chapter 1 and 3, The second wave of COVID-19 infections peaked in the northern half of the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away.

6.7 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.8 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.1: Monthly MADT and Adopted AADT for FY22, TP1 (Oct-21 to Mar-22)

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted AADT
CJV	2,755	2,951	3,024	2,724	3,220	2,975	2,872
LCV	255	217	236	204	225	231	220
Bus	164	160	174	155	186	158	163
2A	1,110	907	977	905	1,006	1,029	969
3A	1,522	1,267	1,315	1,164	1,340	1,307	1,248
MAV	1,778	1,672	1,779	1,585	1,696	1,708	1,611
Total AADT	**7,587**	**7,176**	**7,507**	**6,738**	**7,675**	**7,411**	**7,083**
PCU*	**17,414**	**15,814**	**16,668**	**14,948**	**16,767**	**16,458**	**15,675**

Source: Steer Analysis, *Rigid Trailer PCU factor used for MAV

Table 6.2: Monthly MADT and Adopted AADT for FY22, TP2 (Oct-21 to Mar-22)

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted AADT
CJV	2,096	2,380	2,398	2,164	2,671	2,344	2,284
LCV	233	193	214	187	207	215	201
Bus	153	142	160	140	172	140	148

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted AADT
2A	1,067	872	935	871	969	975	929
3A	1,456	1,258	1,278	1,170	1,336	1,303	1,230
MAV	1,709	1,585	1,706	1,526	1,614	1,636	1,541
Total AADT	**6,717**	**6,432**	**6,692**	**6,058**	**6,971**	**6,615**	**6,333**
PCU*	**16,134**	**14,734**	**15,484**	**14,039**	**15,754**	**15,336**	**14,609**

Source: Steer Analysis, *Rigid Trailer PCU factor used for MAV

Analysis of potential network/developmental impacts

6.9 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous Chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

DME Impact on Delhi-Bangalore and intermediate traffic

6.10 The Delhi-Mumbai Expressway is a 1290-km long greenfield expressway being developed to provide an improved level of service to long-distance traffic between North and Western India, compared to the existing national highways that are already operating at high-capacity utilization. Competing with the traditional north-south NH corridors - NH 2 corridor containing the Asset and the NH 8 corridor part of the Golden Quadrilateral, the upcoming Delhi-Mumbai Expressway could provide faster and unhindered connectivity, as illustrated in the map above.

6.11 As discussed earlier, we have considered two types of north-south movements for this impact, as these have distinct cost comparisons between the Asset corridor and the upcoming expressway:

- **Indore region**: The route through the expressway via Ratlam provides an alternate route for long-distance traffic to reach Indore. However, due to the last-mile connectivity through a road – Ratlam-Multhan-Dr Ambedkar Nagar with a lower level of service, there can be bias against the expressway for this trip segment.
- **Mumbai region and South India**: These movements currently use either NH 8 or NH 2 to play between Mumbai region, Kerala and Karnataka in the south, and Delhi and regions north. While Andhra Pradesh traffic already is part of the NH 44 route and therefore out of scope, we have not included Tamil Nadu in the in-scope traffic as we have observed recent shifts from other corridors to the NH 44 route. Overall, the route through expressway provides cost savings through unhindered, seamless, and quicker travel with potentially competitive toll costs.

GJC comparison

6.12 Present below are the generalised journey cost comparisons for each of the impacts assumed for the Asset.

6.13 Please find below the table for comparison of GJC for Delhi-Bangalore movement with respect to the Asset and Delhi Mumbai Expressway (DME).

Table .1: GJC comparison for Asset and DME

	via Asset			Via Delhi Mumbai Expressway		
	2A	3A	MAV	2A	3A	MAV
Existing Toll rates	9,555	11,585	14,985	10,175	11,795	15,515
Length	2,125	2,125	2,125	2,248	2,248	2,248
GJC	55,061	77,716	1,14,596	54,488	77,020	1,13,021

Source: Steer analysis

6.14 Assuming successful implementation of all the sections of both the expressway, we have estimated impacts as shown in the table below, using a GJC-based logit model. We have staged the impact over three years to account for a phased completion (40%, 80%, 100%) of various sections and gradual unfolding of the impacts. The staging is to account for the gradual network shift as the network stabilises with the expected completion of all sections of the Delhi-Mumbai Expressway in FY26.

Table 6.3: Impact of DME Impact on Delhi-Bangalore traffic

Vehicle category	FY24	FY25	FY26 onwards
Staging of the impact	**40%**	**80%**	**100%**
3A	-1.10%	-2.20%	-2.76%
MAV	-1.27%	-2.55%	-3.19%

Source: Steer analysis

Revenue forecasting assumptions

6.15 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While “trip factors” provide the conversion factor to the former, i.e., traffic (total trips) to tickets sold, “toll segmentation” provides the latter i.e., the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.16 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY22 data available and listed in the table below:

Table 6.4: Trip factors at TP1 Babina

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	45	45	45	7	45	45	45
Local commercial	1	1	1	1	1	1	1

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Local Personal	19	20	20	20	20	20	20

Source: steer analysis of Client TMS data

Table 6.5: Trip factors at TP2 Vigakhet

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	45	45	45	50	45	45	45
Local commercial	1	1	1	1	1	1	1
Local Personal	18	20	20	20	20	20	20

Source: steer analysis of Client TMS data

Toll segmentation

6.17 As discussed in Chapter 3, segmentation trends have largely been stabilising over the last few months, with FASTag now being in a compulsory implementation since Feb-21 and more than 90% of transactions are via FASTag, it can be assumed that travel patterns have stabilised. Therefore, we believe the Oct-Mar FY22 average of the segmentation is representative of the travel patterns on the Asset and the same has been assumed for forecast years as well. This is presented below.

Table 6.6: Toll segmentation for FY22, TP1 Babina

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	34%	80%	36%	87%	92%	84%
Return	45%	15%	32%	9%	5%	14%
Monthly	1%	-	-	-	-	-
Local commercial	1%	-	29%	1%	-	1%
Local personal	7%	-	-	-	-	-
Exemptions	11%	5%	4%	3%	3%	1%

Source: Steer analysis of Client TMS data

Table 6.7: Toll segmentation for FY22, TP2 Vigakhet

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	40%	85%	39%	89%	93%	87%
Return	43%	13%	51%	6%	3%	12%
Monthly	1%	-	-	-	-	-
Local commercial	-	1%	9%	2%	3%	1%
Local personal	4%	-	-	-	-	-

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Exemptions	12%	2%	2%	2%	1%	-

Source: Steer analysis of Client TMS data

Toll evolution

6.18 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.19 We have used actual toll rates from the FY21 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.8: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23	14.27%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by Client

Revenue reconciliation

6.20 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset. To reconcile we have used the segmentation Feb-Mar FY22 average, MADT of the month and compared it with the reported revenue for these months. The exercise was undertaken for Feb 2022. The Steer revenue calculations have been built up from monthly raw traffic data files, containing monthly data and ticket type information; and the toll notifications – all shared by the client. The comparison, as shown in the table below, depicts the difference between

modelled revenue and the reported revenue is within 0.1%, this gives us the confidence on the assumptions around segmentation and trip factors used for estimating forecasting revenue.

Table 6.9: FY22 Revenue reconciliation summary TP Babina (INR Crore)

Modelled Feb-22	Reported Feb-22	Difference (%)	Modelled Mar-22	Reported Mar-22	Difference (%)
5.54	5.54	0.1%	6.07	6.08	(0.1%)

Source: Steer comparison between modelled and reported revenue

Table 6.10: FY22 Revenue reconciliation summary TP Vigakhet (INR Crore)

Modelled Feb-22	Reported Feb-22	Difference (%)	Modelled Mar-22	Reported Mar-22	Difference (%)
3.93	3.91	0.6%	4.28	4.29	(0.0%)

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.21 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.11: Forecast traffic for TP1 Babina

Vehicle Type	FY23	FY28	FY33	FY38	FY51
CJV	2,649	3,728	5,130	6,959	14,404
Mini LCV	415	510	619	746	1,159
Bus	166	185	204	223	279
LCV	230	283	343	413	642
2A	1,010	1,243	1,509	1,816	2,824
3A	1,310	1,622	2,032	2,520	4,211
MAV	1,725	2,349	3,232	4,385	9,074
AADT	**7,504**	**9,919**	**13,069**	**17,063**	**32,595**
PCU	**16,577**	**21,588**	**28,201**	**36,523**	**68,519**

Source: Steer analysis

Table 6.12: Forecast Traffic CAGR (%) for TP1 Babina

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY37	FY22-FY51
CJV	2.8%	7.1%	6.7%	6.3%	6.3%
Mini LCV	2.8%	4.3%	4.0%	3.8%	3.8%
Bus	(13.9%)	2.1%	2.0%	1.9%	1.9%
LCV	(8.6%)	4.3%	4.0%	3.8%	3.8%

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY37	FY22-FY51
2A	19.9%	4.3%	4.0%	3.8%	3.8%
3A	3.0%	4.4%	4.7%	4.4%	4.3%
MAV	7.5%	6.4%	6.7%	6.3%	6.1%
AADT	**5.1%**	**5.8%**	**5.7%**	**5.5%**	**5.4%**
PCUs	**6.3%**	**5.4%**	**5.5%**	**5.3%**	**5.2%**

Source: Steer analysis

Table 6.13: Forecast Revenue for TP1 Babina (INR crores)

Vehicle Type	FY27	FY32	FY42	FY51
CJV	12.3	21.8	61.4	150.5
Mini LCV	1.7	2.7	6.0	12.1
Bus	2.3	3.2	5.9	10.3
LCV	2.0	3.1	6.9	13.9
2A	19.1	29.3	65.6	132.8
3A	27.4	43.7	103.5	219.6
MAV	55.8	97.0	275.7	676.0
OSV	0.0	0.0	0.0	0.0
Revenue	**120.6**	**200.7**	**525.1**	**1,215.3**

Source: Steer analysis

Table 6.14: Forecast Revenue growth CAGR (%) for TP1 Babina

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	2.6%	13.9%	12.2%	10.9%	11.5%
Mini LCV	(4.9%)	10.9%	9.3%	8.3%	8.9%
Bus	(1.3%)	8.7%	6.9%	6.5%	6.9%
LCV	(1.8%)	10.5%	9.2%	8.4%	8.8%
2A	25.1%	11.0%	8.9%	8.4%	8.9%
3A	5.6%	10.8%	9.8%	9.0%	9.4%
MAV	11.2%	13.2%	11.7%	11.0%	11.3%
Revenue	**10.1%**	**12.2%**	**10.7%**	**10.1%**	**10.5%**

Source: Steer analysis

Table 6.15: Forecast traffic for TP2 Vigakhet

Vehicle Type	FY27	FY32	FY37	FY51
CJV	2,840	3,921	7,156	11,723
Mini LCV	333	405	584	788
Bus	165	182	219	254

Vehicle Type	FY27	FY32	FY37	FY51
LCV	248	301	434	586
2A	1,145	1,393	2,007	2,707
3A	1,525	1,915	2,929	4,150
MAV	2,104	2,905	5,300	8,683
AADT	**8,359**	**11,023**	**18,630**	**28,891**
PCU	**19,015**	**24,868**	**41,406**	**63,474**

Source: Steer analysis

Table 6.16: Forecast Traffic CAGR (%) for TP2 Vigakhet

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY37	FY22-FY51
CJV	0.2%	7.1%	6.7%	6.3%	6.3%
Mini LCV	0.2%	4.3%	4.0%	3.8%	3.8%
Bus	3.7%	2.1%	2.0%	1.9%	1.9%
LCV	(13.7%)	4.3%	4.0%	3.8%	3.8%
2A	15.2%	4.3%	4.0%	3.8%	3.8%
3A	2.3%	4.4%	4.7%	4.4%	4.3%
MAV	7.4%	6.4%	6.7%	6.3%	6.1%
AADT	**3.8%**	**5.7%**	**5.7%**	**5.5%**	**5.4%**
PCUs	**5.6%**	**5.4%**	**5.5%**	**5.3%**	**5.2%**

Source: Steer analysis

Table 6.17: Revenue Forecast for TP2 Vigakhet (INR crores)

Vehicle Type	FY21	FY22	FY27	FY32	FY42	FY51
CJV	4.0	4.0	7.7	13.3	38.3	93.6
Mini LCV	0.6	0.5	0.9	1.4	3.1	6.3
Bus	1.0	1.1	1.7	2.3	4.3	7.6
LCV	0.9	0.8	1.4	2.2	4.8	9.8
2A	6.7	8.1	13.5	20.9	46.7	94.5
3A	11.2	12.0	20.0	31.9	75.6	160.7
MAV	19.1	21.3	39.4	68.9	195.0	479.2
Revenue	**43.5**	**47.9**	**84.6**	**140.9**	**368.0**	**851.6**

Source: Steer analysis

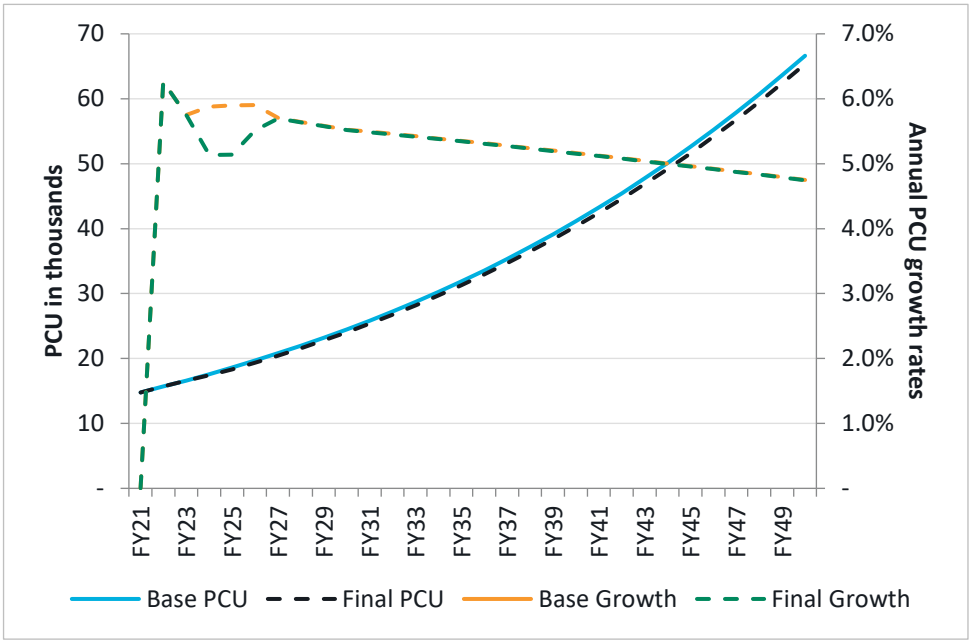
Table 6.18: Forecast Revenue growth CAGR (%) for TP2 Vigakhet

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	13.7%	11.7%	11.1%	11.5%
Mini LCV	10.7%	8.9%	8.5%	8.8%

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
Bus	8.6%	7.0%	6.5%	6.9%
LCV	11.1%	8.7%	8.4%	8.8%
2A	10.9%	9.1%	8.4%	8.9%
3A	10.8%	9.8%	9.0%	9.4%
MAV	13.1%	11.8%	11.0%	11.3%
Revenue	**12.1%**	**10.7%**	**10.1%**	**10.4%**

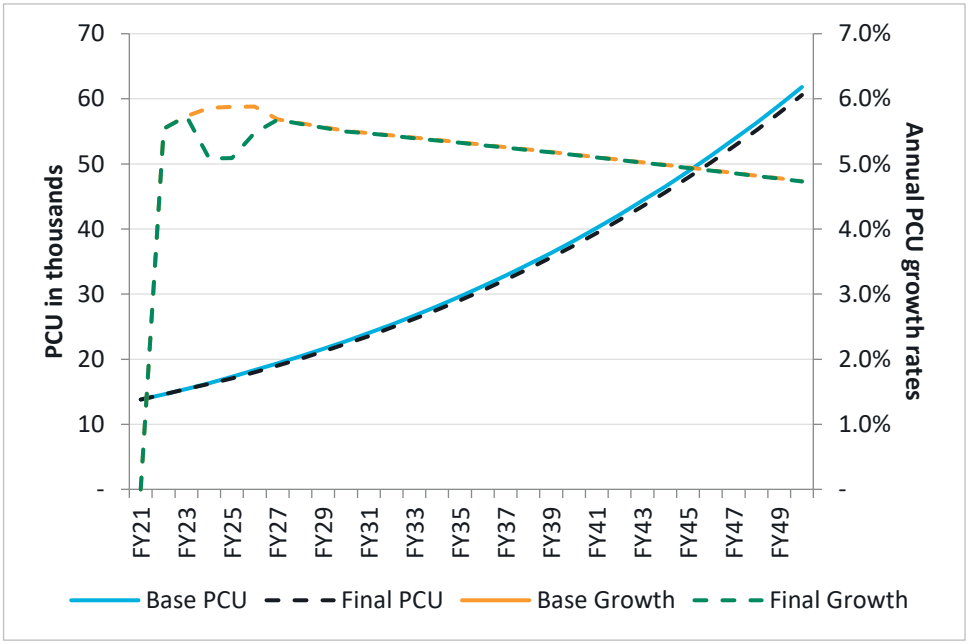
Source: Steer analysis

Figure 6.2: Forecast PCUs and growth rates at TP1 Babina



Source: Steer analysis

Figure 6.3: Forecast PCUs and growth rates at TP2 Vigakhet



Source: Steer analysis

Upside and Downside Cases

6.22 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.23 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.24 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.19: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
JLTL	GDP/GSDP	+1% every year	-1% every year
JLTL	WPI	+1% every year	-1% every year
JLTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.25 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside

(optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.26 The upside case impacts included in forecasts are summarised in below:

Table 6.20: Summary of impacts on the Assets

Impact	Impact of DME on Delhi Bengaluru Traffic		
Year	FY24	FY25	FY26
TP-1	3A: -0.83% MAV: -0.96%	3A: -1.65% MAV: -1.91%	3A: -2.07% MAV: -2.39%
TP-2	3A: -0.83% MAV: -0.96%	3A: -1.65% MAV: -1.91%	3A: -2.07% MAV: -2.39%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.27 The downside case impacts included in forecasts are summarised in below:

Table 6.21: Summary of impacts on the Assets

Impact	Impact of DME on Delhi Bengaluru Traffic		
Year	FY24	FY25	FY26
TP-1	3A: -1.38% MAV: -1.59%	3A: -2.76% MAV: -3.19%	3A: -3.44% MAV: -3.98%
TP-2	3A: -1.38% MAV: -1.59%	3A: -2.76% MAV: -3.19%	3A: -3.44% MAV: -3.98%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.28 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case. Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.22: Traffic forecast (With Upside Impacts) for TP1: Babina

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	2,474	2,694	3,795	5,688	12,190	22,985
Mini LCV	398	419	516	661	1,051	1,546
Bus	163	167	186	210	266	323
LCV	220	232	286	366	583	857

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
2A	969	1,020	1,258	1,610	2,561	3,767
3A	1,248	1,326	1,655	2,205	3,781	5,921
MAV	1,611	1,754	2,411	3,614	7,742	14,598
AADT	**7,083**	**7,612**	**10,106**	**14,353**	**28,174**	**49,998**
PCU's	**15,675**	**16,807**	**22,019**	**30,937**	**59,576**	**104,191**

Source: Steer analysis

Table 6.23: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Babina

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	8.9%	8.9%	8.4%	7.9%	8.0%
Mini LCV	5.3%	5.4%	5.1%	4.8%	4.8%
Bus	2.7%	2.7%	2.5%	2.4%	2.4%
LCV	5.3%	5.4%	5.1%	4.8%	4.8%
2A	5.3%	5.4%	5.1%	4.8%	4.8%
3A	6.2%	5.7%	5.9%	5.5%	5.5%
MAV	8.9%	8.3%	8.4%	7.9%	7.9%
AADT	**7.5%**	**7.3%**	**7.3%**	**7.0%**	**7.0%**
PCU's	**7.2%**	**7.0%**	**7.0%**	**6.8%**	**6.7%**

Source: Steer analysis

Table 6.24: Revenue forecast (With Upside Impacts) for TP1: Babina (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6.4	7.8	13.7	27.2	98.2	303.1
Mini LCV	1.0	1.2	1.9	3.2	8.5	20.4
Bus	1.5	1.7	2.4	3.6	7.6	15.1
LCV	1.2	1.4	2.2	3.7	9.8	23.4
2A	11.3	13.3	20.8	34.7	93.0	223.1
3A	16.4	19.3	30.1	52.6	152.8	388.6
MAV	30.0	36.3	62.9	123.6	446.0	1,371.9
Total Revenue	**67.9**	**81.0**	**134.0**	**248.5**	**816.1**	**2,345.6**

Source: Steer analysis

Table 6.25: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Babina

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	21.5%	15.3%	14.6%	13.7%	14.0%
Mini LCV	17.6%	11.5%	11.0%	10.4%	10.6%
Bus	14.4%	8.9%	8.1%	7.9%	8.1%
LCV	15.0%	12.0%	10.9%	10.3%	10.6%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
2A	17.6%	11.7%	10.8%	10.4%	10.6%
3A	17.5%	11.8%	11.8%	11.3%	11.3%
MAV	21.0%	14.7%	14.5%	13.7%	13.9%
Total	**19.3%**	**13.4%**	**13.1%**	**12.6%**	**12.8%**

Source: Steer analysis

Table 6.26: Traffic forecast (With Upside Impacts) for TP2: Vighakhet

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	2,014	2,192	3,088	4,629	9,921	18,707
Mini LCV	270	285	351	449	715	1,051
Bus	148	152	169	192	242	295
LCV	201	212	261	334	531	782
2A	929	978	1,206	1,543	2,455	3,611
3A	1,230	1,306	1,631	2,172	3,726	5,835
MAV	1,541	1,678	2,307	3,457	7,408	13,968
AADT	**6,333**	**6,803**	**9,013**	**12,777**	**24,998**	**44,248**
PCU's	**14,609**	**15,661**	**20,486**	**28,749**	**55,232**	**96,403**

Source: Steer analysis

Table 6.27: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Vighakhet

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	8.9%	8.9%	8.4%	7.9%	8.0%
Mini LCV	5.3%	5.4%	5.1%	4.8%	4.8%
Bus	2.7%	2.7%	2.5%	2.4%	2.4%
LCV	5.3%	5.4%	5.1%	4.8%	4.8%
2A	5.3%	5.4%	5.1%	4.8%	4.8%
3A	6.2%	5.7%	5.9%	5.5%	5.5%
MAV	8.9%	8.3%	8.4%	7.9%	7.9%
AADT	**7.4%**	**7.3%**	**7.2%**	**6.9%**	**6.9%**
PCU's	**7.2%**	**6.9%**	**7.0%**	**6.7%**	**6.7%**

Source: Steer analysis

Table 6.28: Revenue forecast (With Upside Impacts) for TP2: Vighakhet (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	4.0	4.8	8.7	17.0	61.6	189.0
Mini LCV	0.5	0.6	1.0	1.6	4.4	10.6
Bus	1.1	1.3	1.8	2.6	5.6	11.1
LCV	0.8	1.0	1.5	2.6	6.8	16.4

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
2A	8.1	9.5	14.7	24.7	66.1	158.6
3A	12.0	14.1	22.2	38.5	111.4	284.8
MAV	21.3	25.6	44.5	87.5	315.5	971.6
Total Revenue	**47.9**	**56.9**	**94.3**	**174.6**	**571.4**	**1,642.1**

Source: Steer analysis

Table 6.29: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Vighakhet

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	19.5%	15.9%	14.4%	13.7%	14.0%
Mini LCV	15.6%	12.1%	10.8%	10.4%	10.6%
Bus	14.3%	8.7%	8.3%	7.8%	8.1%
LCV	18.3%	11.6%	10.7%	10.3%	10.5%
2A	17.9%	11.4%	11.0%	10.3%	10.6%
3A	17.8%	12.0%	11.7%	11.2%	11.3%
MAV	20.0%	14.8%	14.5%	13.7%	13.9%
Total	**18.8%**	**13.5%**	**13.1%**	**12.6%**	**12.8%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.29 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.30 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.30: Traffic forecast (With Dowside Impacts) for TP1: Babina

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	2,474	2,609	3,235	4,148	6,553	9,469
Mini LCV	398	411	468	544	718	896
Bus	163	165	177	191	219	245
LCV	220	228	259	301	398	497
2A	969	1,001	1,140	1,325	1,748	2,184
3A	1,248	1,296	1,456	1,735	2,395	3,103
MAV	1,611	1,699	2,022	2,592	4,095	5,916
AADT	**7,083**	**7,408**	**8,756**	**10,836**	**16,125**	**22,310**
PCU's	**15,675**	**16,372**	**19,102**	**23,479**	**34,511**	**47,296**

Source: Steer analysis

Table 6.31: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Babina

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	5.5%	5.5%	5.1%	4.7%	4.7%
Mini LCV	3.3%	3.3%	3.1%	2.8%	2.8%
Bus	1.6%	1.7%	1.5%	1.4%	1.4%
LCV	3.3%	3.3%	3.1%	2.8%	2.8%
2A	3.3%	3.3%	3.1%	2.8%	2.8%
3A	3.8%	3.0%	3.6%	3.3%	3.2%
MAV	5.5%	4.4%	5.1%	4.7%	4.6%
AADT	**4.6%**	**4.3%**	**4.4%**	**4.1%**	**4.0%**
PCU's	**4.4%**	**3.9%**	**4.2%**	**3.9%**	**3.9%**

Source: Steer analysis

Table 6.32: Revenue forecast (With Downside Impacts) for TP1: Babina (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6.4	7.4	11.2	17.4	39.7	79.3
Mini LCV	1.0	1.2	1.6	2.3	4.3	7.5
Bus	1.5	1.7	2.2	2.8	4.7	7.3
LCV	1.2	1.4	1.9	2.6	5.0	8.6
2A	11.3	12.9	17.7	25.2	47.6	82.3
3A	16.4	18.6	25.0	36.5	72.5	129.8
MAV	30.0	34.6	49.6	77.8	176.7	353.1
Total Revenue	**67.9**	**77.7**	**109.1**	**164.6**	**350.5**	**668.0**

Source: Steer analysis

Table 6.33: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Babina

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	16.0%	10.9%	9.2%	8.6%	8.8%
Mini LCV	13.6%	8.6%	7.0%	6.7%	6.9%
Bus	11.7%	6.5%	5.7%	5.1%	5.4%
LCV	12.8%	8.0%	7.1%	6.6%	6.8%
2A	13.9%	8.1%	7.3%	6.6%	6.8%
3A	13.5%	7.6%	7.9%	7.1%	7.2%
MAV	15.3%	9.4%	9.4%	8.6%	8.6%
Total	**14.6%**	**8.8%**	**8.6%**	**7.8%**	**8.0%**

Source: Steer analysis

Table 6.34: Traffic forecast (With Downside Impacts) for TP2: Vighakhet

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	2,014	2,124	2,633	3,376	5,334	7,706
Mini LCV	270	279	318	370	488	609
Bus	148	151	161	174	200	223
LCV	201	208	236	275	363	453
2A	929	959	1,093	1,270	1,676	2,093
3A	1,230	1,277	1,435	1,709	2,359	3,058
MAV	1,541	1,625	1,934	2,480	3,918	5,661
AADT	**6,333**	**6,622**	**7,810**	**9,654**	**14,337**	**19,804**
PCU's	**14,609**	**15,256**	**17,775**	**21,831**	**32,043**	**43,862**

Source: Steer analysis

Table 6.35: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Vighakhet

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	5.5%	5.5%	5.1%	4.7%	4.7%
Mini LCV	3.3%	3.3%	3.1%	2.8%	2.8%
Bus	1.6%	1.7%	1.5%	1.4%	1.4%
LCV	3.3%	3.3%	3.1%	2.8%	2.8%
2A	3.3%	3.3%	3.1%	2.8%	2.8%
3A	3.8%	3.0%	3.6%	3.3%	3.2%
MAV	5.5%	4.4%	5.1%	4.7%	4.6%
AADT	**4.6%**	**4.2%**	**4.3%**	**4.0%**	**4.0%**
PCU's	**4.4%**	**3.9%**	**4.2%**	**3.9%**	**3.8%**

Source: Steer analysis

Table 6.36: Revenue forecast (With Downside Impacts) for TP2: Vighakhet (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	4.0	4.6	7.0	11.0	24.5	49.0
Mini LCV	0.5	0.6	0.8	1.2	2.2	3.9
Bus	1.1	1.2	1.6	2.1	3.4	5.3
LCV	0.8	0.9	1.3	1.8	3.5	6.1
2A	8.1	9.2	12.5	17.9	33.8	58.5
3A	12.0	13.5	18.3	26.7	53.0	94.6
MAV	21.3	24.5	35.3	54.9	125.0	250.0
Total Revenue	**47.9**	**54.6**	**76.8**	**115.6**	**245.3**	**467.4**

Source: Steer analysis

Table 6.37: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Vighakhet

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	13.7%	11.1%	9.4%	8.4%	8.8%
Mini LCV	11.3%	8.8%	7.3%	6.4%	6.9%
Bus	12.2%	6.3%	5.8%	5.1%	5.4%
LCV	11.9%	8.8%	6.8%	6.6%	6.9%
2A	13.7%	8.1%	7.4%	6.5%	6.8%
3A	13.3%	7.8%	7.9%	7.1%	7.2%
MAV	14.9%	9.5%	9.3%	8.6%	8.6%
Total	**14.0%**	**8.9%**	**8.5%**	**7.8%**	**8.0%**

Source: Steer analysis

Target revenues and modification of concession period

6.31 As per the concession agreement, the target revenue for TP1 and TP2 should be 7.9 Cr and 5.3 Cr for the month of March 2030 first calculation of target revenue and 18.9Cr and 12.8Cr for the month of March 2040 for the second calculation of target revenue. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual revenue.' If the target revenue for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6.38: Target Revenues for Extension 1

Asset	Target Month	Target Revenue Cr	Estimated Revenue			Average Revenue	Variation (%)
			2029	2030	2031		
JL TP1	Mar-30	7.87	13.37	14.85	16.36	14.86	88.8%
JL TP2	Mar-30	5.28	9.43	10.42	11.50	10.45	97.9%

Source: Steer analysis

Table 6.39: Target Revenues for Extension 2

Asset	Target Month	Target Revenue	Estimated Revenue			Average Revenue	Variation (%)
		Cr	2039	2040	2041		
JL TP1	Mar-40	18.89	35.63	39.24	43.16	39.34	108.3%
JL TP2	Mar-40	12.81	25.04	27.51	30.29	27.61	115.6%

Source: Steer analysis

6.32 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have forecast seasonality of March month to adjust for seasonal trends and arrive at March traffic from AADT traffic, which is then segmented according to the forecast toll segmentation and trip factors and multiplied with respective estimated toll rates to get to a monthly revenue collection.

6.33 As seen from the table above, the target revenue forecast for the Asset is higher than the concession agreement target revenue by a rounded 75% and 84% for target date 1 and 92% and 99% for target date 2 at TP1 and TP2 respectively. As the difference lies above the permitted 2.5% excess, a renegotiation of the length of the concession agreement is expected. As per the concession agreement, for every 1% excess target revenue, the concession period shall be decreased by 1.5%, with a capping at 20%. Therefore, for the excess traffic on these toll plazas, the concession period, originally 30 years, is expected to be decreased by 5 years from FY51, potentially reducing the last date of concession to FY46.

Summary outlook

6.34 Passenger movement on the asset is largely local in nature, connecting the cities of Jhansi to Lalitpur over the short distance and northern cities of Kanpur and Lucknow to Sagar and Nagpur. Cars are expected to see a healthy growth on the asset following the overall behavioural shift of users away from public transport.

6.35 The biggest advantage for this asset lies in its geographic location and strategic context, connecting the key movement between north India to the southern states of Madhya Pradesh, Karnataka, Telangana and Tamil Nadu. The overall network has been recently upgraded and provides a seamless connectivity for users. This is also demonstrated by the fact that almost 80% of truck users on this asset cover distances of more than 500Km.

6.36 We expect that the implementation of FASTag rules, will also help in improving the operational efficiency and overall compliance levels on the Asset and overall corridor as a whole which should result in an improved level of service, thereby resulting in an improved level of service for all users.

6.37 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

Appendices

Top 10 OD Pairs

Further to the OD analysis presented in Chapter 3, this appendix presents the top 10 OD pairs at each toll plaza. The tables below showcase data for both CJVs as well as MAVs and OSVs combined.

TP1 Babina

Table A.1: CJV top 10 OD pair shares at TP1 Babina

	OD Pair	Share
1.	Lalitpur-Jhansi	37%
2.	Talbehat-Jhansi	12%
3.	Jhansi-Sagar	4%
4.	Lalitpur-Babina	4%
5.	Talbehat-Babina	4%
6.	Lalitpur-Gwalior	2%
7.	Gwalior-Sagar	2%
8.	Babina-Tilak Nagar	2%
9.	Babina-Gujarat	2%
10.	Jhansi-Etawah	1%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Babina

	OD Pair	Share
1.	Hyderabad-NCT of Delhi	7%
2.	Nagpur-NCT of Delhi	6%
3.	Lalitpur-Jhansi	5%
4.	Raipur-NCT of Delhi	5%
5.	Bangalore-NCT of Delhi	5%
6.	Chennai-NCT of Delhi	4%
7.	Hyderabad-Haryana	4%
8.	Hyderabad-Punjab	3%
9.	Raipur-Punjab	2%
10.	Nagpur-Haryana	2%

Source: Steer analysis of OD data

TP1 Vigakhet

Table A.3: CJV top 10 OD pair shares at TP1 Vigakhet

	OD Pair	Share
1.	Lalitpur-Jhansi	40%
2.	Jhansi-Sagar	12%
3.	Lalitpur-NCT of Delhi	5%
4.	Sagar-NCT of Delhi	4%
5.	Lalitpur-Karera	4%
6.	Lalitpur-Gwalior	3%
7.	Gwalior-Etawah	2%
8.	Lalitpur-Talbehat	2%
9.	Lalitpur-Agra	2%
10.	Gwalior-Sagar	1%

Source: Steer analysis of OD data

Table A.4: MAV and OSV top 10 OD pair shares at TP1 Vigakhet

	OD Pair	Share
1.	Bangalore-NCT of Delhi	5%
2.	Nagpur-NCT of Delhi	5%
3.	Hyderabad-NCT of Delhi	5%
4.	Lalitpur-Jhansi	4%
5.	Sagar-NCT of Delhi	4%
6.	Jhansi-Sagar	4%
7.	Raipur-NCT of Delhi	2%
8.	NCT of Delhi-Tamil Nadu	2%
9.	Bangalore-Haryana	2%
10.	Chennai-NCT of Delhi	2%

Source: Steer analysis of OD data

A Data collection exercise

In order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7-day TVC counts

Table B.1: TVC counts at TP1

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
18-01-2021	2,603	419	295	135	836	1,354	1,564	-	7,206
19-01-2021	2,410	377	279	135	699	1,120	1,411	-	6,431
20-01-2021	2,526	446	289	130	708	1,130	1,449	-	6,678
21-01-2021	2,418	462	332	139	831	1,383	1,646	-	7,211
22-01-2021	2,542	399	350	132	904	1,443	1,616	-	7,386
23-02-2021	2,974	436	398	144	953	1,464	1,661	-	8,030
24-02-2021	2,843	405	408	131	913	1,510	1,791	-	8,001

Source: Steer analysis

Table B.1: TVC counts at TP2

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
18-01-2021	2,179	291	264	127	816	1,379	1,487	-	6,543
19-01-2021	2,016	297	261	125	691	1,126	1,322	-	5,838
20-01-2021	2,046	316	257	123	685	1,111	1,367	-	5,905
21-01-2021	2,017	283	304	130	816	1,397	1,582	-	6,529
22-01-2021	2,077	321	356	121	878	1,431	1,519	-	6,703
23-02-2021	2,427	310	335	135	884	1,410	1,574	-	7,075
24-02-2021	2,328	208	368	119	927	1,503	1,704	-	7,157

Source: Steer analysis

TVC vs TMS comparison

Table B.1: TVC and TMS WADT

Toll Plaza	Source	CJV+ Mini LCV	LCV	Bus	2 Axle	3 Axle+ MAV	OSV	Total
TP1	TVC	3,037	336	135	835	2,935	-	7,278
	TMS	2,749	226	145	895	2,950	1	6,966
TP2	TVC	2,445	306	126	814	2,845	-	6,536
	TMS	2,245	225	137	865	2,866	1	6,338

Source: Steer analysis

Zone list

Table A.1: Zone list

Zone No	Zone name	State
1	Lalitpur	Uttar Pradesh
2	Ronda	Uttar Pradesh
3	Maharra	Uttar Pradesh
4	Ander	Uttar Pradesh
5	Saurai	Uttar Pradesh
6	Daulta	Uttar Pradesh
7	Terai	Uttar Pradesh
8	Bijrotha	Uttar Pradesh
9	Talbehat	Uttar Pradesh
10	Pawa	Uttar Pradesh
11	Sukwan	Uttar Pradesh
12	Babina	Uttar Pradesh
13	Rasoi	Uttar Pradesh
14	Tilak Nagar	Uttar Pradesh
15	Khailar	Uttar Pradesh
16	Safa	Uttar Pradesh
17	Bijoli	Uttar Pradesh
18	Saiyar	Uttar Pradesh
19	Dongri	Uttar Pradesh
20	Bamair	Uttar Pradesh
21	Parasai	Uttar Pradesh
22	Orchha	Uttar Pradesh
23	Jeron Khalsa	Madhya Pradesh
24	Jakhora	Uttar Pradesh

Zone No	Zone name	State
25	Sirsee	Uttar Pradesh
26	Dailwara	Uttar Pradesh
27	Gadyana	Uttar Pradesh
28	Kalyanpura	Uttar Pradesh
29	Dawani	Uttar Pradesh
30	Chiglaua	Uttar Pradesh
31	Bar	Uttar Pradesh
32	Kathwar	Uttar Pradesh
33	Chanderi	Madhya Pradesh
34	Tikamgarh	Madhya Pradesh
35	Karera	Madhya Pradesh
36	Jhansi	Uttar Pradesh
37	Gwalior	Madhya Pradesh
38	Pichhore	Madhya Pradesh
39	Gwalior	Madhya Pradesh
40	Agra	Uttar Pradesh
41	Bhopal	Madhya Pradesh
42	Agra	Uttar Pradesh
43	Agra	Uttar Pradesh
44	Allahabad	Uttar Pradesh
45	Ambedkar Nagar	Uttar Pradesh
46	Amethi	Uttar Pradesh
47	Amroha	Uttar Pradesh
48	Auraiya	Uttar Pradesh
49	Azamgarh	Uttar Pradesh
50	Badaun	Uttar Pradesh
51	Baghpat	Uttar Pradesh
52	Bahraich	Uttar Pradesh
53	Ballia	Uttar Pradesh
54	Balrampur	Uttar Pradesh
55	Banda	Uttar Pradesh
56	Barabanki	Uttar Pradesh
57	Bareilly	Uttar Pradesh
58	Basti	Uttar Pradesh
59	Bijnor	Uttar Pradesh
60	Bulandshahr	Uttar Pradesh

Zone No	Zone name	State
61	Chandauli	Uttar Pradesh
62	Chitrakoot	Uttar Pradesh
63	Deoria	Uttar Pradesh
64	Etah	Uttar Pradesh
65	Etawah	Uttar Pradesh
66	Faizabad	Uttar Pradesh
67	Farrukhabad	Uttar Pradesh
68	Fatehpur	Uttar Pradesh
69	Firozabad	Uttar Pradesh
70	Gautam Buddha Nagar	Uttar Pradesh
71	Ghaziabad	Uttar Pradesh
72	Ghazipur	Uttar Pradesh
73	Gonda	Uttar Pradesh
74	Gorakhpur	Uttar Pradesh
75	Hamirpur	Uttar Pradesh
76	Hapur	Uttar Pradesh
77	Hardoi	Uttar Pradesh
78	Hathras	Uttar Pradesh
79	Jalaun	Uttar Pradesh
80	Jaunpur	Uttar Pradesh
81	Jhansi	Uttar Pradesh
82	Kannauj	Uttar Pradesh
83	Kanpur Dehat	Uttar Pradesh
84	Kanpur nagar	Uttar Pradesh
85	kasganj	Uttar Pradesh
86	Kaushambi	Uttar Pradesh
87	Kushinagar	Uttar Pradesh
88	Lakhimpur Kheri	Uttar Pradesh
89	Lalitpur	Uttar Pradesh
90	Lucknow	Uttar Pradesh
91	Mahamaya Nagar	Uttar Pradesh
92	Maharajganj	Uttar Pradesh
93	Mahoba	Uttar Pradesh
94	Mainpuri	Uttar Pradesh
95	Mathura	Uttar Pradesh
96	Mau	Uttar Pradesh

Zone No	Zone name	State
97	Meerut	Uttar Pradesh
98	Mirzapur	Uttar Pradesh
99	Moradabad	Uttar Pradesh
100	Muzaffarnagar	Uttar Pradesh
101	Pilibhit	Uttar Pradesh
102	Pratapgarh	Uttar Pradesh
103	Raebareli	Uttar Pradesh
104	Rampur	Uttar Pradesh
105	Saharanpur	Uttar Pradesh
106	Sambhal	Uttar Pradesh
107	Sant Kabir Nagar	Uttar Pradesh
108	Sant Ravi Das Nagar(bhadohi)	Uttar Pradesh
109	Shahjahanpur	Uttar Pradesh
110	Shamli	Uttar Pradesh
111	Shrawasti	Uttar Pradesh
112	Siddharth Nagar	Uttar Pradesh
113	Sitapur	Uttar Pradesh
114	Sonbhadra	Uttar Pradesh
115	Sultanpur	Uttar Pradesh
116	Unnao	Uttar Pradesh
117	Varanasi	Uttar Pradesh
118	Alirajpur	Madhya Pradesh
119	Anuppur	Madhya Pradesh
120	Ashoknagar	Madhya Pradesh
121	Balaghat	Madhya Pradesh
122	Barwani	Madhya Pradesh
123	Betul	Madhya Pradesh
124	Bhind	Madhya Pradesh
125	Bhopal	Madhya Pradesh
126	Burhanpur	Madhya Pradesh
127	Chhatarpur	Madhya Pradesh
128	Chhindwara	Madhya Pradesh
129	Damoh	Madhya Pradesh
130	Datia	Madhya Pradesh
131	Dewas	Madhya Pradesh
132	Dhar	Madhya Pradesh

Zone No	Zone name	State
133	Dindori	Madhya Pradesh
134	East Nimar	Madhya Pradesh
135	Guna	Madhya Pradesh
136	Harda	Madhya Pradesh
137	Hoshangabad	Madhya Pradesh
138	Indore	Madhya Pradesh
139	Jabalpur	Madhya Pradesh
140	Jhabua	Madhya Pradesh
141	Katni	Madhya Pradesh
142	Mandla	Madhya Pradesh
143	Mandsaur	Madhya Pradesh
144	Morena	Madhya Pradesh
145	Narsimhapur	Madhya Pradesh
146	Neemuch	Madhya Pradesh
147	Panna	Madhya Pradesh
148	Raisen	Madhya Pradesh
149	Rajgarh	Madhya Pradesh
150	Ratlam	Madhya Pradesh
151	Rewa	Madhya Pradesh
152	Sagar	Madhya Pradesh
153	Satna	Madhya Pradesh
154	Sehore	Madhya Pradesh
155	Seoni	Madhya Pradesh
156	Shahdol	Madhya Pradesh
157	Shajapur	Madhya Pradesh
158	Sheopur	Madhya Pradesh
159	Shivpuri	Madhya Pradesh
160	Sidhi	Madhya Pradesh
161	Singrauli	Madhya Pradesh
162	Ujjain	Madhya Pradesh
163	Umaria	Madhya Pradesh
164	Vidisha	Madhya Pradesh
165	West Nimar	Madhya Pradesh
166	Anantapur	Andhra Pradesh
167	Nagpur	Maharashtra
168	Nashik	Maharashtra

Zone No	Zone name	State
169	Dhule	Maharashtra
170	Hyderabad	Telangana
171	Vijayawada	Andhra Pradesh
172	Guntur	Andhra Pradesh
173	Pune	Maharashtra
174	Mumbai	Maharashtra
175	Chennai	Tamil Nadu
176	Bangalore	Karnataka
177	Jaipur	Rajasthan
178	Visakhapatnam	Andhra Pradesh
179	Bilaspur	Chhattisgarh
180	Raipur	Chhattisgarh
181	Korba	Chhattisgarh
182	Andhra Pradesh	Andhra Pradesh
183	Arunanchal Pradesh	Arunanchal Pradesh
184	Assam	Assam
185	Bihar	Bihar
186	Chandigarh	Chandigarh
187	Chhattisgarh	Chhattisgarh
188	Dadara & Nagar Havelli	Dadara & Nagar Havelli
189	Daman & Diu	Daman & Diu
190	Goa	Goa
191	Gujarat	Gujarat
192	Haryana	Haryana
193	Himachal Pradesh	Himachal Pradesh
194	Jammu & Kashmir	Jammu & Kashmir
195	Chhattisgarh	Jharkhand
196	Karnataka	Karnataka
197	Kerala	Kerala
198	Maharashtra	Maharashtra
199	Manipur	Manipur
200	Meghalaya	Meghalaya
201	Mizoram	Mizoram
202	Nagaland	Nagaland
203	NCT of Delhi	NCT of Delhi
204	Puducherry	Puducherry

Zone No	Zone name	State
205	Punjab	Punjab
206	Rajasthan	Rajasthan
207	Sikkim	Sikkim
208	Tamil Nadu	Tamil Nadu
209	Telangana	Telangana
210	Tripura	Tripura
211	Uttarakhand	Uttarakhand
212	West Bengal	West Bengal
213	Odisha	Odisha

Direction wise commodity distribution

Table B.1: Commodity distribution (towards Lalitpur) at TP1

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	7%	3%	9%	10%
Construction	-	1%	3%	7%
Stone	-	-	-	-
Groceries	13%	8%	22%	24%
Minerals	1%	0%	2%	4%
Manufacturing	11%	33%	15%	27%
Petroleum	2%	3%	3%	6%
Miscellaneous	29%	44%	41%	13%
Container	-	1%	-	-
Empty	36%	5%	6%	9%
Cement	1%	-	-	2%

Source: Steer analysis

Table B.1: Commodity distribution (towards Jhansi) at TP1

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	11%	4%	13%	7%
Construction	3%	1%	-	5%
Stone	-	-	-	-
Groceries	23%	7%	17%	16%
Minerals	-	4%	4%	13%
Manufacturing	13%	16%	14%	23%
Petroleum	-	2%	2%	6%
Miscellaneous	21%	43%	43%	22%

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Container	-	-	-	-
Empty	30%	23%	7%	9%
Cement	-	-	-	0%

Source: Steer analysis

Table B.1: Commodity distribution (towards Lalitpur) at TP2

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	8%	10%	15%	16%
Construction	4%	1%	5%	7%
Groceries	16%	12%	16%	20%
Minerals	11%	3%	1%	3%
Manufacturing	21%	40%	27%	29%
Petroleum	1%	2%	2%	4%
Miscellaneous	20%	25%	24%	12%
Empty	19%	8%	9%	8%
Cement	-	-	1%	1%

Source: Steer analysis

Table B.1: Commodity distribution (towards Jhansi) at TP2

Commodity Category	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	8%	10%	15%	16%
Construction	4%	1%	5%	7%
Groceries	16%	12%	16%	20%
Minerals	11%	3%	1%	3%
Manufacturing	21%	40%	27%	29%
Petroleum	1%	2%	2%	4%
Miscellaneous	20%	25%	24%	12%
Empty	19%	8%	9%	8%
Cement	-	-	1%	1%

Source: Steer analysis

Trip length frequency

Table B.1: Trip length frequency at TP1

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	9%	-	3%	0%	0%	1%
65-300 km	68%	79%	43%	14%	7%	14%

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
300-500 km	7%	8%	9%	4%	5%	7%
500-1000 km	7%	8%	12%	10%	10%	14%
>1000 km	10%	5%	33%	72%	78%	64%

Source: Steer analysis of OD data

Table B.1: Trip length frequency at TP2

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
0-65 km	3%	-	-	0%	0%	0%
65-300 km	61%	98%	39%	20%	13%	13%
300-500 km	10%	-	11%	7%	11%	8%
500-1000 km	20%	2%	10%	17%	16%	19%
>1000 km	5%	-	40%	56%	60%	60%

Source: Steer analysis of OD data

B Detailed forecasts

Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

This section presents the detailed traffic forecasts for the forecast period until FY31, year of expected close of the concession. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Forecasts for (background + impacts) traffic – TP1 Babina

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	2,649	415	166	230	1,010	1,310	1,725	**7,504**	**16,577**
FY24	2,840	432	170	240	1,054	1,361	1,825	**7,921**	**17,428**
FY25	3,045	451	173	250	1,099	1,413	1,931	**8,363**	**18,324**
FY26	3,263	471	177	261	1,146	1,476	2,057	**8,851**	**19,334**
FY27	3,489	490	181	272	1,194	1,548	2,199	**9,373**	**20,436**
FY28	3,728	510	185	283	1,243	1,622	2,349	**9,919**	**21,588**
FY29	3,979	531	188	294	1,293	1,698	2,507	**10,491**	**22,792**
FY30	4,243	552	192	306	1,345	1,777	2,674	**11,089**	**24,049**
FY31	4,523	574	196	318	1,398	1,859	2,850	**11,717**	**25,369**
FY32	4,818	596	200	330	1,453	1,944	3,036	**12,377**	**26,752**
FY33	5,130	619	204	343	1,509	2,032	3,232	**13,069**	**28,201**
FY34	5,459	643	207	356	1,567	2,123	3,439	**13,796**	**29,719**
FY35	5,805	668	211	370	1,627	2,217	3,658	**14,557**	**31,307**
FY36	6,170	693	215	384	1,688	2,315	3,888	**15,354**	**32,969**
FY37	6,555	719	219	398	1,751	2,416	4,130	**16,189**	**34,707**
FY38	6,959	746	223	413	1,816	2,520	4,385	**17,063**	**36,523**
FY39	7,385	773	228	428	1,883	2,628	4,652	**17,977**	**38,421**
FY40	7,831	801	232	444	1,951	2,739	4,934	**18,932**	**40,403**
FY41	8,301	830	236	460	2,021	2,854	5,229	**19,931**	**42,470**
FY42	8,793	859	240	476	2,093	2,973	5,540	**20,974**	**44,627**
FY43	9,309	890	244	493	2,167	3,095	5,865	**22,062**	**46,876**
FY44	9,850	921	249	510	2,243	3,221	6,205	**23,198**	**49,219**
FY45	10,416	952	253	528	2,320	3,350	6,562	**24,382**	**51,659**
FY46	11,009	985	257	546	2,399	3,484	6,936	**25,616**	**54,199**
FY47	11,629	1,018	262	564	2,480	3,621	7,326	**26,900**	**56,841**
FY48	12,277	1,052	266	583	2,563	3,762	7,734	**28,238**	**59,588**
FY49	12,954	1,087	270	602	2,648	3,907	8,161	**29,629**	**62,443**
FY50	13,660	1,122	275	622	2,735	4,056	8,605	**31,075**	**65,407**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY51	14,404	1,159	279	642	2,824	4,211	9,074	**32,595**	**68,519**

Source: Steer analysis

Table B.2: Forecasts for (background + impacts) growth rates (%) – TP1 Babina

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	7.1%	4.2%	2.1%	4.2%	4.2%	4.9%	7.1%	**5.9%**	**5.8%**
FY24	7.2%	4.3%	2.2%	4.3%	4.3%	3.9%	5.8%	**5.6%**	**5.1%**
FY25	7.2%	4.3%	2.2%	4.3%	4.3%	3.9%	5.8%	**5.6%**	**5.1%**
FY26	7.2%	4.3%	2.2%	4.3%	4.3%	4.4%	6.5%	**5.8%**	**5.5%**
FY27	6.9%	4.2%	2.1%	4.2%	4.2%	4.8%	6.9%	**5.9%**	**5.7%**
FY28	6.8%	4.1%	2.0%	4.1%	4.1%	4.8%	6.8%	**5.8%**	**5.6%**
FY29	6.7%	4.0%	2.0%	4.0%	4.0%	4.7%	6.7%	**5.8%**	**5.6%**
FY30	6.6%	4.0%	2.0%	4.0%	4.0%	4.7%	6.6%	**5.7%**	**5.5%**
FY31	6.6%	4.0%	2.0%	4.0%	4.0%	4.6%	6.6%	**5.7%**	**5.5%**
FY32	6.5%	3.9%	2.0%	3.9%	3.9%	4.6%	6.5%	**5.6%**	**5.5%**
FY33	6.5%	3.9%	1.9%	3.9%	3.9%	4.5%	6.5%	**5.6%**	**5.4%**
FY34	6.4%	3.8%	1.9%	3.8%	3.8%	4.5%	6.4%	**5.6%**	**5.4%**
FY35	6.3%	3.8%	1.9%	3.8%	3.8%	4.4%	6.3%	**5.5%**	**5.3%**
FY36	6.3%	3.8%	1.9%	3.8%	3.8%	4.4%	6.3%	**5.5%**	**5.3%**
FY37	6.2%	3.7%	1.9%	3.7%	3.7%	4.4%	6.2%	**5.4%**	**5.3%**
FY38	6.2%	3.7%	1.9%	3.7%	3.7%	4.3%	6.2%	**5.4%**	**5.2%**
FY39	6.1%	3.7%	1.8%	3.7%	3.7%	4.3%	6.1%	**5.4%**	**5.2%**
FY40	6.1%	3.6%	1.8%	3.6%	3.6%	4.2%	6.0%	**5.3%**	**5.2%**
FY41	6.0%	3.6%	1.8%	3.6%	3.6%	4.2%	6.0%	**5.3%**	**5.1%**
FY42	5.9%	3.6%	1.8%	3.6%	3.6%	4.2%	5.9%	**5.2%**	**5.1%**
FY43	5.9%	3.5%	1.8%	3.5%	3.5%	4.1%	5.9%	**5.2%**	**5.0%**
FY44	5.8%	3.5%	1.7%	3.5%	3.5%	4.1%	5.8%	**5.1%**	**5.0%**
FY45	5.8%	3.5%	1.7%	3.5%	3.5%	4.0%	5.8%	**5.1%**	**5.0%**
FY46	5.7%	3.4%	1.7%	3.4%	3.4%	4.0%	5.7%	**5.1%**	**4.9%**
FY47	5.6%	3.4%	1.7%	3.4%	3.4%	3.9%	5.6%	**5.0%**	**4.9%**
FY48	5.6%	3.3%	1.7%	3.3%	3.3%	3.9%	5.6%	**5.0%**	**4.8%**
FY49	5.5%	3.3%	1.7%	3.3%	3.3%	3.9%	5.5%	**4.9%**	**4.8%**
FY50	5.5%	3.3%	1.6%	3.3%	3.3%	3.8%	5.5%	**4.9%**	**4.7%**
FY51	5.5%	3.3%	1.6%	3.3%	3.3%	3.8%	5.5%	**4.9%**	**4.8%**

Source: Steer analysis

Table B.3: Forecasts for (background + impacts) traffic – TP2 Vigakhet

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	2,156	282	151	210	968	1,291	1,650	**6,708**	**15,447**
FY24	2,311	294	155	219	1,010	1,341	1,746	**7,076**	**16,232**
FY25	2,478	307	158	228	1,054	1,393	1,848	**7,465**	**17,059**
FY26	2,656	320	161	238	1,099	1,455	1,968	**7,896**	**17,993**
FY27	2,840	333	165	248	1,145	1,525	2,104	**8,359**	**19,015**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY28	3,034	347	168	258	1,192	1,598	2,248	**8,844**	**20,083**
FY29	3,238	361	171	268	1,240	1,673	2,399	**9,351**	**21,199**
FY30	3,453	375	175	279	1,289	1,751	2,558	**9,881**	**22,364**
FY31	3,681	390	178	290	1,340	1,832	2,727	**10,438**	**23,586**
FY32	3,921	405	182	301	1,393	1,915	2,905	**11,023**	**24,868**
FY33	4,175	421	185	313	1,447	2,002	3,093	**11,636**	**26,210**
FY34	4,443	437	189	325	1,502	2,092	3,291	**12,279**	**27,615**
FY35	4,725	454	193	338	1,560	2,185	3,500	**12,953**	**29,085**
FY36	5,022	471	196	350	1,618	2,281	3,720	**13,659**	**30,623**
FY37	5,335	489	200	363	1,679	2,381	3,952	**14,398**	**32,232**
FY38	5,664	507	204	377	1,741	2,483	4,195	**15,171**	**33,912**
FY39	6,010	525	207	391	1,805	2,590	4,452	**15,980**	**35,668**
FY40	6,374	545	211	405	1,870	2,699	4,721	**16,825**	**37,500**
FY41	6,756	564	215	419	1,938	2,812	5,004	**17,708**	**39,412**
FY42	7,156	584	219	434	2,007	2,929	5,300	**18,630**	**41,406**
FY43	7,576	605	223	450	2,077	3,049	5,611	**19,592**	**43,485**
FY44	8,017	626	226	465	2,150	3,174	5,937	**20,595**	**45,650**
FY45	8,478	647	230	481	2,224	3,301	6,279	**21,641**	**47,905**
FY46	8,960	670	234	498	2,300	3,433	6,636	**22,731**	**50,251**
FY47	9,465	692	238	515	2,378	3,568	7,010	**23,865**	**52,692**
FY48	9,992	715	242	532	2,457	3,707	7,400	**25,046**	**55,229**
FY49	10,543	739	246	549	2,538	3,850	7,808	**26,274**	**57,865**
FY50	11,117	763	250	567	2,621	3,997	8,234	**27,550**	**60,602**
FY51	11,723	788	254	586	2,707	4,150	8,683	**28,891**	**63,474**

Source: Steer analysis

Table B.4: Forecasts for (background + impacts) growth rates (%) – TP2 Vigakhet

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	7.1%	4.2%	2.1%	4.2%	4.2%	4.9%	7.1%	**5.9%**	**5.7%**
FY24	7.2%	4.3%	2.2%	4.3%	4.3%	3.9%	5.8%	**5.5%**	**5.1%**
FY25	7.2%	4.3%	2.2%	4.3%	4.3%	3.9%	5.8%	**5.5%**	**5.1%**
FY26	7.2%	4.3%	2.2%	4.3%	4.3%	4.4%	6.5%	**5.8%**	**5.5%**
FY27	6.9%	4.2%	2.1%	4.2%	4.2%	4.8%	6.9%	**5.9%**	**5.7%**
FY28	6.8%	4.1%	2.0%	4.1%	4.1%	4.8%	6.8%	**5.8%**	**5.6%**
FY29	6.7%	4.0%	2.0%	4.0%	4.0%	4.7%	6.7%	**5.7%**	**5.6%**
FY30	6.6%	4.0%	2.0%	4.0%	4.0%	4.7%	6.6%	**5.7%**	**5.5%**
FY31	6.6%	4.0%	2.0%	4.0%	4.0%	4.6%	6.6%	**5.6%**	**5.5%**
FY32	6.5%	3.9%	2.0%	3.9%	3.9%	4.6%	6.5%	**5.6%**	**5.4%**
FY33	6.5%	3.9%	1.9%	3.9%	3.9%	4.5%	6.5%	**5.6%**	**5.4%**
FY34	6.4%	3.8%	1.9%	3.8%	3.8%	4.5%	6.4%	**5.5%**	**5.4%**
FY35	6.3%	3.8%	1.9%	3.8%	3.8%	4.4%	6.3%	**5.5%**	**5.3%**
FY36	6.3%	3.8%	1.9%	3.8%	3.8%	4.4%	6.3%	**5.4%**	**5.3%**
FY37	6.2%	3.7%	1.9%	3.7%	3.7%	4.4%	6.2%	**5.4%**	**5.3%**
FY38	6.2%	3.7%	1.9%	3.7%	3.7%	4.3%	6.2%	**5.4%**	**5.2%**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY39	6.1%	3.7%	1.8%	3.7%	3.7%	4.3%	6.1%	**5.3%**	**5.2%**
FY40	6.1%	3.6%	1.8%	3.6%	3.6%	4.2%	6.0%	**5.3%**	**5.1%**
FY41	6.0%	3.6%	1.8%	3.6%	3.6%	4.2%	6.0%	**5.2%**	**5.1%**
FY42	5.9%	3.6%	1.8%	3.6%	3.6%	4.2%	5.9%	**5.2%**	**5.1%**
FY43	5.9%	3.5%	1.8%	3.5%	3.5%	4.1%	5.9%	**5.2%**	**5.0%**
FY44	5.8%	3.5%	1.7%	3.5%	3.5%	4.1%	5.8%	**5.1%**	**5.0%**
FY45	5.8%	3.5%	1.7%	3.5%	3.5%	4.0%	5.8%	**5.1%**	**4.9%**
FY46	5.7%	3.4%	1.7%	3.4%	3.4%	4.0%	5.7%	**5.0%**	**4.9%**
FY47	5.6%	3.4%	1.7%	3.4%	3.4%	3.9%	5.6%	**5.0%**	**4.9%**
FY48	5.6%	3.3%	1.7%	3.3%	3.3%	3.9%	5.6%	**4.9%**	**4.8%**
FY49	5.5%	3.3%	1.7%	3.3%	3.3%	3.9%	5.5%	**4.9%**	**4.8%**
FY50	5.5%	3.3%	1.6%	3.3%	3.3%	3.8%	5.5%	**4.9%**	**4.7%**
FY51	5.5%	3.3%	1.6%	3.3%	3.3%	3.8%	5.5%	**4.9%**	**4.7%**

Source: Steer analysis

Revenue forecasts

Table B.5: Forecasts revenue (INR crores) – TP1 Babina

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY23	754	118	170	138	1,305	1,880	3,542	**7,905**
FY24	853	130	183	152	1,437	2,077	3,952	**8,785**
FY25	977	145	197	167	1,589	2,251	4,405	**9,730**
FY26	1,097	158	211	183	1,737	2,480	4,939	**10,805**
FY27	1,226	172	227	199	1,911	2,736	5,584	**12,056**
FY28	1,393	191	244	222	2,082	3,017	6,270	**13,419**
FY29	1,543	206	260	240	2,271	3,299	6,981	**14,801**
FY30	1,737	226	278	261	2,477	3,638	7,817	**16,434**
FY31	1,939	246	297	281	2,696	3,969	8,681	**18,110**
FY32	2,175	269	317	310	2,934	4,366	9,697	**20,067**
FY33	2,388	288	336	333	3,170	4,730	10,800	**22,045**
FY34	2,681	316	360	363	3,454	5,165	11,975	**24,314**
FY35	2,940	338	383	395	3,752	5,666	13,363	**26,837**
FY36	3,293	370	410	430	4,081	6,176	14,860	**29,621**
FY37	3,658	401	434	465	4,403	6,723	16,455	**32,540**
FY38	4,063	435	462	503	4,784	7,323	18,240	**35,811**
FY39	4,503	471	493	543	5,185	8,003	20,242	**39,440**
FY40	4,992	510	525	594	5,625	8,749	22,552	**43,546**
FY41	5,544	554	557	637	6,057	9,491	24,929	**47,769**
FY42	6,138	599	593	692	6,561	10,352	27,571	**52,506**
FY43	6,779	647	631	749	7,125	11,266	30,521	**57,718**
FY44	7,512	702	673	811	7,706	12,320	33,889	**63,613**
FY45	8,304	759	715	880	8,347	13,367	37,349	**69,721**
FY46	9,156	819	760	947	9,005	14,511	41,279	**76,477**
FY47	10,099	884	808	1,026	9,737	15,779	45,643	**83,975**
FY48	11,271	965	862	1,112	10,575	17,166	50,478	**92,430**
FY49	12,391	1,039	915	1,196	11,396	18,600	55,534	**1,01,071**
FY50	13,627	1,119	972	1,297	12,290	20,232	61,257	**1,10,795**
FY51	15,051	1,210	1,034	1,394	13,275	21,963	67,602	**1,21,530**

Source: Steer analysis

Table B.6: Forecasts revenue (INR crores) – TP2 Vigakhet

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY23	474	62	124	95	925	1,370	2,515	**5,565**
FY24	536	68	133	106	1,020	1,521	2,794	**6,180**
FY25	602	74	144	115	1,117	1,650	3,109	**6,810**
FY26	686	83	155	128	1,240	1,826	3,515	**7,633**
FY27	767	90	166	142	1,352	1,996	3,943	**8,456**
FY28	868	99	179	153	1,493	2,210	4,423	**9,426**
FY29	962	107	191	168	1,615	2,426	4,960	**10,430**
FY30	1,079	117	205	179	1,768	2,663	5,516	**11,527**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY31	1,192	126	217	196	1,908	2,915	6,162	**12,718**
FY32	1,335	138	233	215	2,086	3,193	6,889	**14,088**
FY33	1,512	152	248	233	2,261	3,470	7,639	**15,516**
FY34	1,678	165	264	254	2,452	3,774	8,479	**17,067**
FY35	1,858	178	280	275	2,654	4,135	9,444	**18,826**
FY36	2,039	191	300	298	2,902	4,531	10,521	**20,783**
FY37	2,303	211	318	322	3,121	4,927	11,633	**22,834**
FY38	2,534	226	338	353	3,386	5,358	12,938	**25,135**
FY39	2,826	247	361	380	3,668	5,862	14,353	**27,697**
FY40	3,105	265	386	409	4,005	6,414	15,926	**30,511**
FY41	3,464	289	408	444	4,307	6,963	17,620	**33,496**
FY42	3,834	313	435	482	4,670	7,563	19,504	**36,801**
FY43	4,208	336	462	522	5,051	8,250	21,632	**40,461**
FY44	4,681	365	493	567	5,467	9,004	23,995	**44,573**
FY45	5,166	394	524	610	5,910	9,751	26,406	**48,761**
FY46	5,702	426	556	657	6,390	10,623	29,192	**53,546**
FY47	6,348	464	593	714	6,935	11,546	32,300	**58,901**
FY48	7,031	503	632	777	7,489	12,558	35,753	**64,742**
FY49	7,683	538	670	838	8,068	13,618	39,396	**70,812**
FY50	8,529	585	713	905	8,740	14,776	43,423	**77,671**
FY51	9,359	628	758	976	9,448	16,070	47,920	**85,159**

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit 4.0

Author/originator

Anshika Saxena

Reviewer/approver

Samhita Indurkar

Other contributors

Vaibhav Gupta, Wasey Khan, Aditya Karan, Chanda Malhotra

Distribution

Client: Steer:

Version control/issue number

V1.0

Date

April 2022

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Jaipur Mahua Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence for Jaipur Mahua Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Content

Disclaimer ..... **vi**

Glossary Items ..... **viii**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Concession and tolling details 8

Key economic activities 9

Alternate Routes 10

3 Traffic description **12**

Introduction 12

Historical trends 12

Data collection and validation 24

Key findings of the TVC data analysis 24

Key findings of origin-destination analysis 27

Conclusions 37

4 Socio Economic Context **38**

Introduction 38

Population growth 38

Economic growth 39

5 Traffic growth analysis **41**

Introduction 41

Estimation of background elasticities 41

Forecasts for background elasticities 47

Forecasts for growth drivers 47

6 Forecasts: Base year AADT and Impacts 50

Introduction 50

Seasonality Correction factors 51

Base year FY22 AADT estimates 52

Analysis of potential network/developmental impacts 53

Revenue forecasting assumptions 60

Traffic and Revenue forecasts 63

Upside and Downside Cases 67

Traffic and Revenue Forecasts-Upside case 69

Traffic and Revenue Forecasts-Downside case 72

Summary outlook 75

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4

Figure 2.1: Asset location in the regional network context 6

Figure 2.2: Asset context 7

Figure 2.3: Typical cross-sections and toll plazas on the Asset 8

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1 Sikandra 15

Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2 Rajadhok 16

Figure 3.3 Month on Month traffic recovery vs FY20 17

Figure 3.4 FASTag penetration: Sikandra toll plaza 19

Figure 3.5 FASTag penetration: Rajadhok oll plaza 20

Figure 3.6 Ticket-segmentation for CJV at TP1 Sikandra 20

Figure 3.7 Ticket-segmentation for MAV at TP1 Sikandra 21

Figure 3.8 Ticket-segmentation for CJV at TP2 Rajadhok 21

Figure 3.9: Ticket-segmentation for MAV at TP2 Rajadhok 21

Figure 3.10 WADT at TP1 and TP2 25

Figure 3.11 Comparison between TVC and TMS daily traffic data on TP1 Sikandra 25

Figure 3.12: Comparison between TVC and TMS daily traffic data on TP2 Rajadhok 26

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs 26

Figure 3.14 Zonal influence at TP1 Sikandra 29

Figure 3.15 Zonal influence at TP2 Rajadhok 29
Figure 3.16 Internal-external distribution at TP1 Sikandra 30
Figure 3.17 Internal-external distribution at TP2 Rajadhok 31
Figure 3.18 Commodity distribution at TP1 Sikandra (Both directions) 33
Figure 3.19 Commodity distribution at TP1 Sikandra (towards Jaipur) 33
Figure 3.20 Commodity distribution at TP1 Sikandra (towards Agra) 34
Figure 3.21 Commodity distribution at TP2 Rajadhok (Both directions) 34
Figure 3.22 Commodity distribution at TP2 Rajadhok (towards Jaipur) 35
Figure 3.23 Commodity distribution at TP2 Rajadhok (towards Agra) 35
Figure 3.24 Trip length distribution TP1 Sikandra 36
Figure 3.25 Trip length distribution TP2 Rajadhok 36
Figure 4.1: Evolution of Rajasthan's state GDP and national GDP 39
Figure 4.2: Sectoral contribution to Rajasthan's GSDP 40
Figure 5.1: Relationship between CJV traffic and Rajasthan GSDP 43
Figure 5.2: Relationship between LCV+2A combined traffic and Rajasthan GSDP 45
Figure 5.3: Relationship between Bus traffic and Rajasthan GSDP 45
Figure 5.4: Relationship between 3A+MAV combined traffic and Rajasthan's GDP 46
Figure 5.5: GDP-GSDP forecast 49
Figure 6.1: Alternate routes and Asset route shown against the regional network context 53
Figure 6.2: Asset location on long-distance route option between Udaipur/Chittorgarh and Kanpur 57
Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP1 Sikandra .. 66
Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP2 Rajadhok . 67

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Summary of concession 8
Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022 9
Table 2.3: PCU factors 11
Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Sikandra 12
Table 3.2: Historical evolution in AADT by vehicle class at TP2 – Rajadhok 13
Table 3.3 Historical evolution in YOY growth by vehicle class at TP1: Sikandra 13
Table 3.4 Historical evolution in YOY growth by vehicle class at TP2: Rajadhok 13

Table 3.5: Historical revenue evolution by class (in INR crores): 16
Table 3.6: Typical ticket types sold at NHAI plazas 18
Table 3.7: Timeline of national ETC implementation 18
Table 3.8: Overloading shares for FY19, FY20 and FY22 23
Table 3.9: Data collection schedule 24
Table 3.10: Sample rates for OD data 27
Table 3.11: Zone aggregations for zonal influence analysis 28
Table 3.12: Aggregate commodity categories 31
Table 4.1: CAGR of population in India 38
Table 4.2: Population Growth in India (2001 – 2011) 39
Table 5.1: Vehicle wise growth and CAGR (%) at Sikandra toll plaza 41
Table 5.2: Split between individual vehicle types at each toll plaza 42
Table 5.3: Identified growth drivers to model traffic growth at Asset level 42
Table 5.4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 47
Table 6.1: Key intermediate and final outputs in the forecast 50
Table 6.2: Seasonality correction factors for TP1 Sikandra 51
Table 6.3: Seasonality correction factors for TP2 Rajadhok 51
Table 6.4 Monthly AADT and Adopted AADT for FY22 - TP1 Sikandra 52
Table 6.5: List of network/other developments 53
Table 6.6: Impact of government efforts to revive sand industry 55
Table 6.7: Impact of completion of Jaipur Ring Road 55
Table 6.8: Impact due to completion of Delhi-Mumbai Expressway, TP2 Rajadhok 56
Table 6.9: Impact due to completion of pending section on Agra Ring Road 58
Table 6.10: Impacts due to construction-related movement for specific upcoming infrastructure projects 58
Table 6.11: Summary of impact assessments, excluding construction-related vehicles 59
Table 6.12: Forecast toll segmentation, FY22 onwards- TP1 Sikandra 60
Table 6.13: Forecast toll segmentation, FY22 onwards- TP2 Rajadhok 60
Table 6.14: Overloading assumptions for forecast years FY22 onwards 61
Table 6.15: WPI growth forecast assumptions 62
Table 6.16: Revenue reconciliation for Feb 2022 63
Table 6.17: Traffic forecasts (with impacts) forecast for TP1 Sikandra 63

Table 6.18: Traffic forecasts (with impacts) CAGR (%) for TP1 Sikandra 63
Table 6.19: Revenue forecast for TP1 Sikandra (INR crores) 64
Table 6.20: Revenue growth CAGR (%) for TP1 Sikandra 64
Table 6.21: Traffic forecast (with impacts) for TP2 Rajadhok 64
Table 6.22: Traffic forecast (with impacts) CAGR (%) for TP2 Rajadhok 65
Table 6.23: Revenue forecast for TP2 Rajadhok (INR crores) 65
Table 6.24: Revenue growth rates (%) for TP2 Rajadhok 65
Table 6.25: Summary of Macro Assumptions for upside and downside cases 67
Table 6.26: Summary of impacts on the Assets 68
Table 6.27: Summary of impacts on the Assets 68
Table 6.28: Traffic forecast (With Upside Impacts) for TP1: Sikandra 69
Table 6.29: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Sikandra 70
Table 6.30: Revenue forecast (With Upside Impacts) for TP1: Sikandra (In Cr) 70
Table 6.31: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Sikandra 70
Table 6.32: Traffic forecast (With Upside Impacts) for TP2: Rajadhok 71
Table 6.33: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Rajadhok 71
Table 6.34: Revenue forecast (With Upside Impacts) for TP2: Rajadhok(In Cr) 71
Table 6.35: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Rajadhok 72
Table 6.36: Traffic forecast (With Downside Impacts) for TP1: Sikandra 72
Table 6.37: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Sikandra 72
Table 6.38: Revenue forecast (With Downside Impacts) for TP1: Sikandra (In Cr) 73
Table 6.39: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Sikandra 73
Table 6.40: Traffic forecast (With Downside Impacts) for TP2: Rajadhok 74
Table 6.41: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Rajadhok 74
Table 6.42: Revenue forecast (With Downside Impacts) for TP2: Rajadhok(In Cr) 74
Table 6.43: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Rajadhok 75

Appendices

A Developments in sandmining
B Top 10 OD Pairs
C Detailed forecasts
D Data Collection Exercise

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.
Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.
While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March

Acronym	Meaning
RNP	Registered Number Plate
SCF	Seasonality Correction Factor
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on Jaipur-Mahua Toll Road (the "Asset").

1.2 Our scope of work for the traffic and revenue forecasts process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors – Overloading shares	Calculated from historical data provided by the Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI and WPI line based on forecasts provided by the client

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on existing/brownfield Assets.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from April FY09 to March FY22
  - Concession agreement and toll notifications
  - Previous studies
- Steer-commissioned TVC counts from 27th January to 2nd February 2021
- Steer conducted OD surveys on behalf of the client in July 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.

- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset against our Steer knowledge base (e.g., similar asset types in the same state or on the same corridor), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes major network and other impacts including change in toll rates and more. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until May 3rd 2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

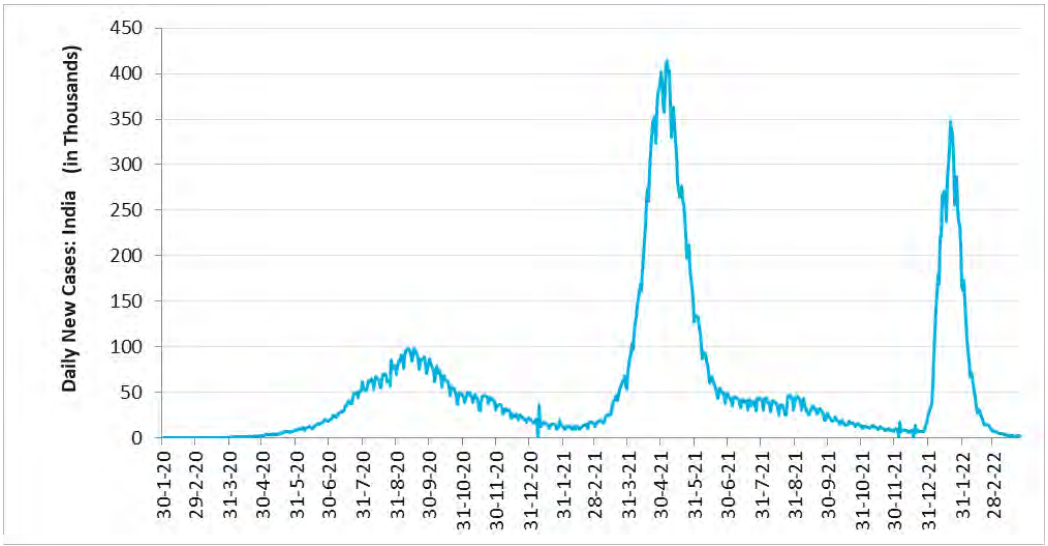
1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

1.11 Data from various roads across the country indicates that the largest impact on overall traffic was experienced March 2020 onwards where the CJV traffic was par FY20 levels in Q4FY21. Vehicle categories like LCV still haven't recovered to pre-COVID-19 levels with 2A's having slight recovery. The Asset has strong industrial influence where the goods traffic continued growing during COVID-19 related lockdowns. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories and as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption /production etc. being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 28th February 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for first quarter only. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second of week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19,but was less severe in comparison to fatality rate, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave.

1.16 Now that COVID-19 had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus service. This shift is expected to sustain and continue in the short term as such perception shifts for longer periods of time could result in more permanent changes in passenger choices. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis
- Chapter 4 discusses the socio-economic context of the corridor and region containing the Asset
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, assessment of network impacts, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

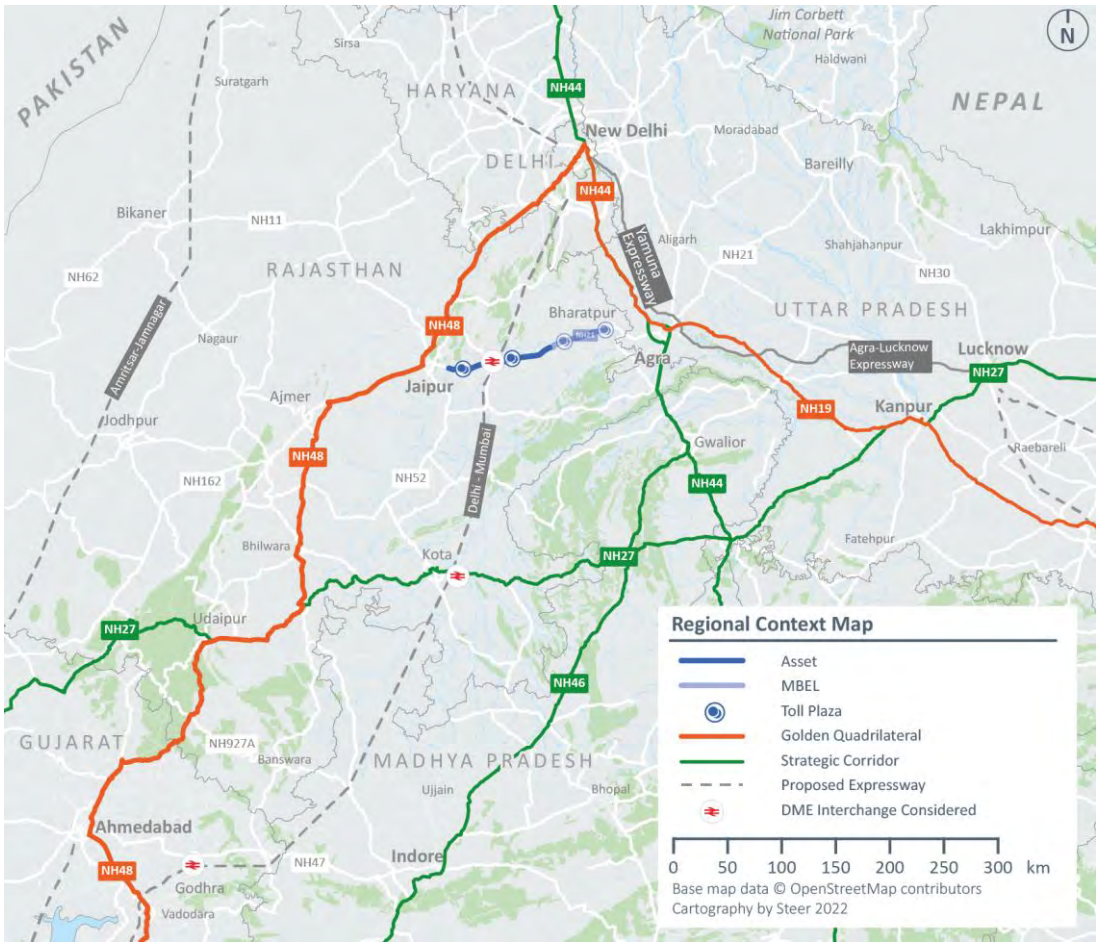
Introduction

2.1 This chapter provides a description of the Asset, based on concession agreement, site observations, our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Rajasthan, connecting the state capital Jaipur to Mahua on the east, near the edge of the south-western Uttar Pradesh (UP). The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



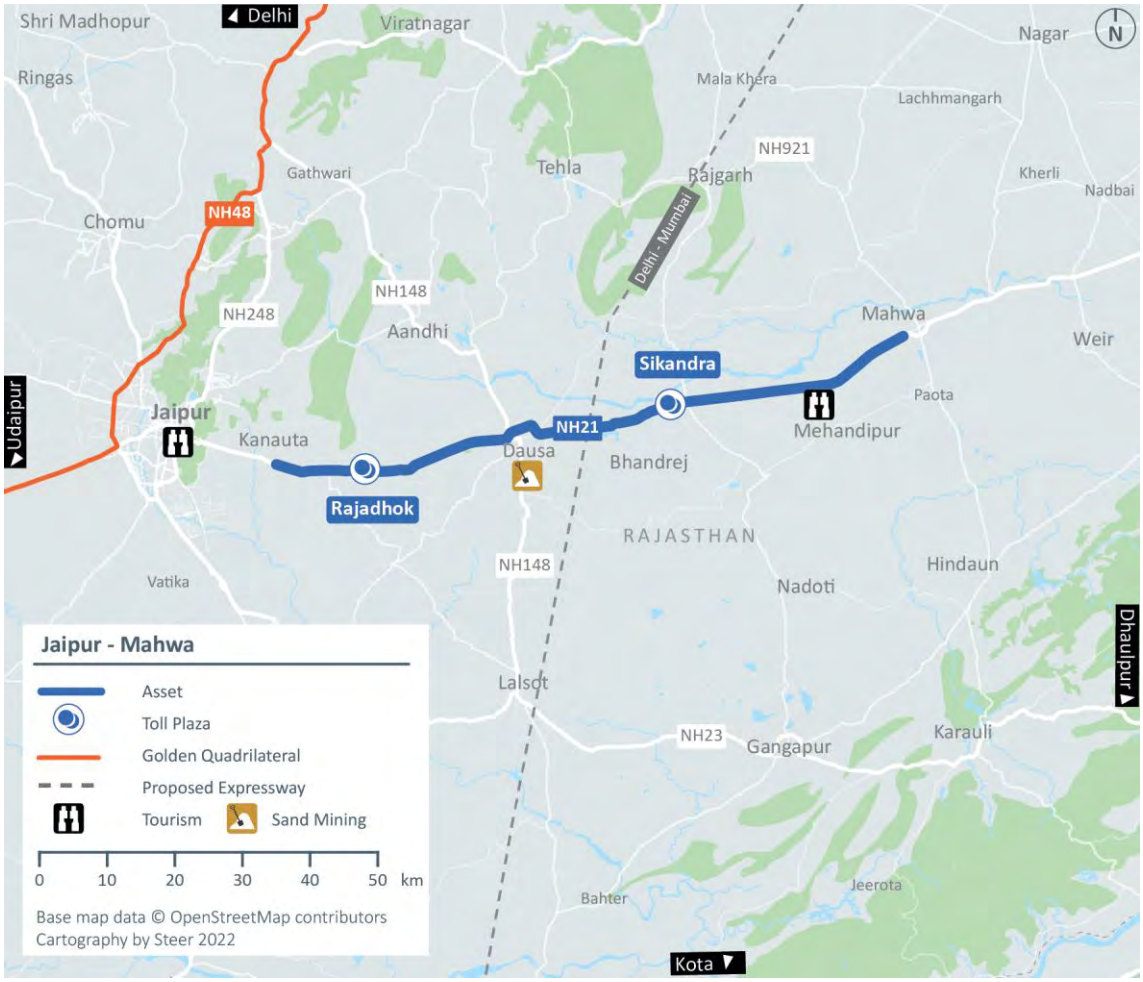
Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to three types of strategic movements:

- **Short-distance trips** including tourism and leisure trips between some of the key tourist destinations in India. Such trips are mostly comprising of CJVs which are either local or run between key tourist locations of Agra and Bharatpur at one end and Jaipur on the other.
- **Medium-distance trips** between Rajasthan and Uttar Pradesh connect marble-processing sites of Rajasthan to its consumption sites in Uttar Pradesh. The Asset also transports significant number of manufactured products across the states of UP and Rajasthan.
- **Long-distance trips** between Gujarat and southern Rajasthan, and UP/East India connects ports and industries of western India to major consumption and production centres in North India.

2.4 The Asset is a 109.09-km toll road which forms a part of the NH 21 in Rajasthan. It is a four-lane Asset with two toll plazas, namely, Sikandra (TP1) at Km 156.6 (closer to Mahua) and Rajadhok (TP2) at Km 204.7 (closer to Jaipur). The following figure provides a closer view of the Asset in the context of its immediate surroundings and location of toll plazas.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plazas on the Asset have been operational since April (TP1) and September (TP2) 2009 and the Client took over its operations in May 2015. There are 11 years left in the concession period which ends in FY32. The following table presents a summary of the concession.

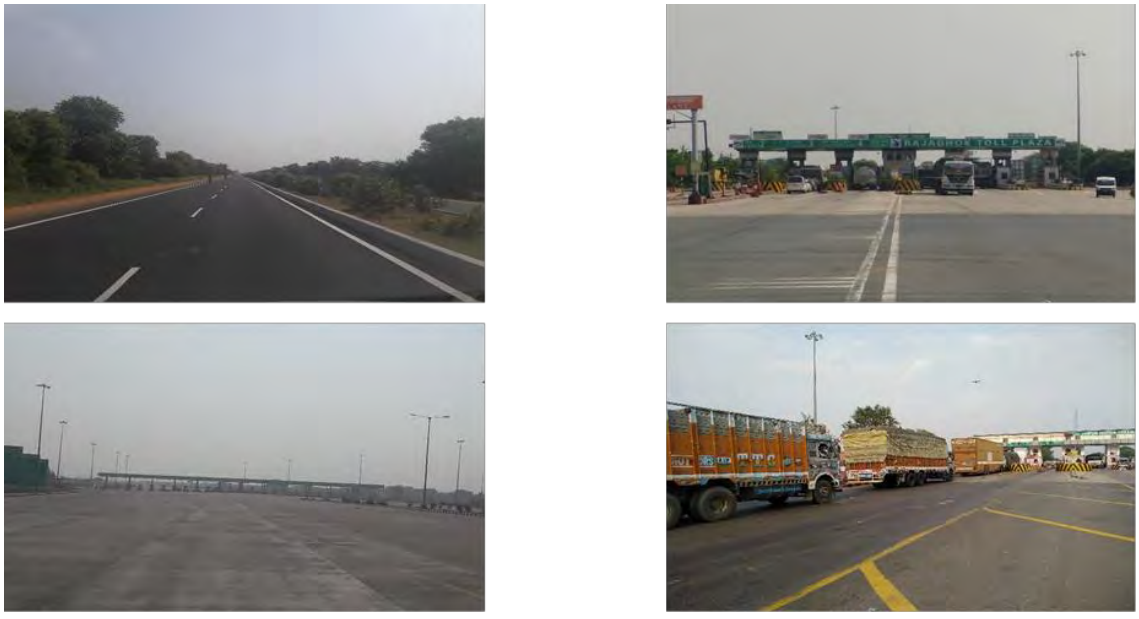
Table 2.1: Summary of concession

	Particulars
State	Rajasthan
Highway and lane configuration	NH11 and NH 21 four lane
Toll plazas	• TP1: Sikandra • TP2: Rajadhok
Length (km) as per concession agreement, applicable	• TP1: 54.73 km • TP2: 54.36 km
Commencement of operations	• TP1: April 2009 • TP2: September 2009
Operated by Client since	May 2015
Concession period	25 years
Last year of concession	FY32

Source: Client data

2.6 Figure 2.3 shows a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross-sections and toll plazas on the Asset



Source: Steer site visit

2.7 The tolls on the Asset are collected for following vehicle toll categories with rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022

Type of Vehicle	Single Journey Fee	
	TP1 Sikandra	TP2 Rajadhok
CJV	70	65
LCV	120	120
Bus/Truck	240	235
3A/MAV	380	380
HCM/EME/OSV	380	380

Source: NHAI Revision of User fee Rate w.e.f 01.07.2021

2.8 The Asset currently issues tickets including single, local commercial, monthly, exempt and local personal under NHAI concession. There are no return tickets issued with monthly tickets issued only at Rajadhok plaza of the Asset. The local personal ticket category is a discounted single-entry pass issued to trips originating within 10kms of the asset. Whereas local commercial is another single entry discounted pass issued at the Asset plaza to commercial vehicles registered within the Asset district. Further, detailed information on this have been provided in Chapter 3 of the report.

Key economic activities

2.9 Rajasthan is the largest state in India by area, sharing borders with five major states- Uttar Pradesh, Haryana, Punjab, Madhya Pradesh and Gujarat. It is rich in natural resources particularly minerals and produces about 57 different minerals.[1] Predominantly an agrarian economy and a major producer of grains, oilseeds and edible oil, the recent times has seen a high rise in the service sector growth wherein the sector contributed 47% to state's GSDP in 2019-20 followed by agriculture with 32% and industries with 21%.[2]

Urban centres, business and tourism

2.10 The state of Rajasthan and its bordering cities in UP (e.g. Agra and Mathura) are known for their tourist destinations. This contributes significantly to high passenger traffic volumes both within cities and on highways. The capital city of Jaipur, located on one end of the Asset, is a thriving urban city which is the main centre of administration, governance, culture, education, business and service sector in the state. It is a prominent tourism destination contributing majorly to the flourishing hospitality industry in the state. This reflects in considerable passenger volumes between the three nodes of India's Golden Triangle - Delhi, Jaipur and Agra – observed on the Asset. In recent times, the city has also emerged as a promising hub for global outsourcing and IT industry. Jaipur's strategic location on the golden quadrilateral

[1] http://www.mines.rajasthan.gov.in/dmgcms/page?menuName=YzCjPSj/AU7RGgRfpUoY5A==#:~:text=Rajasthan%20is%20the%20richest%20state,zinc%20ores%2C%20selenite%20and%20wollastonite.

[2] Please refer to Chapter 4 for more detail.

connects it with major industrial, agricultural, and cultural centres of Chennai, Kolkata, Delhi, and Mumbai.

Marble, cement and sand

2.11 The State is also a leading producer of cement grade limestone with around 67.23 million tonnes of production in FY20.[3] Places like Kishangarh, Kota and Dausa produce stone and sand, apart from being a hub of major marble processing centres, with a history of supplying marble to the rest of India.

2.12 Sandmining in India has long faced issues of corruption involving local mafias and a lack of proper implementation of mining policies by the government. Since November FY18, when Supreme Court order ruled the requirement of environmental clearances for all sand mines, including those less than five hectares of size, there has been a reported drop in traffic carrying construction-related commodities on the Asset, particularly sand. State government requests to allow earlier licence holders to mine sand were also rejected by the court.

2.13 However, on 25 January 2021, Rajasthan released a policy on Manufactured Sand (M-Sand) which provides an industry status to the units producing sand for construction work and reduces dependency on riverbed sand. M-Sand is an artificially created sand which is produced by grinding hard rocks like basalt, granite, silica and sandstone among others. It is different from naturally occurring sand which is extracted through riverbed sand mining and is potentially less harmful for the environment. The main aim of the Rajasthan policy is to reduce dependency on river-based sand whereas creating local employment opportunities with establishment of new mineral-based industries in the state[4]. The new policy is expected to revive the sand mining activities, give rise to new sand production units and likely increase the traffic carrying construction-related commodities on the Asset. The expected extent of impact this new policy could have on the Assets traffic is discussed briefly in Chapter 6 of this report.

Alternate Routes

2.14 For long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states, there is an alternative route along NH 27 that joins Udaipur to Kanpur via Chittorgarh-Kota-Jhansi. Majority of travel patterns are already well established and the choice between using NH27 vs. NH48 and the Asset for east-west movements has been established over a number of years. However, for a small proportion of traffic on NH27 the route via the Asset is expected to become more attractive as the key feeders of the Asset improve. In Chapter 6, we have discussed how the completion of the Jaipur Ring Road, which is now operational, and Agra Ring Road improves the relative level of service on the Asset corridor and has a positive impact.

2.15 The Dausa-Lalsot corridor connects to the Asset between the two toll plazas. It acts as a feeder to the Asset. As For medium-distance trips between southern Rajasthan and east of Dausa, there is an alternate road that bypasses TP2 Rajadhok through the Tonk-Lalsot-Dausa connection. As of 2021, this corridor is operational now with a positive impact of increasing traffic on Sikandra plaza of the Asset with a slight traffic dip on Rajadhok plaza. Further details on this are discussed in Chapter 6 of the report.

---

[3] **https://www.ibef.org/states/rajasthan.aspx#:~:text=The%20state%20is%20the%20leading,million%20foreign%20tourists%20visited%20Rajasthan**., accessed on 13 April 2021

[4] **Rajasthan M Sand Policy 2020 Summary | Download PDF - RajRAS**

2.16 During our site visit to the Asset, no major micro-diversions through local roads were observed close to the toll plazas.

PCU factors considered for reporting

2.17 Please refer the PCU factors considered in the below table as per IRC64 1990. Based on the discussion with client, for reporting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5 as defined in IRC64 1990.Appendices on previous pages will have page numbers; Appendices on this and subsequent pages will not.

Table 2.3: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.82
OSV	4.5

Source: Steer analysis and IRC64,1990

3 Traffic description

Introduction

3.1 This chapter outlines the historical and current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic volume count (TVC) data. This includes data collected as a part of this study and previous studies of this Asset, as well as data provided by the Client.

3.2 Traffic data is generally collected and analysed to understand the volume and vehicle composition of traffic currently using the Asset, while OD data is used to obtain a better understanding of commodity movements, travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the asset as well as the commodities being moved by the goods vehicle. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trends

3.4 The following table presents the historical variation in traffic volume at the toll plazas, in terms of vehicle shares and total AADT. The data was provided for the period of April 2009 to March 2022. In case of Rajadhok plaza it was provided from September 2010.

3.5 In terms of vehicle composition, CJVs are biggest contributor on the Asset with a share of over 50% since FY16 except for a slight dip in FY21 due to COVID-19. These shares are higher at TP2 which is closer to urban centre Jaipur which generates heavy daily passenger trips. Also, 2A's and LCV's have dropping trend across the years with increasing bus traffic on the Asset. There has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag. Further, the high observed bus shares on the Asset is due to high exemptions reported than following trend under bus category.

3.6 As shown in the table below the CAGR at PCU level for TP1 total traffic was of 4.4% between FY12 and FY20 and 5.3% between FY16-18 due to the factors mentioned above. Even the highest CAGRs for the entire FY18 to FY22 period have been in the Bus and CJV categories with a positive growth.

Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Sikandra

Class	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	3,153	3,834	4,741	4,708	5,550	6,170	6,613	6,299	6,541	6,663	6,744	7,402	8,356
LCV	852	933	1,061	1,128	1,329	1,427	1,547	1,519	1,249	1,206	1,135	709	428
Bus	702	679	754	788	792	826	865	923	1,053	1,078	1,200	1,294	1,754

Class	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
2A	515	506	494	469	487	504	455	368	612	577	458	218	126
3A/ MAV	1,979	2,221	2,551	2,761	2,892	3,156	3,671	3,900	4,297	3,679	3,692	3,930	3,947
Total	**7,201**	**8,173**	**9,602**	**9,854**	**11,051**	**12,082**	**13,151**	**13,009**	**13,751**	**13,204**	**13,229**	**13,553**	**14,611**
PCU	**15,649**	**17,284**	**19,834**	**20,730**	**22,444**	**24,368**	**26,932**	**27,366**	**29,840**	**27,509**	**27,540**	**28,030**	**29,733**

Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

Table 3.2: Historical evolution in AADT by vehicle class at TP2 – Rajadhok

Class	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	3,454	4,462	4,912	5,340	6,218	7,213	8,205	8,375	8,921	8,641	8,691	8,982	9,686
LCV	814	1,082	1,085	1,103	1,190	1,267	1,335	1,388	1,293	1,190	1,086	663	416
Bus	749	807	795	828	853	877	917	984	1,127	1,122	1,173	1,106	1,433
2A	357	396	366	369	373	375	331	246	420	352	268	136	88
3A/ MAV	1,541	1,869	1,978	2,191	2,248	2,388	2,689	2,705	2,763	2,548	2,545	2,707	2,725
Total	**6,915**	**8,616**	**9,136**	**9,832**	**10,882**	**12,120**	**13,478**	**13,697**	**14,524**	**13,853**	**13,764**	**13,593**	**14,348**
PCU	**13,886**	**16,840**	**17,588**	**18,968**	**20,278**	**22,003**	**24,239**	**24,489**	**26,068**	**24,592**	**24,379**	**24,052**	**25,295**

Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

3.7 Share of MAVs on the Asset has been flat with around 20% of total traffic. TP1 of the Asset has high share of goods traffic as it provides direct connectivity to industries located in south of Rajasthan, Gujarat and U.P.

3.8 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Table 3.3 Historical evolution in YOY growth by vehicle class at TP1: Sikandra

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY18-22	CAGR FY16-22
CJV	7.2%	(4.7%)	3.8%	1.9%	1.2%	9.8%	12.9%	**(0.5%)**	**6.3%**	**4.0%**
LCV	8.4%	(1.8%)	(17.8%)	(3.4%)	(5.9%)	(37.5%)	(39.6%)	**(10.2%)**	**(23.5%)**	**(19.3%)**
Bus	4.7%	6.7%	14.0%	2.5%	11.3%	7.9%	35.5%	**10.3%**	**13.6%**	**12.5%**
2A	(9.7%)	(19.1%)	66.4%	(5.6%)	(20.7%)	(52.5%)	(42.0%)	**16.0%**	**(32.6%)**	**(19.2%)**
3A/MAV	16.3%	6.2%	10.2%	(14.4%)	0.4%	6.4%	0.4%	**8.2%**	**(2.1%)**	**1.2%**
Total	8.8%	(1.1%)	5.7%	(4.0%)	0.2%	2.4%	7.8%	**2.3%**	**1.5%**	**1.8%**
PCU	10.5%	1.6%	9.0%	(7.8%)	0.1%	1.8%	6.1%	**5.3%**	**(0.1%)**	**1.7%**

Source: Steer analysis of TMS data provided by client

Table 3.4 Historical evolution in YOY growth by vehicle class at TP2: Rajadhok

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY18-22	CAGR FY16-22
CJV	13.7%	2.1%	6.5%	(3.1%)	0.6%	3.3%	7.8%	**4.3%**	**2.1%**	**2.8%**

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY18-22	CAGR FY16-22
LCV	5.3%	4.0%	(6.8%)	(7.9%)	(8.8%)	(38.9%)	(37.3%)	**(1.6%)**	**(24.7%)**	**(17.7%)**
Bus	4.7%	7.2%	14.5%	(0.5%)	4.6%	(5.8%)	29.7%	**10.8%**	**6.2%**	**7.7%**
2A	(11.7%)	(25.9%)	70.9%	(16.3%)	(23.7%)	(49.4%)	(34.9%)	**12.6%**	**(32.3%)**	**(19.8%)**
3A/MAV	12.6%	0.6%	2.1%	(7.8%)	(0.1%)	6.3%	0.7%	**1.4%**	**(0.3%)**	**0.2%**
Total	11.2%	1.6%	6.0%	(4.6%)	(0.6%)	(1.2%)	5.6%	**3.8%**	**(0.3%)**	**1.0%**
PCU	10.2%	1.0%	6.4%	(5.7%)	(0.9%)	(1.3%)	5.2%	**3.7%**	**(0.7%)**	**0.7%**

Source: Steer analysis of TMS data provided by client

3.9 The slowdown between FY19 and FY20 was due to a combination of factors associated with-:

- Completion of large construction activities in the vicinity (Agra-Lucknow expressway) – negative traffic impact due to construction
- Construction activity on a key feeder route (Dausa-Lalsot) - traffic loss due to construction
- Construction of Jaipur ring road - negative traffic impact due to construction
- Revision in axle load norms and economic slowdown - observed over seven quarters starting FY19 up to Q3 FY20 resulting a negative impact on Asset's traffic

3.10 However, since FY21 traffic volumes have recovered especially in CJV category primarily because of opening of Dausa-Lalsot section and completion of DME (Delhi- Mumbai Expressway) spur. Traffic growth on TP2 Rajadhok plaza of this Asset has been stronger than TP1, primarily due to its proximity to Jaipur and is driven by the rapid car growth influenced by the urban characteristic of Jaipur. Resumption of sand mining activity in the region has also aided growth in the MAV category.

3.11 The CAGR for this Asset was comprised of a positive 4.2% PCU level during the FY12-20 period and averaged 0.3% during the FY16-20 period however between FY20-22 the Asset has recorded averaged positive of 2.9% PCU CAGR primarily driven by growth in CJV, Bus and MAV category, key reasons for the traffic growth profile is presented below.

- Starting in 2021, Dausa- Lalsot section is operational which has increased CJV and MAV traffic on Sikandra plaza of the Asset while resulted in slight traffic dip on Rajadhok plaza. The CJV traffic growth at Rajadhok plaza is because of the plaza providing direct connectivity to Kota/ Gujarat through NH148. Furthermore, with the preference for personal mobility post COVID-19 and the non-resumption of train network across the country has led to healthy growth of CJV traffic on the Asset.

- Goods vehicles at Rajadhok plaza have witnessed a 1.4% degrowth between FY16-20 primarily because of the sand mining ban in the state. Whereas, Sikandra plaza has seen 0.1% of MAV growth between FY16-20 with positive impact of Dausa -Lalsot section getting completed. Overall, MAV volume on the Asset has increased by 3% between FY20 -22 with the lifting of sandmining ban in Nov 2021 along with positive construction impact. MAVs continue to exhibit positive growth trend in FY22 as well, in spite of COVID-19 related disruptions in FY21 and FY22 due to increased pent-up demand and long-term effects of growth drivers.

3.12 Historically, buses on the Asset have seen a healthy growth with positive CAGR of over 5% between FY12 -20 and FY16-20 with a further increased CAGR from FY20-22. However, this growth is even higher at Sikandra plaza being closer to urban city. Additionally, in the last five

years the volume of buses on the Asset is higher than LCV and 2A. This is because of high reporting of buses under "ETC punch ticket" category which applies the toll rates of single ticket.

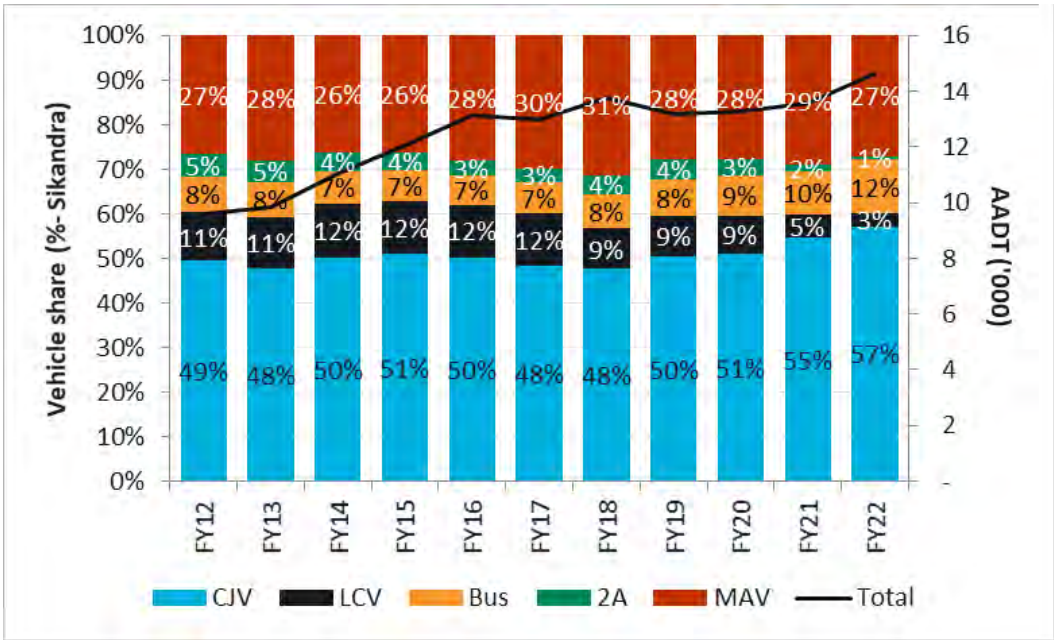
3.13 The LCV- 2A category has historically been affected by classification issues because of similar size and look of the vehicle. Additionally, there has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag.

3.14 2A's on this Asset have witnessed a drastic declining trend where the overall drop in 2A category is of the order of 40%. This is because of the classification issues between Bus and 2A which occurred because of the introduction of FASTag.

3.15 Overall, the Asset saw steady and healthy growth from FY12 to FY18 but decline in growth in FY19 and FY20. The underlying growth trends between FY12 and FY18 combined with the strong recovery observed in FY21, which was a pandemic influenced year, shows the underlying strength of traffic growth drivers that influence this Asset.

3.16 The impact of these past trends on the future outlook of traffic growth have been discussed in further detail in Chapter 5. The figure below presents the vehicle shares as they have evolved from FY12 upto FY22.

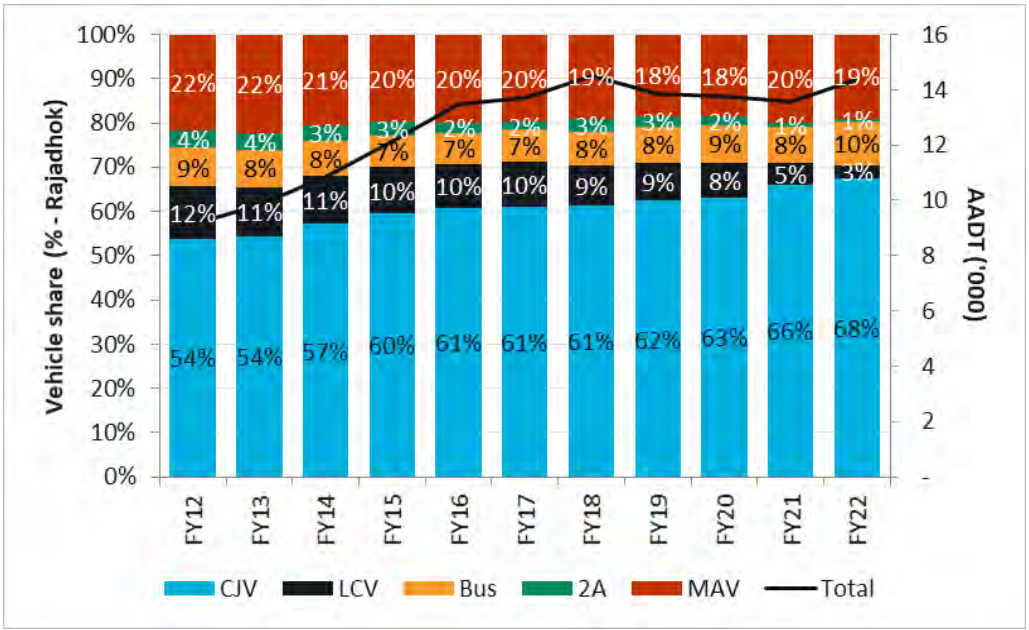
Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1 Sikandra



Source: Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

3.17 The vehicle distribution has broadly remained consistent over the years, with proportion of Cars increasing recently specially on TP2 of the Asset. This could be due to proximity of TP2 to Jaipur which drives rapid car growth on the Asset plaza. Other possible reasons include recent completion and operation of Dausa-Lalsot section feeding traffic of Rajasthan and south, Section completion of Delhi-Mumbai expressway and Jaipur-Ring Road section.

Figure 3.2: Historical evolution in vehicle shares and reported AADT for TP2 Rajadhok



Source: Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

3.18 The table below presents the reported historical revenue of the Asset.

Table 3.5: Historical revenue evolution by class (in INR crores):

	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
JMTL	117.34	142.61	137.17	143.55	142.91	169.26

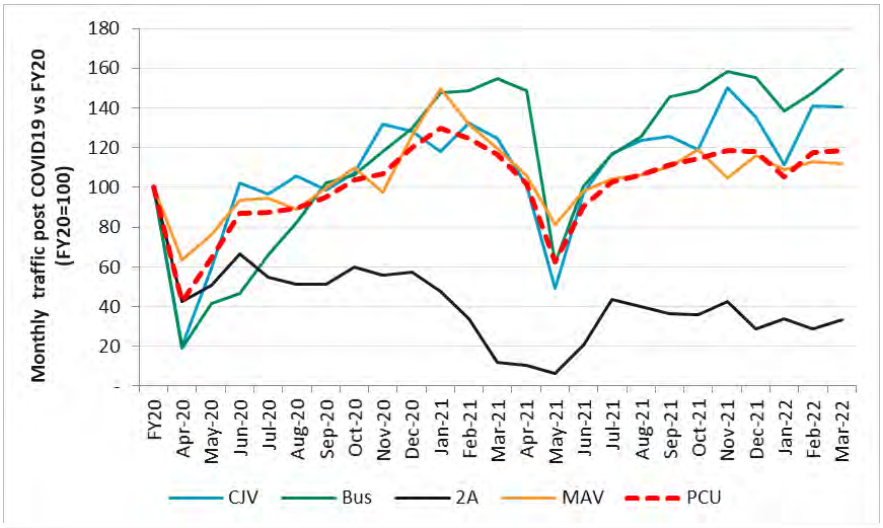
Source: Steer analysis of the Client data

3.19 The Asset has registered a robust revenue CAGR over the years with FY22 registering higher revenue growth over FY21 and FY20, this can be attributed to traffic volumes increasing due to several network improvements and post pandemic recovery. Further an increase in overloading revenue has added to the higher revenue receipts in FY22. It was informed by the client that overloading is now being charged in both directions as new equipment has been installed, which was not the case in earlier years.

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.20 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March 2020 – 19th April 2020. 2nd wave of COVID-19 resulted in regional lockdowns in Q1 and Q2 FY22, while the 3rd wave of COVID-19 impacted traffic volumes in Q4 of FY22. The evolution of traffic FY20 onwards is presented in the figure below:

Figure 3.3 Month on Month traffic recovery vs FY20



Source: Steer analysis of the Client data

3.21 As we can see from the figure above, by Q3FY21 the Asset reached the FY20 PCU levels, these high levels were sustained in Q4FY21 as well, with the full FY21 being impacted by COVID-19 related restrictions in Q1FY21. The impact of 2nd wave of COVID-19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to goods traffic. From the above graph we can see 2A and MAV traffic have witnessed a lower degrowth as compared to other modes due. However, post second wave of COVID-19 MAVs have seen a growth due to ease of sand mining ban on the Asset.

3.22 Compared to FY20 levels, buses reported on this Asset are higher than 2A and LCV. This is specially in the September month of FY22 where Rajasthan government issued letter regarding REET (a state level student's engineering exam) asking toll operators to exempt bus traffic on some dates of the month affecting the overall monthly average. Additionally, there are high buses reported than historical trend under "ETC tag ticket" category in FY22 which is another reason for high bus volume trend as shown in Figure 3.3.

Toll Frequencies

3.23 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.24 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. The same can be verified from OD data analysis where the average trip length of CJV's is short to medium distance within 300kms at all plazas of the Asset. Rajadhok plaza being closer to Jaipur city has higher share short length trips less than 65kms. Also, around 70% of CJV trips plying on the plaza have one of their trip-end locally. For MAV, single is the highest ticket issued category which is justified by the trip length where at

all plazas of the Asset more than 50% of MAV trips are over 500kms moving towards Gujarat, Central and North India. This is also verified by internal-external analysis where around 40% MAV trips have one of their ends outside the Asset state. Post FASTag implementation local passes like monthly, through in and through out got discontinued on the Asset which is another possible behind increasing shares Single ticket for each vehicle category.

3.25 However, this varies from asset to asset or even toll plaza to toll plaza. The Asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the Asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.26 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.6: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Local Personal	Discounted single entry pass only for private cars of residents within 10km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.27 In addition to the above ticket categories, a special category pass of "Monthly" is also being sold on Rajadhok plaza the Asset for CJV and LCV vehicle category. Under this, the user is charged 1/3rd the fee of Single ticket applicable on the plaza for 50 allowed trips.

3.28 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

FASTag implementation

3.29 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.7: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.30 FY21 had multiple disruptions in traffic patterns related to the pandemic. There was also significant change in ticket segmentation observed across several toll roads around the country due to the imposition of mandatory use of FASTag, the electronic toll payment mechanism mandated by NHAI. This resulted in shares of users paying by FASTag jump significantly across all vehicle categories. To encourage that nearly all toll plaza users shift to FASTag, there was also a penalty for cash payers introduced. The final deadline for mandatory use of FASTag was set for 15th February 2021 which has had the desired impact of over 95% of toll revenue collection now being collected through FASTag across the NHAI toll plazas. This has also increased the operational efficiency of toll plazas significantly as well as improved the traffic and revenue reporting standards due to limited use of cash through manual means at toll plazas.

3.31 As discussed earlier, FY20-21 saw an increased use of FASTag. The increase FASTag ensured efficient tolling operations as well as increased compliance. Moreover, with better management due to FASTag the combined share of exemption and violations reported under CJV category as shown in section below have decreased by 3-6% in FY22 in comparison to FY19. By March 2022, FASTag penetration increased significantly across various vehicle types. The table below presents the reported percentage of transactions via FASTag as of Mar'22.

Table 3.8: %age of traffic via FASTag, Mar 2022

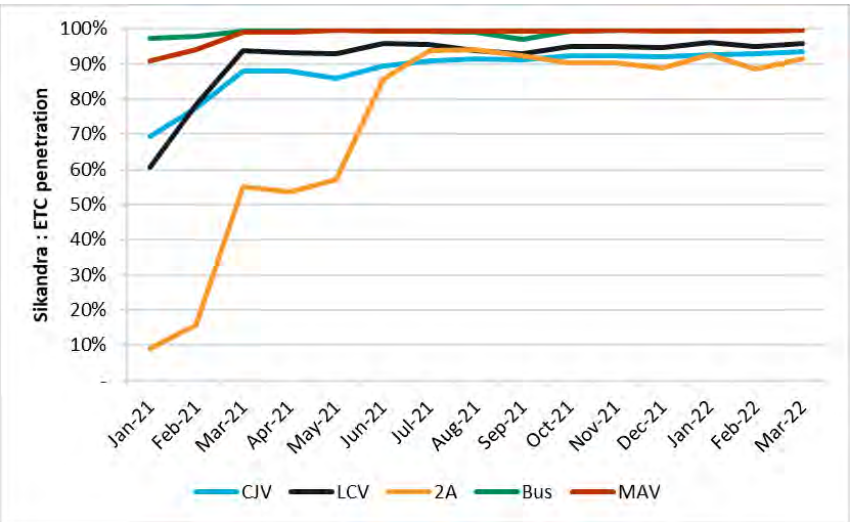
Toll Plaza	CJV	LCV	2A	Bus	MAV
Sikandra toll plaza	94%	96%	91%	100%	94%
Rajadhok toll plaza	94%	92%	86%	100%	94%

Source: Steer Analysis

3.32 As we can see from the table above most of the categories of vehicle types across the toll plaza are reporting more than 90% FASTag penetration, with 2A's also reporting more than 80% proportions at Rajadhok plaza of the Asset. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time.

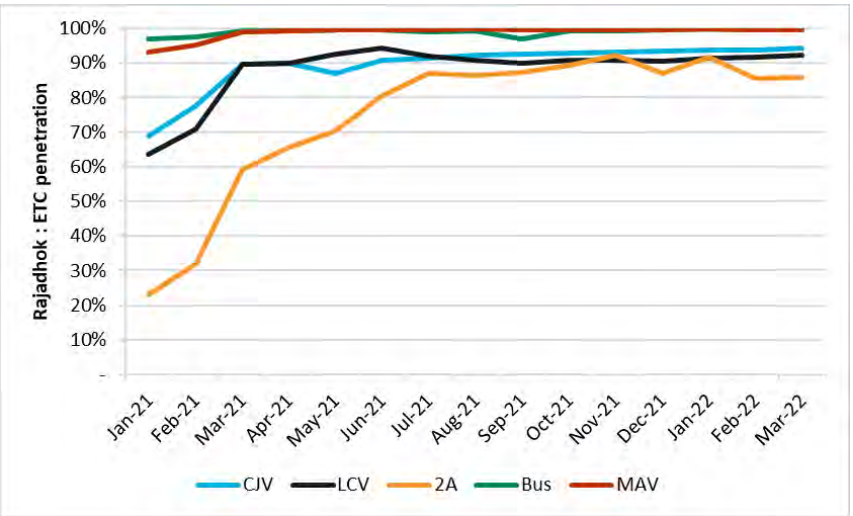
3.33 The figure below illustrates the evolution of the percentage of traffic via FASTag at all the plazas.

Figure 3.4 FASTag penetration: Sikandra toll plaza



Source: Steer analysis of the Client data

Figure 3.5 FASTag penetration: Rajadhok oll plaza



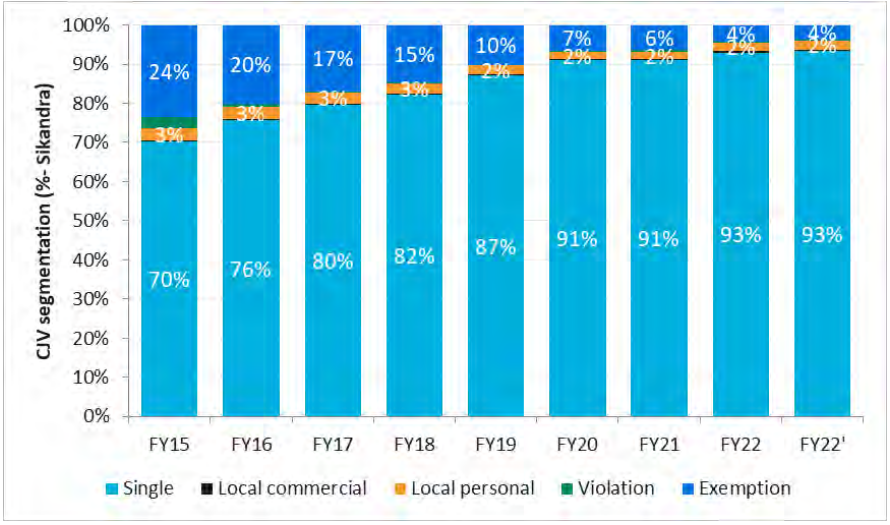
Source: Steer analysis of the Client data

3.34 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in ETC penetration, it was observed that traffic patterns have begun to return to their normal segmentation.

Share of traffic by payment type

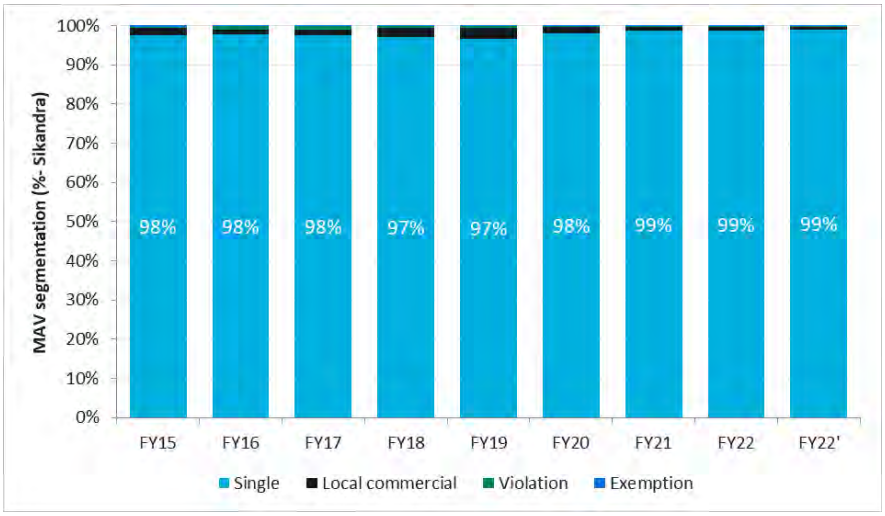
3.35 The following figures provide the toll segmentation for the historical years at TP1 Sikandra and TP2 Rajadhok for CJV and MAV while the table provides the same for the remaining vehicle types.

Figure 3.6 Ticket-segmentation for CJV at TP1 Sikandra



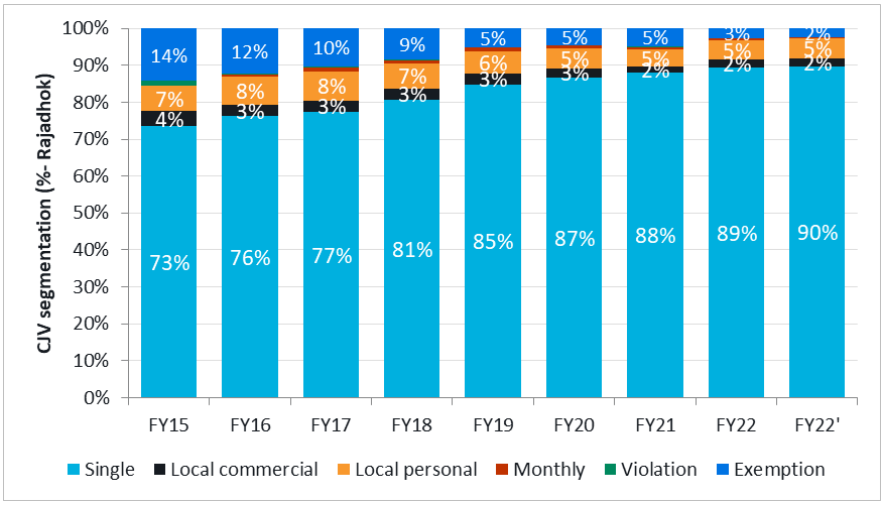
Source: Steer analysis of the Client data ** FY22 is the annual level segmentation*
**FY22' is the averaged Oct-Mar segmentation*

Figure 3.7 Ticket-segmentation for MAV at TP1 Sikandra



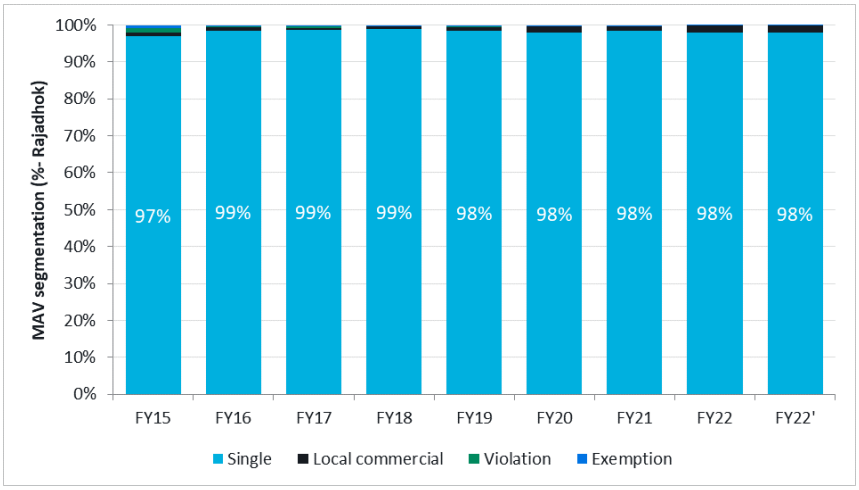
Source: Steer analysis of the Client data ** FY22 is the annual level segmentation*
**FY22' is the averaged Oct-Mar segmentation*

Figure 3.8 Ticket-segmentation for CJV at TP2 Rajadhok



Source: Steer analysis of the Client data ** FY22 is the annual level segmentation*
**FY22' is the averaged Oct-Mar segmentation*

Figure 3.9: Ticket-segmentation for MAV at TP2 Rajadhok



Source: Steer analysis of the Client data ** FY22 is the annual level segmentation*
**FY22' is the averaged Oct-Mar segmentation*

3.36 As can be seen in the following figure and table below, in FY22 at TP1 the share of single tickets is over 90% for CJV's whereas for TP2 it is 1% lower making "Single" as the major ticket category issued on the Asset plaza for CJV. The Asset does not have return ticket, explaining the very high proportion of single tickets in the toll segmentation. Also, the CJVs plying on the Asset are doing short-medium distanced movement within 300kms also in the OD below. Major share of these CJV trips originate outside 10kms of the Asset making them non-valid for a discounted local pass. This is in line with the Asset being a major tourist driven corridor fetching passenger from other surrounding regions.

3.37 Most MAVs at both TP1 and TP2 are observed to have high shares of single tickets with the share of MAVs buying single tickets, reaching as high as 99% at TP1 and 98% at TP2 (below figures) in FY22. This reflects the long-distance and through nature of heavy truck movement on the Asset. The high share of single ticket type is due to other tickets such as return and monthly being not available as per the toll notification. A small and gradually decreasing proportion buys local commercial with upto 5% of used buying the local commercial pass. As expected, there is a negligible share of violations for MAVs.

3.38 From above figures it is observed that for CJVs and MAVs there has been a steady decline in the number of exemptions reported on the Asset starting FY16, however the exemptions have stabilised in FY20 and FY21 to 7% levels at TP1 and 6% levels at TP2. However, the level of exemptions on the Asset have dropped by 2% in FY22. This is also due to increasing ETC penetration on the Asset and reduction in the local passes issued by the operators.

3.39 Similar to other NHAI assets, this Asset also saw a significant shifts in ticket segmentation due to FASTag implementation and increase uptake mentioned above. Therefore, for FY22' representation in the figure below we assumed Oct-Mar averaged segmentation. This is because Oct-Mar months followed similar traffic trends with FY20 and FY21 being not normal years because of COVID-19. The ticket segmentation of other vehicle types is presented in the table below.

Table 3.9: Historical ticket segmentation at TP1 Sikandra

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
LCV									
Single	85%	87%	87%	84%	87%	90%	95%	94%	94%
Local commercial	10%	8%	8%	8%	7%	5%	2%	2%	2%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	1%
Exemption	5%	5%	5%	7%	7%	5%	3%	3%	3%
Bus									
Single	97%	97%	97%	98%	98%	99%	99%	99%	99%
Local commercial	2%	2%	2%	1%	1%	1%	0%	0%	0%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exemption	1%	0%	1%	1%	1%	0%	1%	0%	0%

Source: Steer analysis of the Client data **FY22' is the averaged Oct-Mar segmentation*

Table 3.10: Historical ticket segmentation at TP2 Rajadhok

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
LCV									
Single	78%	80%	80%	80%	81%	83%	87%	78%	76%
Local commercial	18%	16%	16%	16%	15%	13%	8%	16%	17%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Monthly	0%	1%	2%	2%	3%	3%	2%	4%	5%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exemption	3%	3%	2%	2%	1%	1%	3%	2%	2%
Bus									
Single	93%	93%	93%	95%	95%	96%	97%	97%	97%
Local commercial	6%	6%	6%	4%	4%	4%	2%	2%	3%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exemption	1%	0%	0%	0%	0%	0%	1%	0%	0%

Source: Steer analysis of the Client data **FY22' is the averaged Oct-Mar segmentation*

Overloading

3.40 The Asset being a part of NHAI concession follows the NHAI Overloading policy released in 2016 which bans the overloading of commercial vehicle on any NHAI toll plaza. In case of non-compliance, overloaded vehicles on the Asset are charged twice the toll fee they would otherwise pay for a Single ticket at the toll plaza. The plaza currently charges overloading under single and local commercial category. These shares are determined using the total single journey traffic and total local commercial traffic. The table shows the share of overloaded vehicles paying twice the Single journey toll fee on each toll plaza for FY19 andFY20. Also, it shows the averaged October- March overloading share for FY22. The significant increased levels of overloading shares shown in below table in FY22 relative to FY20-19 levels is because of two reasons, firstly of the bidirectional overloading charge on the Asset which until FY21 was unidirectional. Secondly, lifting of the sandmining ban in FY22 in accordance with the Supreme court which has increased the share of overloading carrying vehicles on the Asset.

Table 3.8: Overloading shares for FY19, FY20 and FY22

Vehicle type	TP1 Sikandra			TP2 Rajadhok		
Single Overloading shares						
	FY19	**FY20**	**FY22***	**FY19**	**FY20**	**FY22***
LCV	-	1.6%	5.9%	0.5%	2.0%	4.7%
2A	-	2.9%	16.8%	0.4%	1.8%	20.8%
MAV	-	4.5%	7.3%	0.7%	2.8%	6.7%
Local Commercial Overloading shares						
LCV	-	-	2.4%	-	-	-
2A	-	-	4.3%	-	-	0.5%

Vehicle type	TP1 Sikandra			TP2 Rajadhok		
MAV	-	-	2.4%	-	-	4.6%

Source: Steer review of Client TMS data , FY22* is averaged share of October- March months.

Data collection and validation

Overview

3.41 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.9: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	**End date**	**Time (hrs)**	**Start date**	**State time**
TP1 Sikandra	27 Jan 2021	02 Feb 2021	0000-2359	04 July 2019	0900 hours
TP2 Rajadhok	27 Jan 2021	02 Feb 2021	0000-2359	05 July 2019	0900 hours

Source: Steer analysis

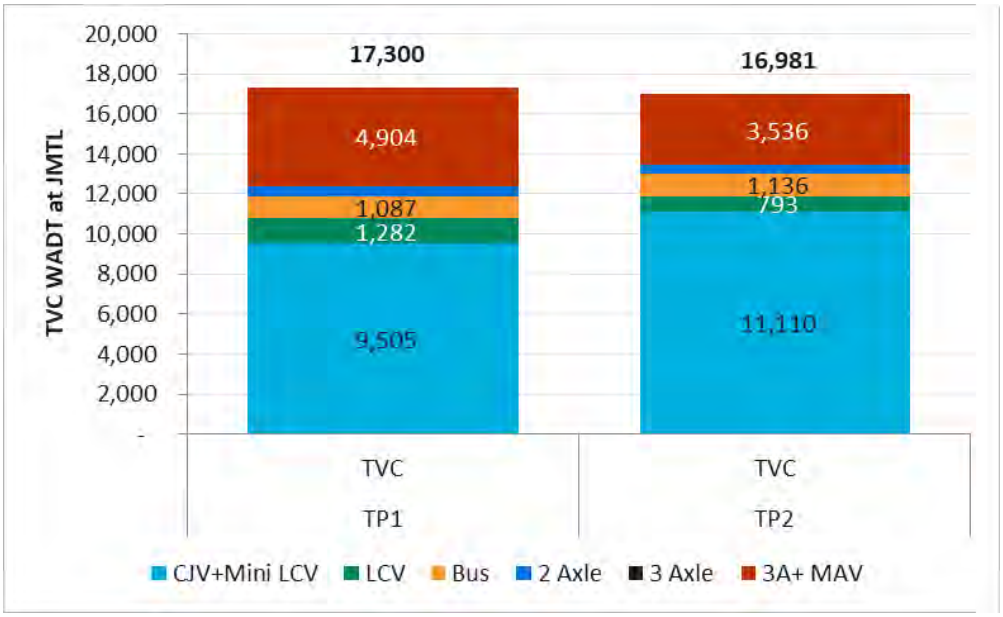
3.42 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.43 Taking an average of the seven-day TVC counts (27th Jan – 2nd Feb 2021, 0000-2359 hours), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-toll able vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Figure 3.10 WADT at TP1 and TP2



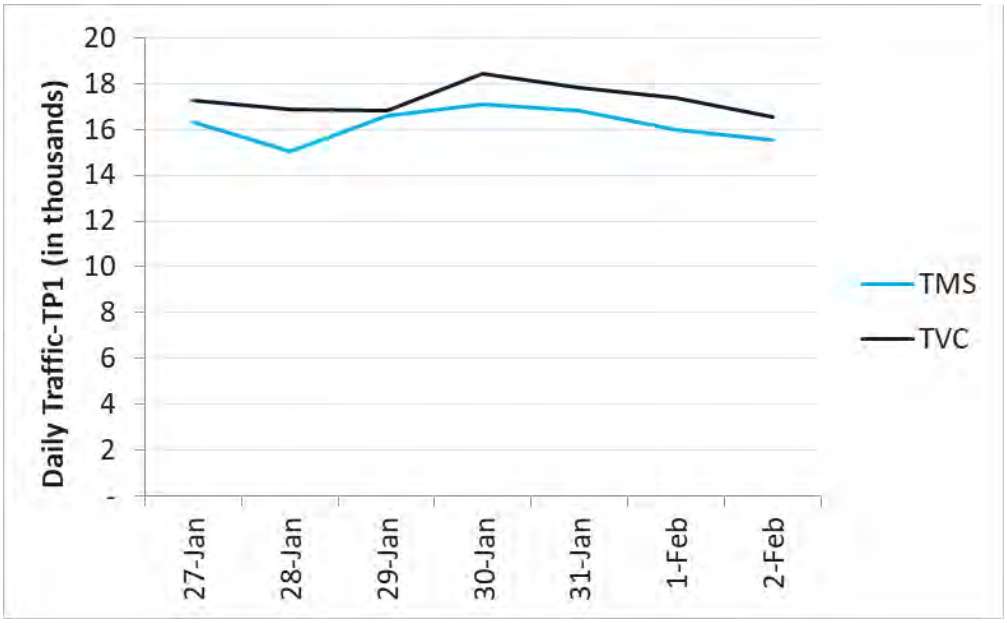
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.44 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those particular days, as provided by the Client.

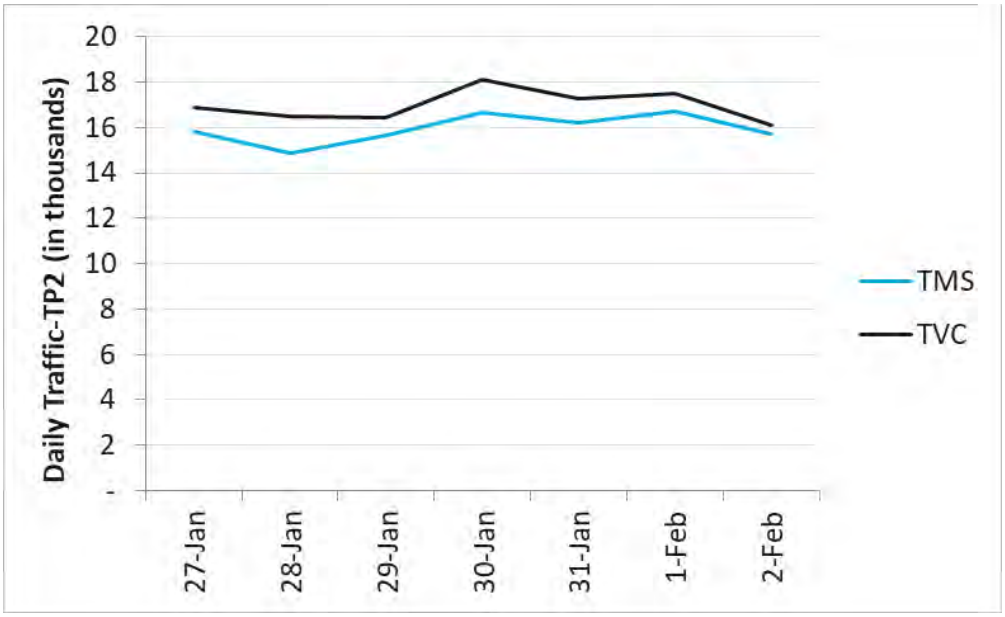
3.45 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas. As shown in the figures below, the TVC and TMS overall are within the acceptable range of variation. The vehicle category which is causing this variation is CJV which is attributable to a small proportion of local users who are not being captured by the TMS.

Figure 3.11 Comparison between TVC and TMS daily traffic data on TP1 Sikandra



Source: Steer analysis of TVC and Client TMS data

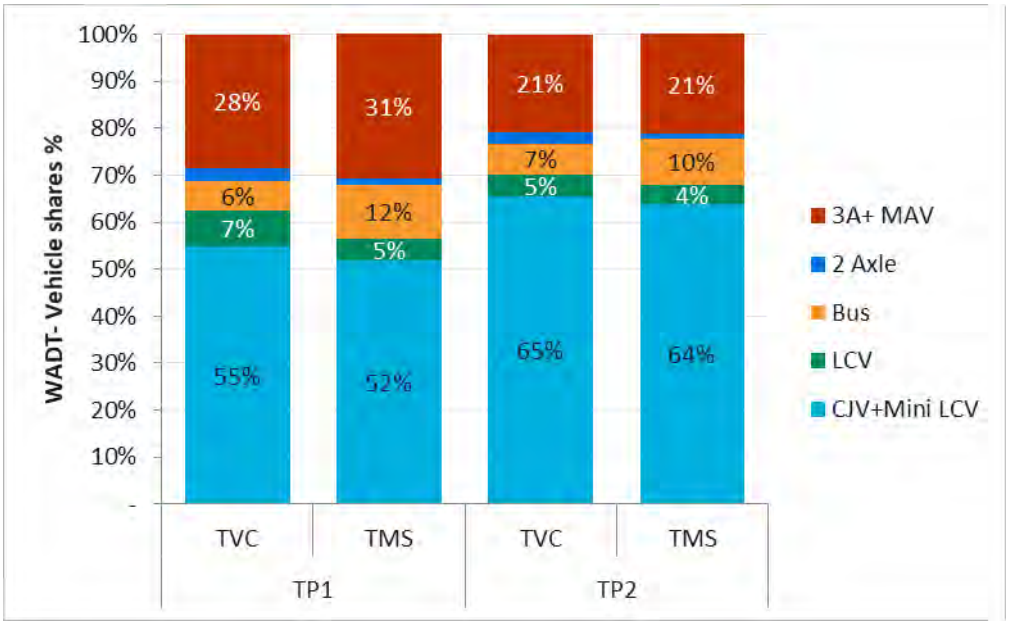
Figure 3.12: Comparison between TVC and TMS daily traffic data on TP2 Rajadhok



Source: Steer analysis of TVC and Client TMS data

3.46 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. However, this difference varies across different vehicle categories. As can be seen, whilst the share of CJVs is higher for TVC compared to TMS, it is vice-versa for other vehicle categories. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.47 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.48 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in July 2019. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred during this period.

3.49 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.50 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported on this Asset. Trip length distribution shows 'how far' vehicles and people travel, and goods get transported. This set of analysis is used to estimate key drivers of traffic and aid in making informed forecasting assumptions related to traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.51 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TMS data) during the same period. Table 3.10 below presents the sample rates for key vehicle type aggregations at both toll plazas. We believe that the sample rates of the OD data are reasonable for the analysis required and that the high sample rate for goods traffic at TP1 could be due to Mini LCV-CJV related difference in classification in the TMS data.

Table 3.10: Sample rates for OD data

Vehicle Category	TP1	TP2
Car	38%	71%
Bus	71%	80%
LCV	59%	41%
2A Truck	132%	82%
MAV	88%	37%
Total	56%	59%

Source: Steer analysis of OD data

Zone categories

3.52 To facilitate better understanding of key regional traffic drivers as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset,

we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.11: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Rajasthan	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Uttar Pradesh	Uttar Pradesh (including Agra, Mathura)
Rest of North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central NCR	Delhi State, including New Delhi
Gujarat & Maharashtra	Gujarat and Maharashtra (including Mumbai)
Central India	Madhya Pradesh, Chhattisgarh
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states
Outside India	Nepal, Bhutan, Bangladesh
Local	Local zones are those that fall on or very close to the Asset.

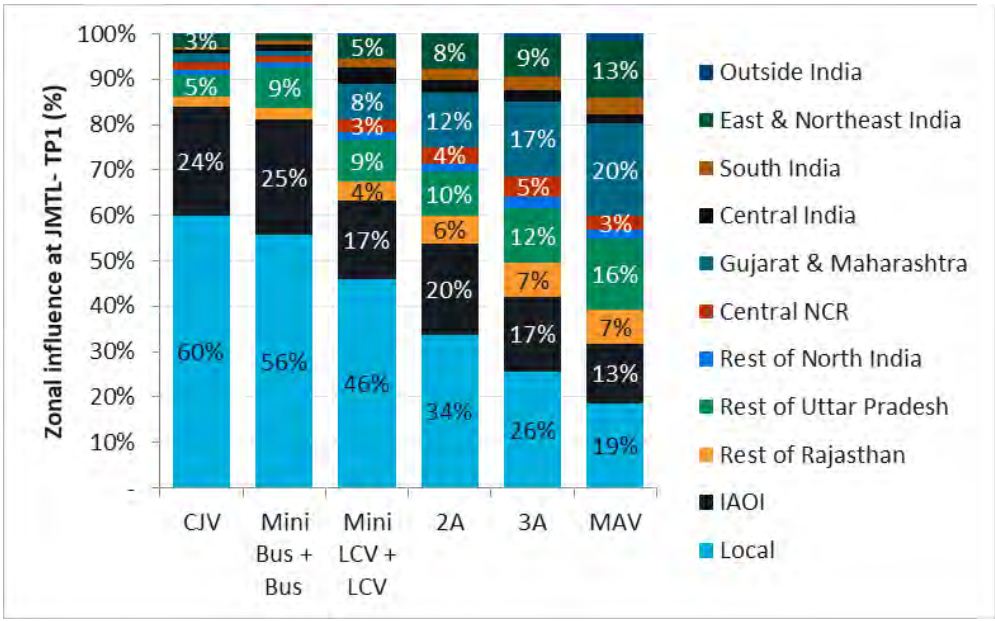
Zonal influence

3.53 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed based on trip ends and not trips.

3.54 From the figures below, it can be seen that the local category (trip ends lying on the Asset) has one of the highest shares across vehicle types. TP2 Rajadhok has a higher share of local trips with 43% for MAV to 79% for CJV, whereas TP1 Sikandra has only 19% local MAV trips and 60% local CJV trips. TP2 is closer to Jaipur and hence the toll plaza is surrounded by an area of high urban population density, resulting in a higher local influence at the plaza.

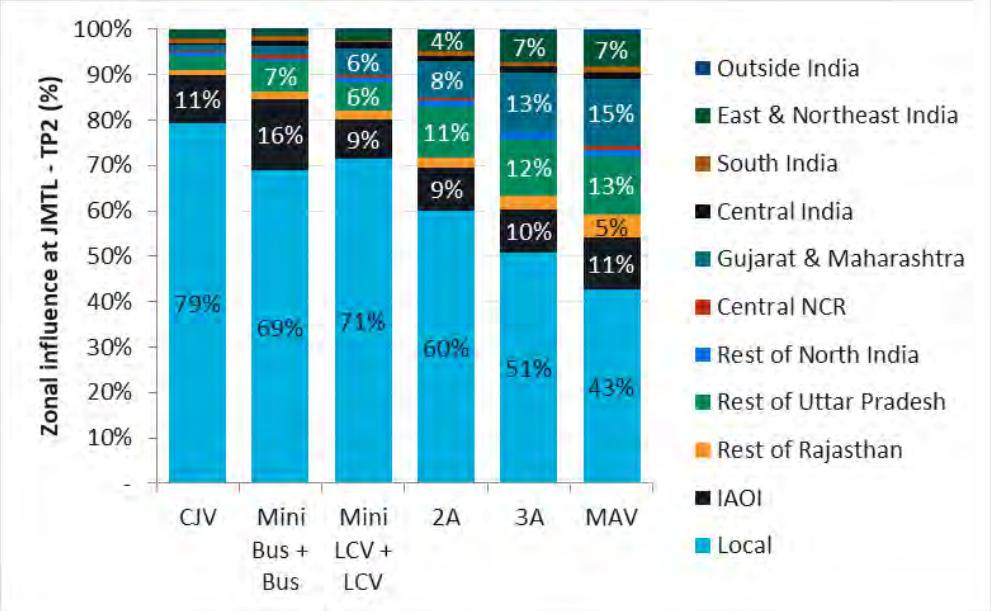
3.55 High zonal influence from Gujarat and Uttar Pradesh is observed in 2A, 3A and MAVs. TP1 and TP2 have 16% and 13% trips to or from UP and 20% and 15% to or from Gujarat for their MAVs.

Figure 3.14 Zonal influence at TP1 Sikandra



Source: Steer analysis of OD data

Figure 3.15 Zonal influence at TP2 Rajadhok



Source: Steer analysis of OD data

Internal External analysis

3.56 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e. local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

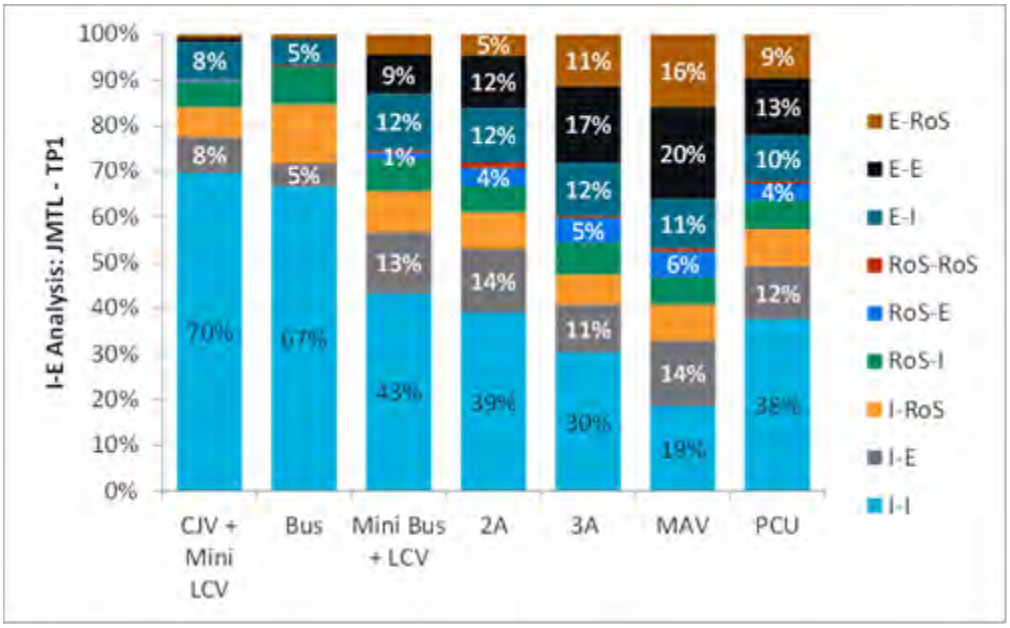
3.57 The figures below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

3.58 We see that TP1 has about 20% of E-E trips for MAVs, whereas TP2 has only about 10% E-E trips for MAVs. As discussed earlier in Chapter 2, this is partly due to TP1 having a higher share of long-distance traffic that joins the Asset through Dausa. These are strategic movements moving between western and eastern regions in the immediate vicinity of the corridor, e.g. North Gujarat-Wester Uttar Pradesh, and therefore prefer using the Asset due to the connectivity it offers to these regions.

3.59 As expected, CJVs and Bus show insignificant external (E-E) trips and more trips in the I-E, E-I and I-I mix which represents a higher share of captive traffic on the Asset. LCV and 2A have a good mix of trips representing all four cases with TP1 still showing a higher share of E-E trips at 12% for 2As while TP2 shows higher share of I-I trips. Movement from local to external or vice versa (I-E and E-I) is similar for both TPs for commercial trucks (2A, 3A and MAVs).

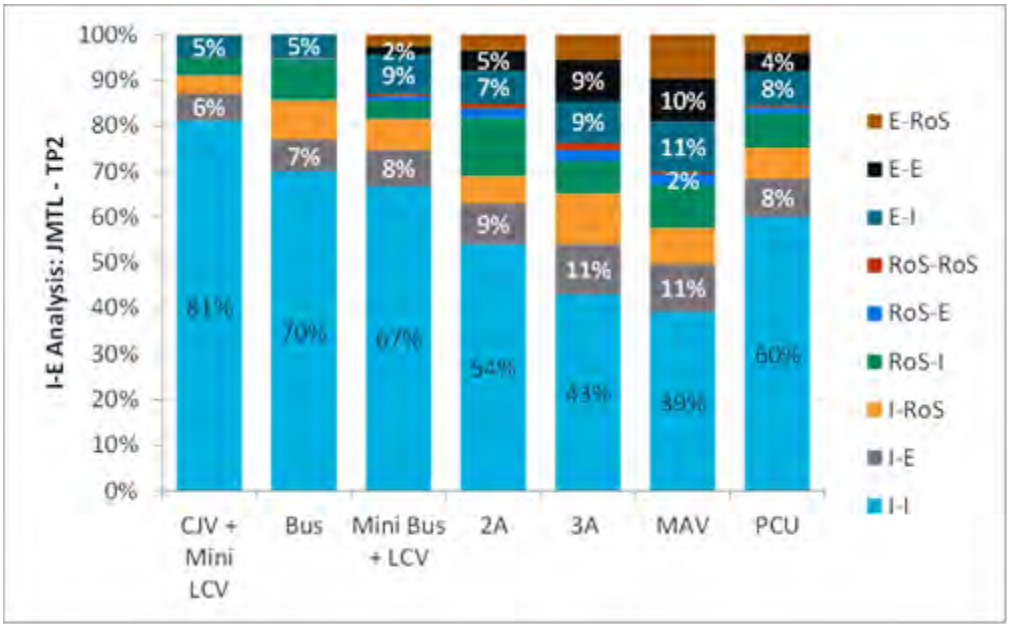
3.60 Overall, at a PCU level this analysis shows that the share of E-E trips is less than 10% (averaged across both toll plazas) which is consistent with commodity analysis and confirms that the key growth driver are local economic centres of Jaipur, Agra, Bharatpur, Alwar as well as regional feeders of Dausa-Lalsot. This also confirm that a vast majority of the traffic is 'sticky' to the Asset.

Figure 3.16 Internal-external distribution at TP1 Sikandra



Source: Steer analysis of OD data

Figure 3.17 Internal-external distribution at TP2 Rajadhok



Source: Steer analysis of OD data

3.61 Furthermore, in Chapter 6 we present the impacts analysis which gives an estimation of captive traffic. The non-captive traffic is a minority share, with the impacts being insignificant for all but the impact of Deli-Mumbai expressway on TP2 Rajadhok.

Commodity distribution

3.62 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.12: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	

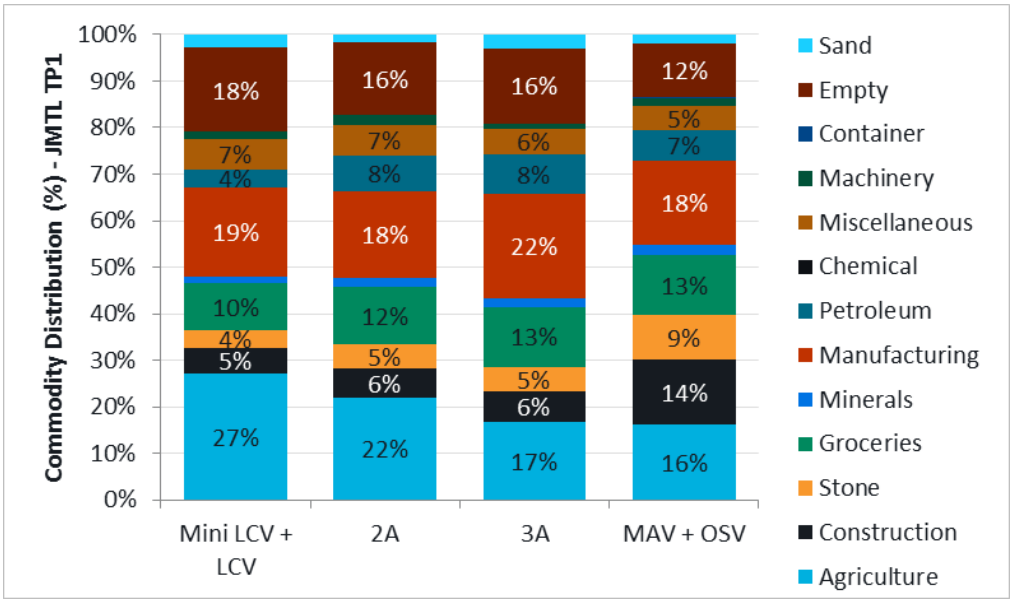
Commodity Description	Code	Combined codes used for charts
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

3.63 The following figures present the commodity distribution for goods vehicles at the two toll plazas, at the total level as well as split by direction, towards Jaipur and Agra. As observed during our site visit, the figures below indicate that agricultural products make up about 30% of commodity share across the two toll plazas. 3A+MAVs also carry a significant share of a variety of manufactured goods between Udaipur and Gujarat at one end and Uttar Pradesh, Bihar and the rest of eastern India at the other end. Stone has 9% and 13% share respectively at TP1 and TP2, which includes marble being transported from Rajasthan and Gujarat towards Uttar Pradesh, Bihar, Odisha etc. Agricultural produce is mostly transported within the state of Rajasthan and manufactured products have Rajasthan, Uttar Pradesh and Delhi NCR as the top origins or destinations.

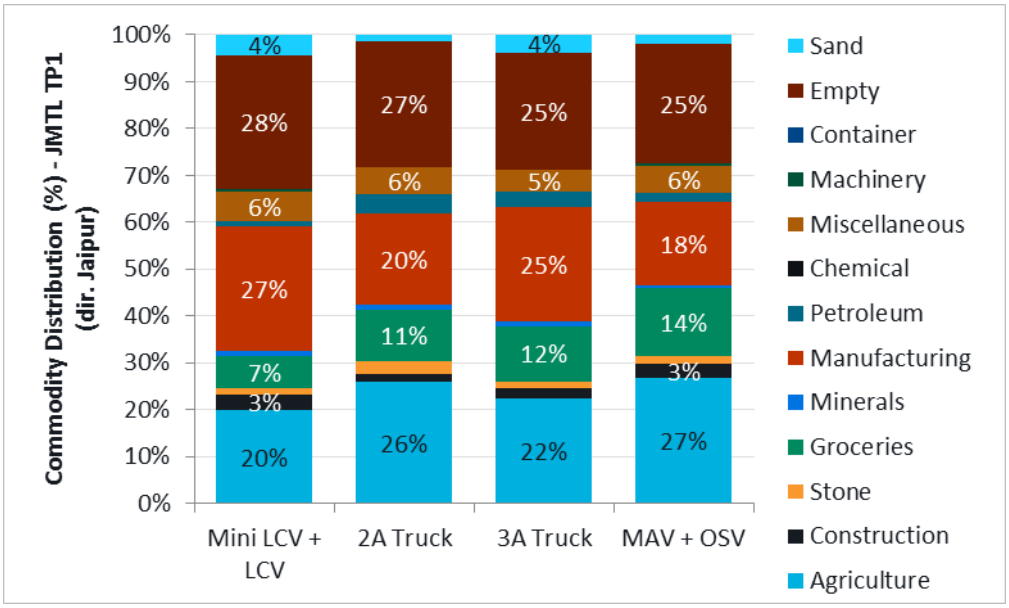
3.64 Looking by direction, a greater share of vehicles also travels empty towards Jaipur, than those travelling in the opposite direction towards Agra. Also, agricultural products make up a significant commodity shares for vehicles travelling towards Jaipur, then those travelling towards Agra. However, other commodity groups hold a greater commodity share in the direction towards Agra as compared to Jaipur, including stone, construction and petroleum products. The above is true for both TP1 and TP2.

Figure 3.18 Commodity distribution at TP1 Sikandra (Both directions)



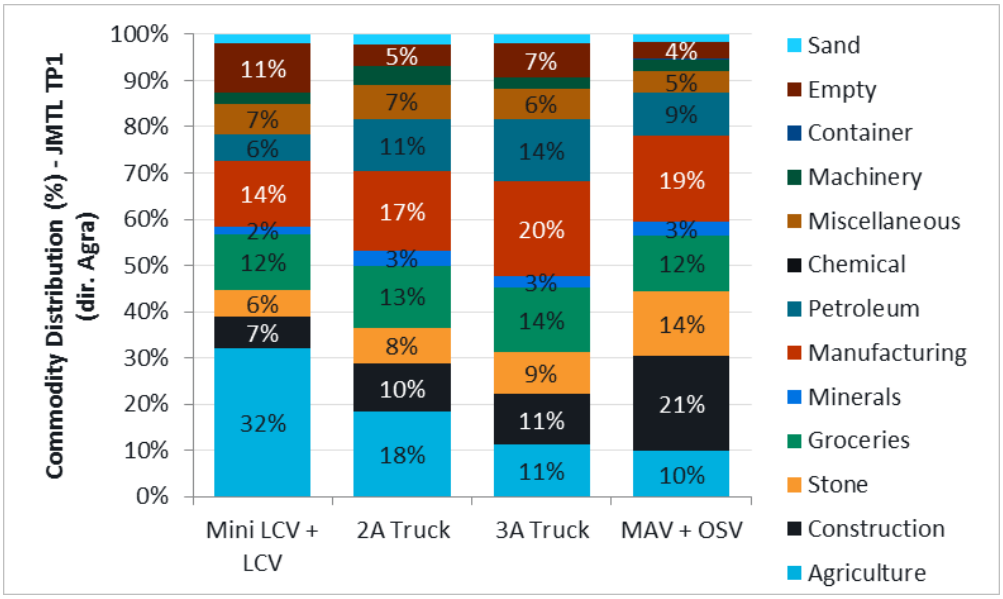
Source: Steer analysis of OD data

Figure 3.19 Commodity distribution at TP1 Sikandra (towards Jaipur)



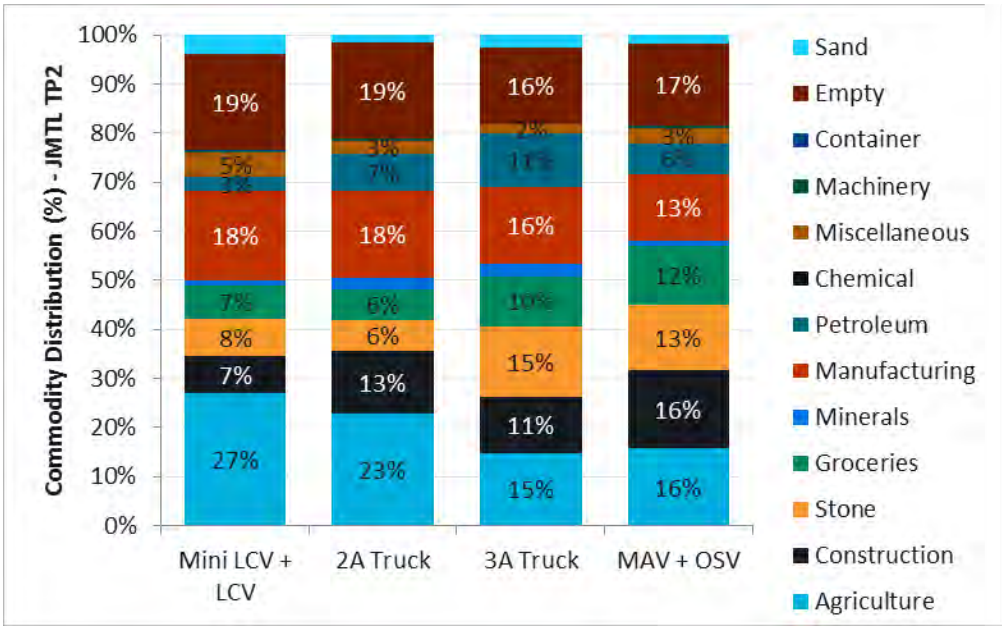
Source: Steer analysis of OD data

Figure 3.20 Commodity distribution at TP1 Sikandra (towards Agra)



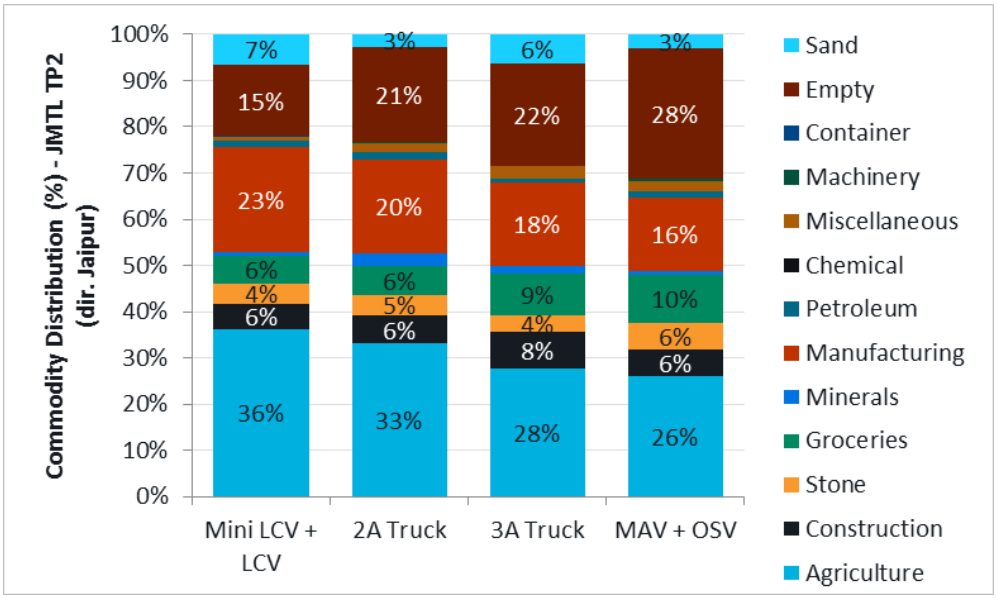
Source: Steer analysis of OD data

Figure 3.21 Commodity distribution at TP2 Rajadhok (Both directions)



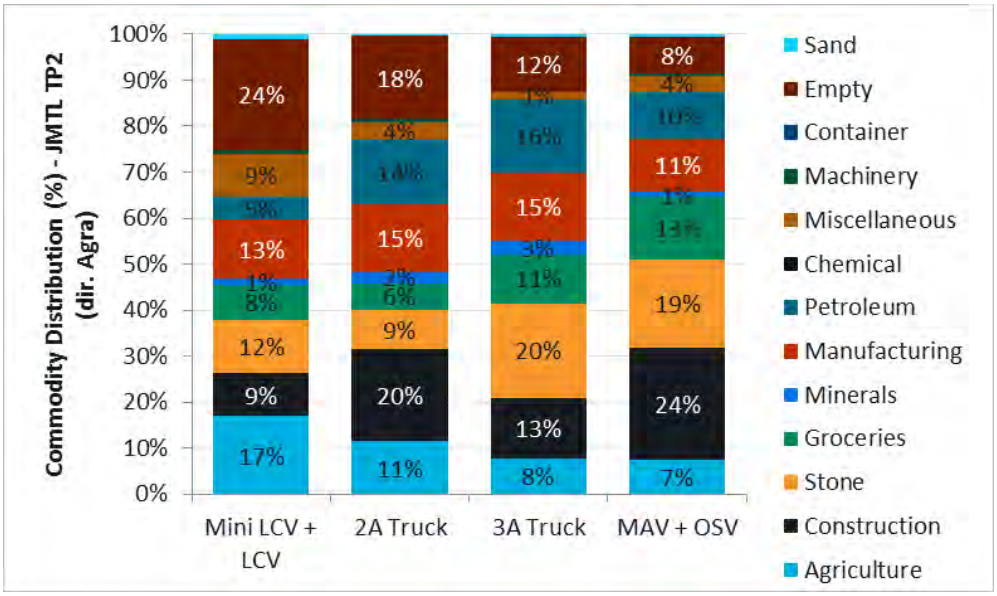
Source: Steer analysis of OD data

Figure 3.22 Commodity distribution at TP2 Rajadhok (towards Jaipur)



Source: Steer analysis of OD data

Figure 3.23 Commodity distribution at TP2 Rajadhok (towards Agra)



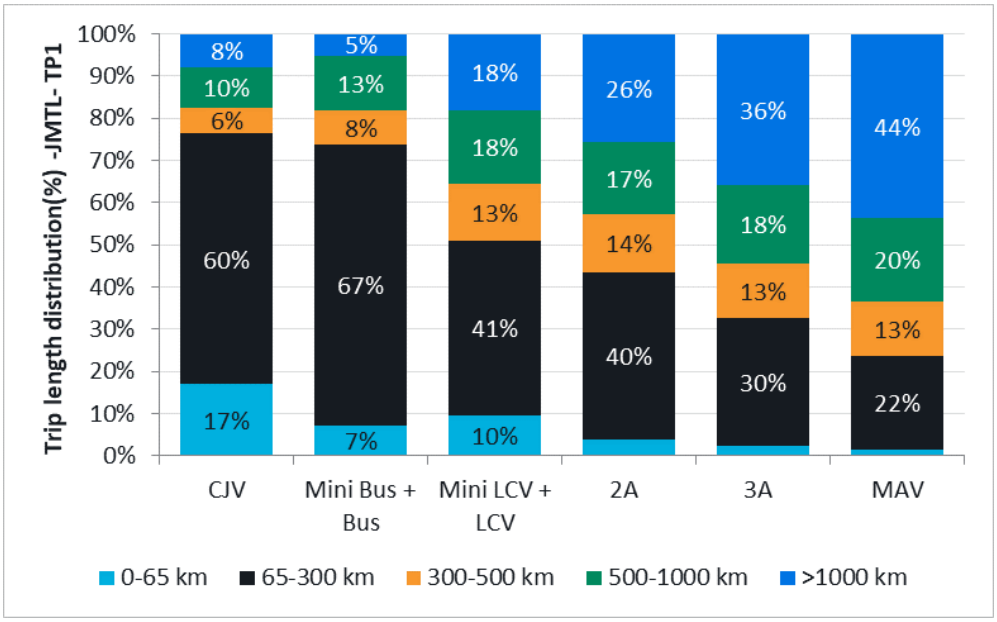
Source: Steer analysis of OD data

Trip length analysis

3.65 Trip-length distribution provides the distance-based profile of various vehicle categories. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

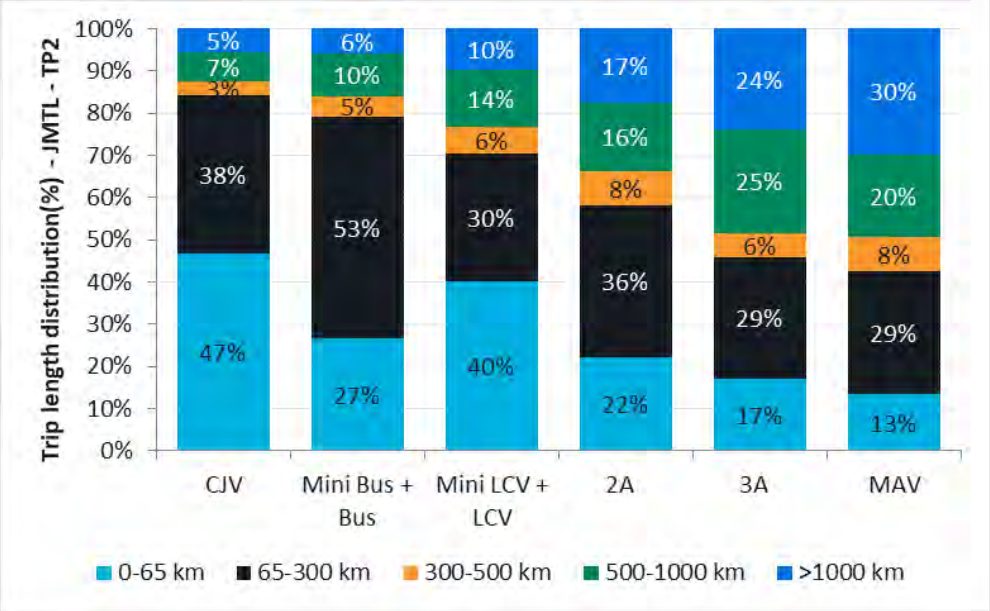
distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[5]

Figure 3.24 Trip length distribution TP1 Sikandra



Source: Steer analysis of OD data

Figure 3.25 Trip length distribution TP2 Rajadhok



Source: Steer analysis of OD data

[5] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

3.66 As observed in above figures and the internal-external analysis, TP2 has a large share of local and short-distance trips (up to 300 km), ranging from 42% for MAVs to 85% for CJVs, this share is lower at TP1 Sikandra, ranging from 24% for MAVs to 77% for CJVs .

3.67 In terms of long-distance and very-long-distance trips more than 500 km long, CJVs understandably do not have a significant proportion, as has been seen across other Assets around the country. As expected, MAVs show a much higher share, up to 64% at TP1 and 50% at TP2 due to long distance movements between western and eastern India.

Conclusions

3.68 In summary, in FY22 the Asset had an AADT of 14,611 at TP1 Sikandra and an AADT of 14,348 at TP2 Rajadhok. Looking at the vehicle shares of this Asset, the dominant vehicle class is CJV, holding 57% of vehicle share at TP1 and 68% at TP2. Further, MAVs at TP1 has a higher share (27% compared to 19% at TP2). Shares of other vehicle category volumes are consistent between the two toll plazas. Traffic has shown significant recovery starting FY22 when the Dausa-Lalsot section and Jaipur Ring Road was commissioned resulting in improved connectivity to Delhi and South. Also, with the re-opening of tourist sites in Rajasthan and Delhi, the CJV traffic has increased. MAV's have also grown in the recent years driven by increase in sand mining traffic as one of the key reasons.

3.69 The TVC counts does show variation on the TMS, at the total level TMS is 6% lower than TVC at TP1, and 6% lower than TVC at TP2, primarily attributable to local CJV users. However, the differences are smaller for the larger revenue generating categories (3A, MAV and OSV combined), 1% and -4% at TP1 and TP2 respectively.

3.70 The OD analysis found that in terms of zonal influence, TP2 had a higher share of local trips compared to TP1, which is explained by TP2's proximity to Jaipur and a higher urban population density. CJV and Bus traffic driven with origins and destinations at both ends of the Asset corridor is seen to be driven by the urban population and tourism related drivers. The key commodities transported on the Asset on 3A/MAV trucks include agricultural products, which make up around 30% of the commodity share at both plazas. Stone also holds a respectable share, at 9% and 13% at TP1 and TP2 respectively. Majority of the traffic is sticky to the Asset with only 8% being external-external in PCU terms which is using the Asset as it offers excellent connectivity to the regions in the immediate vicinity of the corridor.

3.71 The overall characteristic of the Asset is strategic is nature connecting several key urban and economic activity centres of Jaipur, Agra, Bharatpur in immediate vicinity with wider generators and attractors of south Rajasthan, Gujarat, Maharashtra to Uttar Pradesh and Delhi NCR also being connected by the Asset. Urban population and tourism linked growth is seen as an added advantage for CJV and Bus traffic.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Rajasthan (containing the Asset), compared to that of the country. Overall, as can be seen, the trend observed at the

country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, Rajasthan has grown at a rate which is slightly higher than the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Rajasthan	56.5	43.3	13.2	68.5	51.5	17.0	2.0%	1.8%	2.6%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of patterns of urbanisation, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

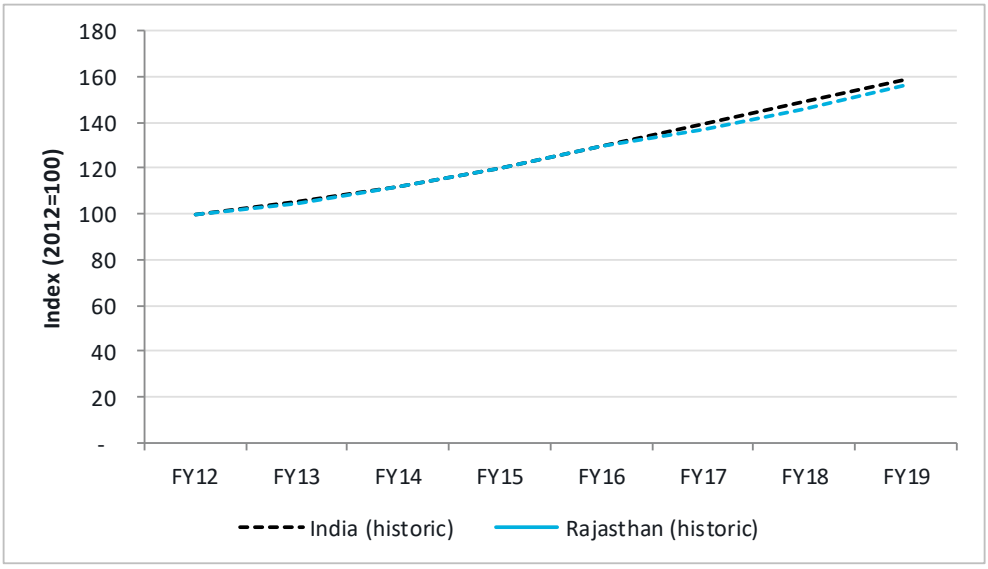
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Rajasthan has been very similar to the country. The state contributes approximately 5% to India's GDP. The following figures illustrates the evolution of India and Rajasthan's GDP.

Figure 4.1: Evolution of Rajasthan's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

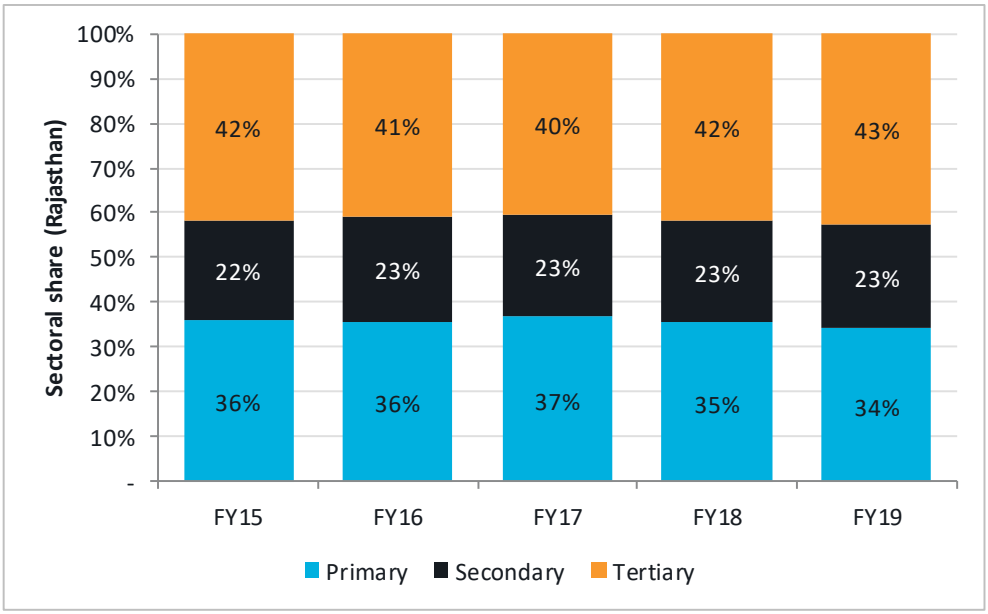
Economic activity in the state

4.9 Rajasthan, the largest (area-wise) state in India, is in the north-western part of the country. In terms of sectoral contribution to the state GDP, tertiary sector has the highest share followed by primary and secondary, with the shares remaining stable during the last five years.

4.10 The tourism and transport sector constitutes a major share of state's tertiary sector. Rajasthan is considered a favoured tourist destination in India, with key tourist destinations being Jaipur, Jodhpur, Jaisalmer, Bharatpur and Udaipur. In 2018, the state attracted over 50 million domestic tourist arrivals in the country whereas, in terms of foreign tourist arrivals it holds fifth position in the country with over 1.7 million6 tourist visiting state every year.

4.11 In terms of secondary sector, the state has key industrial areas in Kishangarh (marble); Manesar (automobile), Pali and Jodhpur (textiles), Chittorgarh -Neemuch (cement), Kota (stone). Rajasthan is one of the largest minerals producing state in India and is the sole producer of lead and zinc ores in India. The state has one of the largest limestone reserves, making it a hub for cement industries. In terms of agricultural produce, the state is largely known for its production of wheat, cotton, cereals and pulses.

Figure 4.2: Sectoral contribution to Rajasthan's GSDP



Source: Central Statistics Organisation

[6] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 To understand the historical traffic trends in relation to these growth drivers, we carry out regression analysis to determine the historical relationship between traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The traffic demand is the dependent variable while the one or more identified growth drivers are the independent or explanatory variables.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.5 Elasticities, in the case of traffic growth are the relationships between traffic and growth drivers. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.6 The table below shows the historical CAGRs on the Asset by each vehicle category. The growth rates have been bucketed to analyse the historical growth under different time periods to arrive at an elasticity assumption.

Table 5.1: Vehicle wise growth and CAGR (%) at Sikandra toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY18-22	CAGR FY16-22
CJV	7.2%	(4.7%)	3.8%	1.9%	1.2%	9.8%	12.9%	**(0.5%)**	**6.3%**	**4.0%**
LCV	8.4%	(1.8%)	(17.8%)	(3.4%)	(5.9%)	(37.5%)	(39.6%)	**(10.2%)**	**(23.5%)**	**(19.3%)**
Bus	4.7%	6.7%	14.0%	2.5%	11.3%	7.9%	35.5%	**10.3%**	**13.6%**	**12.5%**
2A	(9.7%)	(19.1%)	66.4%	(5.6%)	(20.7%)	(52.5%)	(42.0%)	**16.0%**	**(32.6%)**	**(19.2%)**
3A/MAV	16.3%	6.2%	10.2%	(14.4%)	0.4%	6.4%	0.4%	**8.2%**	**(2.1%)**	**1.2%**
Total	8.8%	(1.1%)	5.7%	(4.0%)	0.2%	2.4%	7.8%	**2.3%**	**1.5%**	**1.8%**
PCU	10.5%	1.6%	9.0%	(7.8%)	0.1%	1.8%	6.1%	**5.3%**	**(0.1%)**	**1.7%**

Source: Steer analysis of TMS data provided by client

Table 5.2: Vehicle wise growth and CAGR (%) at Rajadhok toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY18-22	CAGR FY16-22
CJV	13.7%	2.1%	6.5%	(3.1%)	0.6%	3.3%	7.8%	**4.3%**	**2.1%**	**2.8%**
LCV	5.3%	4.0%	(6.8%)	(7.9%)	(8.8%)	(38.9%)	(37.3%)	**(1.6%)**	**(24.7%)**	**(17.7%)**
Bus	4.7%	7.2%	14.5%	(0.5%)	4.6%	(5.8%)	29.7%	**10.8%**	**6.2%**	**7.7%**
2A	(11.7%)	(25.9%)	70.9%	(16.3%)	(23.7%)	(49.4%)	(34.9%)	**12.6%**	**(32.3%)**	**(19.8%)**
3A/MAV	12.6%	0.6%	2.1%	(7.8%)	(0.1%)	6.3%	0.7%	**1.4%**	**(0.3%)**	**0.2%**
Total	11.2%	1.6%	6.0%	(4.6%)	(0.6%)	(1.2%)	5.6%	**3.8%**	**(0.3%)**	**1.0%**
PCU	10.2%	1.0%	6.4%	(5.7%)	(0.9%)	(1.3%)	5.2%	**3.7%**	**(0.7%)**	**0.7%**

Source: Steer analysis of TMS data provided by client

5.7 As the TMS data did not provide a breakup between the individual vehicle categories for the toll categories 3A/MAV, we have used FY21 TVC data, as discussed in Chapter 3, to estimate the splits in FY22. In case of Bus and 2A because of reporting issue where bus reported are higher than past trends, TVC splits of FY21 are used in the model for traffic and revenue estimation. The following table presents the splits which have also helped in the elasticity estimation. However, in our regression analysis, we have used the combined traffic as data for historical years which were available only in combined form.

Table 5.2: Split between individual vehicle types at each toll plaza

Toll Plaza	Vehicle type (for toll)	Vehicle type (for growth)	Share (%)
Sikandra toll plaza	Bus/2A	Bus	68%
		2A	32%
Sikandra toll plaza	3A/MAV	3A	16%
		MAV	84%
Rajadhok toll plaza	Bus/2A	Bus	74%
		2A	26%
Rajadhok toll plaza	3A/MAV	3A	14%
		MAV	86%

Source: Steer analysis of independent TVC counts

5.8 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.3: Identified growth drivers to model traffic growth at Asset level

Vehicle type	Growth Driver
Car	GSDP Rajasthan
LCV	GSDP Rajasthan
Bus	GSDP Rajasthan
2A	GSDP Rajasthan
3A	GDP India
MAV	GDP India

Source: Steer analysis of Client data

5.9 The recent historical period of tolling is variable, with disparities in traffic growth between years for certain vehicle types, due to construction of the Dausa-Lalsot road and the Supreme

Court ban on sandmining, impacting movement of commercial vehicles. Therefore, certain impacted years were not included in the regression analysis. This is one of the reasons for differences between the derived and assumed elasticities as we typically forecast elasticities to reflect the more recently observed relationship between traffic and macroeconomic growth either based on recent elasticities or benchmarks.

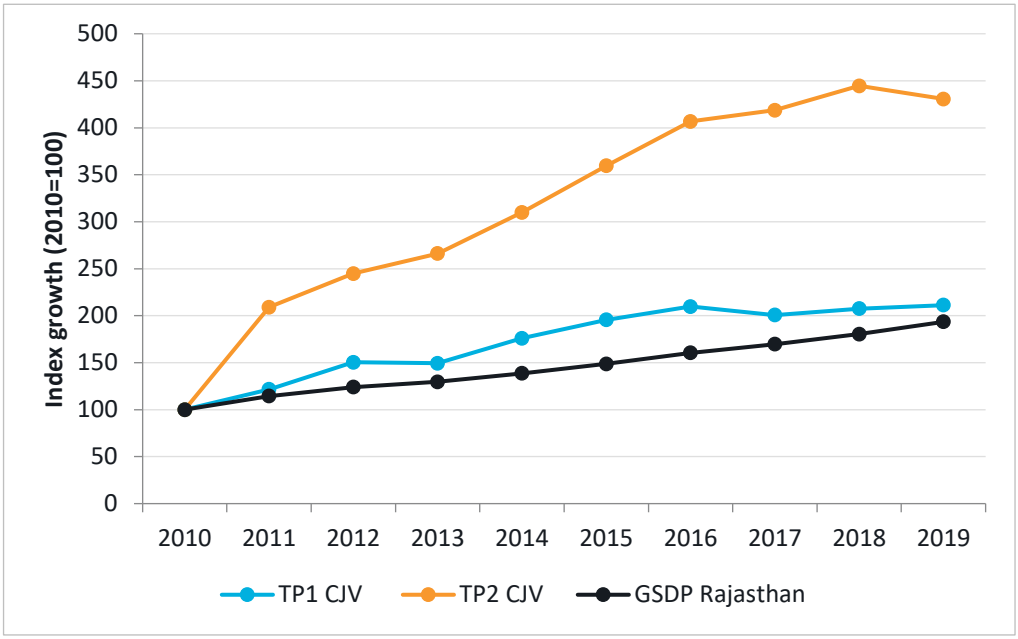
5.10 It should be noted that in our regression analysis, we have used the combined traffic for toll categories as data for historical years was available only in combined form. Given the high uncertainties driven by the on-going pandemic, we believe that the regressions and elasticities found in the historical data analysis up to FY19 are more reliable for the forecast. We therefore, maintained FY19 assumptions for our forecasts.

5.11 Further, FY21 and FY22 have been impacted by COVID-19 related restrictions and the traffic volumes on the Asset were significantly impacted during the travel restrictions imposed during the first, second and third wave of COVID-19. Hence, FY21 and FY22 have not been considered while undertaking the regression analysis.

CJV

5.12 It was observed from the OD data, that CJVs primarily cater to regional movements between Jaipur, Bharatpur, Agra and other towns lying in the vicinity of the Asset. We have therefore assumed Rajasthan GSDP to be the growth driver for modelling growth of CJV traffic. The following figure shows the relationship between indexed values of CJV traffic and Rajasthan GSDP at TP1 Sikandra and TP2 Rajadhok.

Figure 5.1: Relationship between CJV traffic and Rajasthan GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.13 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or are slightly higher than growth in GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. However, in

FY20 there was brief drop in car sales primarily owing to scheduled roll out of BS VI norms from April 2020.

5.14 Historically, the CJV traffic on the Asset has shown strong growth in the FY12-FY18 period, with the growth in this category moderating in the recent years. The shift to personal mobility choices has seen strong recovery in this vehicle category due to people avoiding public transport. This trend is expected to sustain as user perception of preferring personal vehicle in the medium term will continue driving CJV growth.

5.15 Nevertheless, the regression analysis suggests that during more stable years, CJVs have grown with a background traffic growth elasticity of 1.0 with respect to GSDP. Taking note of the positive outlook for passenger traffic on the tourism-driven Asset and the regression results, we have assumed a forecast background elasticity of 1.00 and 0.95 with respect to Rajasthan GSDP for CJV at TP1 Sikandra and TP2 Rajadhok respectively. The elasticity of CJV assumed at Sikandra plaza is higher than Rajadhok plaza mainly because the yearly growth rates of CJVs post FASTag implementation since FY18 is higher on TP1. Further it is assumed with growing tourism-related development in the state TP1 will cater higher CJV volumes connecting tourist places Jaipur, Udaipur and South.

LCV, 2A

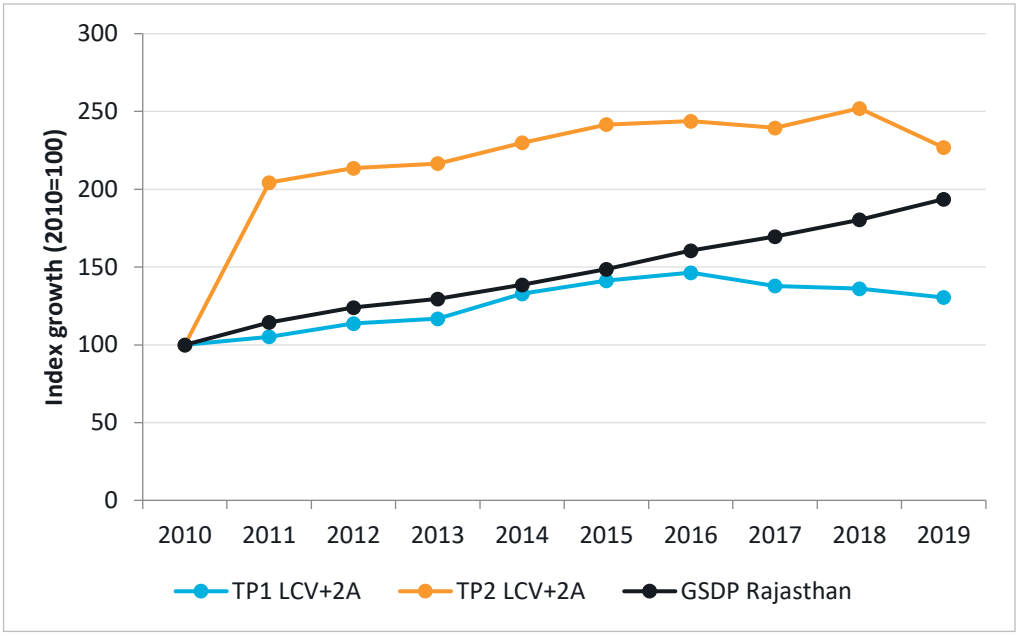
5.16 Compared to heavy vehicles such as 3A and MAV; LCV and 2As are used for regional movements within the state – Rajasthan in this case as seen in the OD data analysis. We therefore believe the GSDP of Rajasthan would be the more appropriate growth driver to model growth of LCV+2A traffic. The following figure shows the relationship between indexed values of LCV+2A combined traffic and Rajasthan's GSDP.

5.17 Analysing the growth of LCV+2A over two periods – FY12-16 and FY16-19, we observe that though LCV grew positively during the FY12-16 period; 2A traffic declined. However, during FY16-19, 2A traffic increased which could be due to a shift in traffic from LCV to 2A, and/or classification issues. As we have observed 2As growing faster than LCVs on other roads across the country, we believe this is due to a preference for 2A over LCVs partly due to the revised axle load norms7 that were implemented in July 2018.

5.18 Further as LCV volumes are much higher compared to 2A; the combined LCV-2A traffic witnesses positive growth in FY12-16 followed by decline during FY16-19 due to higher decrease in LCVs compared to growth in 2As. Therefore, though regression shows 0.70 for LCV and 2A combined, the recent years trends show slower growth or decline in the combined category, therefore, we have assumed lower elasticities of 0.30 and 0.50 for LCVs and 2As respectively to GSDP of Rajasthan.

[7] https://pib.gov.in/PressReleseDetail.aspx?PRID=1538941

Figure 5.2: Relationship between LCV+2A combined traffic and Rajasthan GSDP

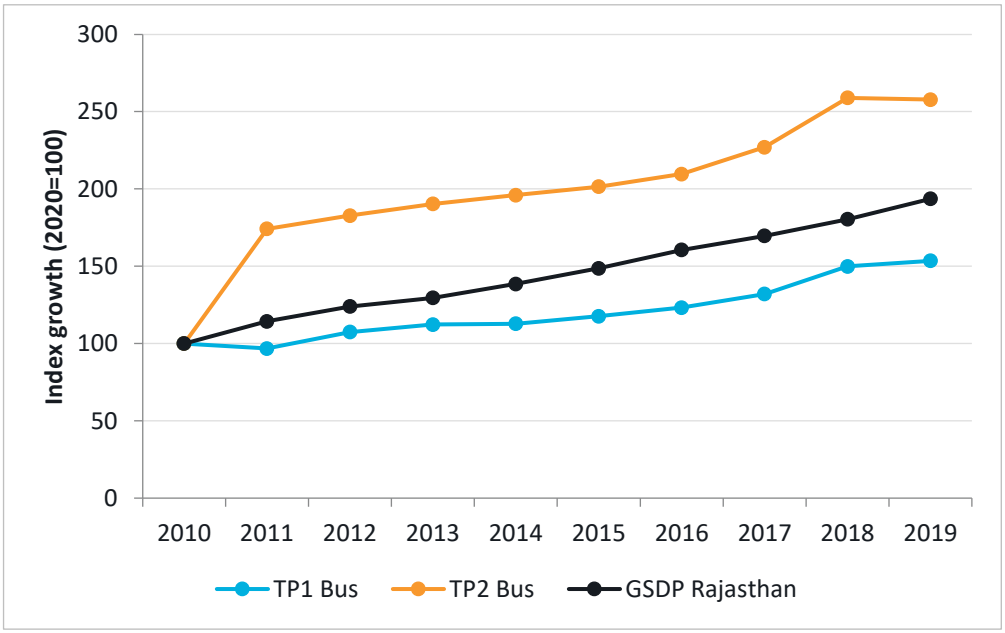


Source: Steer analysis of Client TMS data and publicly available GSDP data

Bus

5.19 The following figure shows the relationship between indexed values of bus traffic and Rajasthan's GSDP.

Figure 5.3: Relationship between Bus traffic and Rajasthan GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.20 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at different intervals of time. Based on our experience across the country, buses on inter-urban and tourism corridors show elasticities of 0.3 to 0.6 with respect to the GSDP. The regression results for certain reliable years also show

elasticities in the range of 0.50 to 0.60 on the Asset. Based on the regression results and benchmarks, we have therefore assumed an elasticity of 0.50 with respect to GSDP Rajasthan.

3A/MAV Trucks

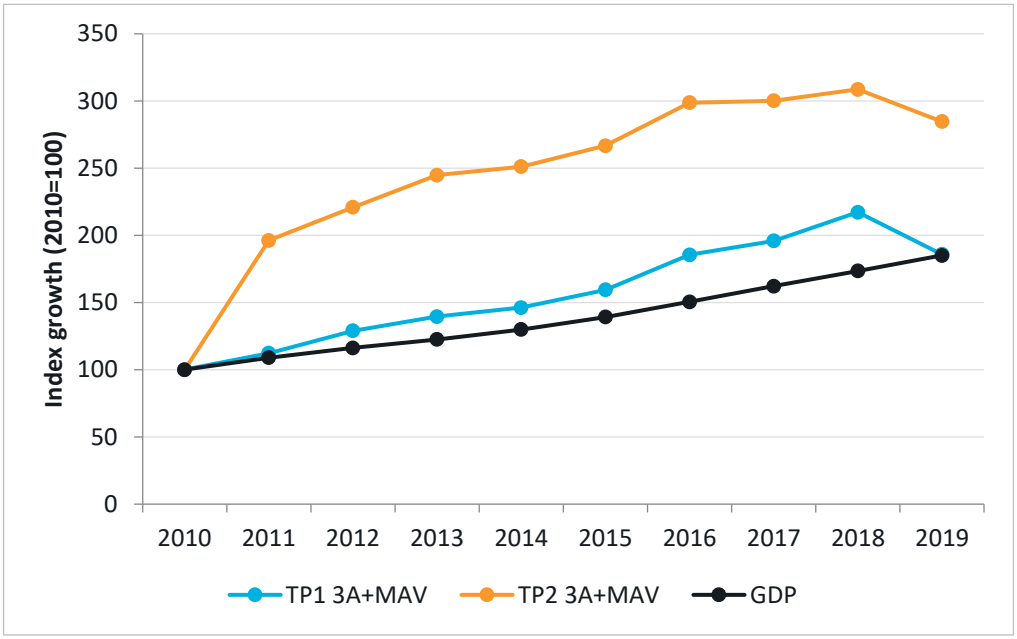
5.21 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence the commodity distribution resulting in traffic growth in 3A and MAV to be dependent on industry demand-supply ecosystems spread across the country therefore we have assumed GDP as the growth driver to model the traffic growth in 3A and MAV vehicle category. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

5.22 Historically, 3A+MAV combined traffic grew positively in the FY12-FY16 period at 8-9%, growing further in FY17 and FY18, before losing volumes in FY19 and FY20. This was due to:

- Primarily the ban on sandmining in Rajasthan imposed by a Supreme Court of India's order in November 2017, and
- To a lesser extent: the construction of Dausa-Lalsot road which caused traffic to use alternate routes like Lalsot-Gangapur road.

5.23 As mentioned previously, this impact loss is smaller on TP2 Rajadhok due to the choices available for long-distance road users at Dausa. The difference of about 1,000 3A+MAV trucks between TP1 Sikandra and TP2 Rajadhok which can be partially attributed to these alternate movements. However, given positive developments due to the new policy providing industry status to manufacturing of m-sand, movement of sand in goods vehicles may show recovery.

Figure 5.4: Relationship between 3A+MAV combined traffic and Rajasthan's GDP



Source: Steer analysis of Client TMS data and publicly available GDP data

5.24 We believe 3As to grow slower than MAVs due to a shift, as there is an increasing preference seen for MAVs instead of 3As for long-distance movements. This is because MAVs have higher load capacity which generate economies of scale resulting in lower costs. However, it is

unlikely that 3A trucks will disappear from the market completely as there are best suited for certain commodities or movements.

5.25 Based on the above points, considering the regression results and the hit in the industry ecosystem surrounding construction-related material including sand, we have assumed elasticities of 0.60 and 0.80 for 3A and MAV trucks respectively, with respect to India GDP growth.

Forecasts for background elasticities

5.26 The following table presents a summary of the results of the regression analysis carried out on historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.27 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle type	Growth driver	History		Forecast	
		Derived elasticity	Years considered	Assumed forecast elasticity	Evolution of elasticity
TP1 Sikandra					
Car	GSDP Rajasthan	1.00	FY14-FY16, FY18-FY19	1.00	No change
LCV*	GSDP Rajasthan	0.70	FY11 to FY16	0.30	No change
Bus	GSDP Rajasthan	0.40	FY13-FY17, FY19	0.50	No change
2A*	GSDP Rajasthan	0.70	FY11 to FY16	0.50	No change
3A	GDP	1.30	FY11-FY15, FY17-FY18	0.60	No change
MAV	GDP			0.80	No change
TP2 Rajadhok					
Car	GSDP Rajasthan	1.30	FY13, FY16-FY18	0.95	No change
LCV*	GSDP Rajasthan	0.50	FY12-FY16, FY18	0.30	No change
Bus	GSDP Rajasthan	0.60	FY12-FY17	0.50	No change
2A*	GSDP Rajasthan	0.50	FY12-FY16, FY18	0.50	No change
3A	GDP	1.00	FY12 to FY18	0.60	No change
MAV	GDP			0.70	No change

Source: Steer analysis of Client data *regression was run on LCV and 2A combined

Forecasts for growth drivers

5.28 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key

macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.29 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing assets, lower manufacturing outputs and lower rural consumption.

5.30 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in Figure 5.5.

5.31 The India GDP growth provided by the Client is in line with other independent forecasts available form from independent sources such as IMF, World Bank and RBI in the short and medium term, while the long term GDP forecasts are considered to be optimistic.

5.32 Based on these sources, we have adopted GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY32, end of concession.

State GSDP

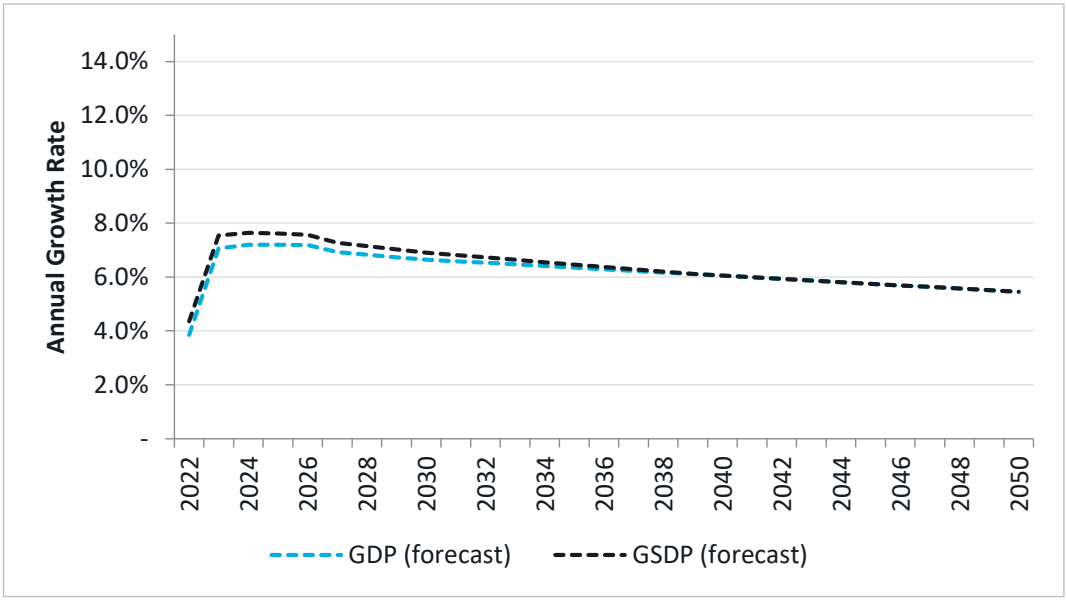
5.33 As per Client projections, Rajasthan's GSDP growth assumes to continue outpacing the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.34 There are significant investments expected to take place as part of the state's plan and Rajasthan is expected to receive a significant proportion of these investments, given its leading position in industrial investments. Higher than expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Rajasthan's state economy.

5.35 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.36 The GDP-GSDP lines are expected to converge by FY38. The chart below shows the forecast growth lines for GDP and Rajasthan GSDP.

Figure 5.5: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP projections based on Steer estimates of historical trends compared to GDP

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our base growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the concession period which are used to estimate traffic and revenue forecast. In the final section, this chapter summarises traffic growth rates for the forecast years.

6.2 The following table lists key intermediate and final outputs that have been presented in previous Chapters and in this chapter.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Historical elasticities with respect to growth drivers	Chapter 5, Appendix C
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix C
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer analysis

6.3 All traffic is presented as AADT for vehicle category at each plaza, for financial years (April-March). All revenue is presented in INR (nominal terms). Though FY32 is the last year of concession, we have developed our forecasts until FY32 for the Client's reference.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied monthly traffic the seasonality – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. The averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 The seasonality factors assumed for individual vehicle types for each toll plaza are shown in the table below.

Table 6.2: Seasonality correction factors for TP1 Sikandra

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.95	1.00	1.02	1.06	1.05	1.13	1.00	0.95	1.00	1.04	0.88	0.96
LCV	0.81	1.02	1.02	1.14	1.20	1.10	1.00	0.97	0.98	1.01	0.93	0.91
Bus	1.03	0.99	1.04	1.05	1.03	1.04	0.96	0.92	1.02	1.02	0.95	0.97
2A	0.93	0.99	1.02	1.13	1.22	1.04	0.99	0.96	0.98	1.02	0.88	0.91
3A/MAV	1.00	1.04	0.99	1.08	1.14	1.03	1.02	1.04	1.01	0.95	0.87	0.89

Source: Steer analysis of Client historical TMS data

Table 6.3: Seasonality correction factors for TP2 Rajadhok

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.96	0.98	1.01	1.08	1.06	1.14	1.05	0.94	1.00	1.00	0.88	0.95
LCV	0.88	0.95	1.00	1.11	1.10	1.03	0.95	0.98	1.03	1.06	0.97	0.98
Bus	1.02	0.97	1.02	1.06	1.03	1.06	0.98	0.92	1.01	1.02	0.98	0.96
2A	0.95	1.00	0.97	1.06	1.18	1.03	0.94	0.99	0.97	1.03	0.94	0.97
3A/MAV	1.02	1.04	1.00	1.10	1.09	1.00	0.98	1.00	0.95	0.95	0.93	0.96

Source: Steer analysis of Client historical TMS data

Base year FY22 AADT estimates

6.8 As discussed earlier in chapter 1 and in section 3.11, The second wave of COVID-19 infections peaked in the norther half of the country in the months of April and May 2021. The tourist centres of Jaipur, Delhi, Agra, Mathura had implemented strict COVID-19 related protocols for tourists. As a result, a significant reduction in tourism travel was recorded during this period. Therefore, the traffic volumes on the Asset were impacted during Q1FY22.

6.9 In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.10 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.11 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.4 Monthly AADT and Adopted AADT for FY22 - TP1 Sikandra

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	8,375	10,567	9,694	7,779	9,903	10,285	9,345
LCV	461	447	431	375	435	466	421
Bus	1,955	2,107	2,050	1,790	1,918	2,092	1,949
2A	132	122	110	142	119	159	125
3A/MAV	4,357	3,892	4,303	4,042	4,204	4,232	4,014
Total	**15,280**	**17,135**	**16,588**	**14,129**	**16,579**	**17,234**	**15,854**
PCU	**31,990**	**32,809**	**33,276**	**29,597**	**32,745**	**33,919**	**31,549**

Source: Steer analysis FY22* for CJV and Bus is averaged Oct-Mar (excluding Jan) due to 3rd wave COVID-19 impact

Table 6.5 Monthly AADT and Adopted AADT for FY22 – TP2 Rajadhok

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	9,996	12,518	11,115	9,364	11,785	11,240	10,900
LCV	466	459	449	390	457	462	444
Bus	1,592	1,666	1,652	1,510	1,598	1,707	1,597
2A	116	157	91	98	84	86	103
3A/MAV	3,067	2,667	2,968	2,777	2,879	2,804	2,750
Total	**15,238**	**17,466**	**16,276**	**14,139**	**16,803**	**16,300**	**15,793**
PCU	**27,549**	**28,873**	**28,371**	**25,394**	**28,527**	**28,038**	**27,180**

Source: Steer analysis FY22* for CJV and Bus is averaged Oct-Mar (excluding Jan) due to 3rd wave COVID-19 impact

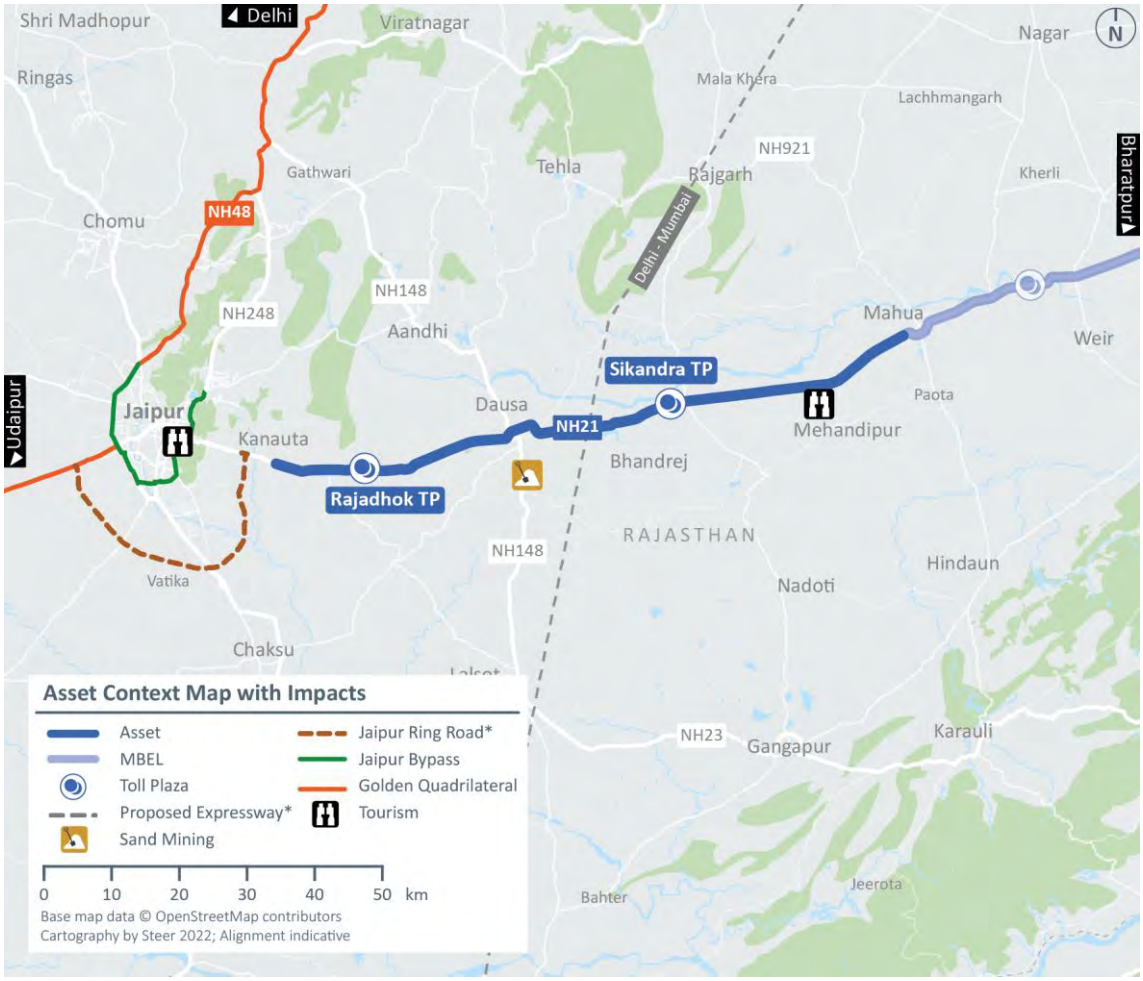
Analysis of potential network/developmental impacts

Summary of alternate routes and planned changes

6.12 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.13 The map below shows the immediate road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context



Source: Steer analysis and cartography

6.14 Apart from the impact of ease of sandmining ban in FY22 by the Supreme Court, we have estimated impacts of potential network changes and developments around the Asset. These are indicated in the following table.

Table 6.5: List of network/other developments

S. No.	Development	Route affected	Year of completion	Impact (+/-)	Plaza
1.	Ease of Sandmining Ban	Vehicles carrying sand and other material dependent on the construction industry	FY23	+ve	TP1 &TP2

S. No.	Development	Route affected	Year of completion	Impact (+/-)	Plaza
2.	Jaipur Ring Road (LOS improvement)	Trips with one end west of Jaipur	FY23	+ve	TP1 & TP2
3.	Completion of pending sections on Agra Ring Road	Asset route: Bhilwara/Udaipur-Jaipur-***Asset***-Agra-Kanpur Alternate route: Bhilwara/Udaipur-Chittorgarh-Kota-Jhansi-Kanpur	FY25	+ve	TP1 & TP2
4.	Completion of construction of Delhi-Mumbai Expressway	Asset route: Delhi-Dausa+Dausa-Kota+Dausa-Godhra Alternate route: Jaipur-Delhi via NH8	FY23	+ve	TP2
5.	Construction-related vehicles for upcoming infrastructure developments	Construction demand for Jewar Airport, Jewar Metro and Delhi-Mumbai Expressway considered to be served by sites in Dausa.	FY23 to FY26	+ve	TP1

Source: Steer analysis.

Impact assessment for network/other developments

6.15 As seen in the previous sub-section, the assessed impacts primarily fall into either the category of road network developments or development in other modes of transport. Under network developments, changes in the road network could be either brownfield (upgrade to existing road) or greenfield (development of new road). We typically assess impacts of the changes in costs and travel time on routes in these networks using binary logit models that compare generalised journey costs (GJC) between Asset and alternate routes. However, each impact is dealt individually in its own network or industry context.

6.16 The subsections below include a narrative of each of the improvements, and impacts associated from each of these on our traffic forecasts. Please note that all traffic volumes for impacts were estimated and impact rates were applied on FY22 AADT.

Easing of ban on sandmining

6.17 As mentioned previously, the ban on sandmining has caused significant negative growth in 3A+MAV traffic in FY20. Since FY15, there have been policy changes (through the Ministry for Environment and Forests) and regulatory developments (through the National Green Tribunal) that have been affecting sandmining across the country.

6.18 In Rajasthan particularly, the government made efforts to find alternate means i.e., suitable sand reaches including those that were allotted before the changes in regulation. However, subsequent court judgements, especially the one in November 2018, laid strict regulations on sand reaches for gaining environmental clearance. Existing holders also needed to this clearance. The court judgement prohibited 82 large sandmining lease holders. Appendix A presents a chronological summary of developments – policy, regulatory and judicial –

surrounding sandmining in India and Rajasthan in particular. As of Nov 2021, the Supreme court of India has lifted up the sandmining ban from the state of Rajasthan which led to healthy growth of goods traffic volume.

6.19 Further, the positive impact of Dausa-Lalsot section has been removed as its already operational since FY22 which is a part of current traffic plying on the Asset.

6.20 Based on the efforts by the Rajasthan government and recovery in traffic seen so far in FY20, and a new policy in January 2021 providing industry status to manufacturing of m-sand, we have considered a recovery of traffic for sandmining ban. The sandmining recovery ban on the Asset has been considered from FY23 onwards where the impact is 0.5% lower at Rajadhok plaza across the concession period. Further, it is assumed from FY24 onwards the ease in sandmining would result in further ~0.5% growth in both 3A and MAV traffic volumes.

Table 6.6: Impact of government efforts to revive sand industry

Vehicle type	FY23	FY24
TP1 Sikandra		
3A	2.6%	3.2%
MAV	2.6%	3.2%
TP2 Rajadhok		
3A	2.2%	2.7%
MAV	2.2%	2.7%

Source: Steer analysis

Induced traffic following better connectivity due to Jaipur Ring Road

6.21 The Jaipur Ring Road (JRR), as shown in the network context map, is a new circular road that is expected to serve as a peripheral alternative to the existing Jaipur bypass. This existing Jaipur bypass, though access-controlled both at sections that are grade-level and elevated, is currently congested. For users making trips from one end west of Jaipur, the new ring road is expected to provide higher speed and an improved level of service, apart from releasing capacity on the existing bypass. As of February 2021, the construction of JRR is complete with a cloverleaf junction (Ajmer Road and Tonk Road) yet to be completed, and the ring road has been reportedly operational since November 2020 (through a makeshift connection). Therefore, we believe a large part of the impact to be already part of the base traffic, however since the construction is not yet completed, we believe there is still some residual impact of this construction yet to appear on the road.

6.22 The table below summarises the net impact, estimated using an elasticity-based approach to calculate additional demand generated by an improvement in the level of service.

Table 6.7: Impact of completion of Jaipur Ring Road

Vehicle type	FY23 onwards	
	TP1 Sikandra	TP2 Rajadhok
3A	0.4%	0.3%
MAV	0.8%	0.6%

Source: Steer analysis

Positive diversion due to the upcoming Delhi-Mumbai Expressway

6.23 The Delhi-Mumbai Expressway is a greenfield expressway being developed to provide an improved level of service to long-distance traffic between North and Western India, compared to the existing network of national highways that are already operating at high levels of utilisation. Though the Asset currently does not directly serve north-south movement (e.g., Delhi-Jaipur and Jaipur-Gujarat) as the NH8 directly provides connectivity to them, the upcoming Delhi-Mumbai Expressway could provide faster and unhindered connectivity through an interchange with the Asset near Dausa at km-169. As illustrated in the alternate route map, the diverted traffic through the expressway would pass only through TP2 Rajadhok.

6.24 We have considered the following three types of north-south movements for this impact:

- **Delhi-Jaipur**: These movements currently use the NH8 via Neemrana. The route through the proposed expressway via Dausa provides a competitive alternate with high time savings and good end-to-end connectivity, despite higher toll rates.
- **Gujarat and southern Gujarat-Jaipur**: These movements currently use the NH8 via Kishangarh. The route through proposed expressway via Dausa does not provide a competitive alternate given the Chittorgarh-Kota non-expressway section slows down the journey.
- **Southern Rajasthan-Jaipur**: These movements currently use the NH8 via Kishangarh. The route through the proposed expressway via Dausa provides a competitive alternate with high time savings and good end-to-end connectivity, despite higher toll rates.

6.25 Assuming successful implementation of all the sections of both the expressway and the Dausa-Jaipur link, along with benchmark in-scope shares applied on available traffic volume counts at various locations on NH8, we have estimated the impacts shown in the table below. We have staged the impact over three years to account for a phased completion of various sections and gradual ramp-up of the impacts. As discussed, these are applied solely to TP2 Rajadhok.

Table 6.8: Impact due to completion of Delhi-Mumbai Expressway, TP2 Rajadhok

Vehicle type	FY23	FY24	FY25	FY26	FY26 onwards
Impact staging	30%	80%	100%	50%	50%
CJV	7.3%	19.5%	24.3%	12.2%	12.2%
LCV	2.5%	6.7%	8.4%	4.2%	4.2%
Bus	12.0%	32.0%	40.0%	20.0%	20.0%
2A	5.7%	15.2%	19.0%	9.5%	9.5%
3A	10.1%	26.9%	33.7%	16.8%	16.8%
MAV	6.3%	16.7%	20.9%	10.4%	10.4%

Source: Steer analysis

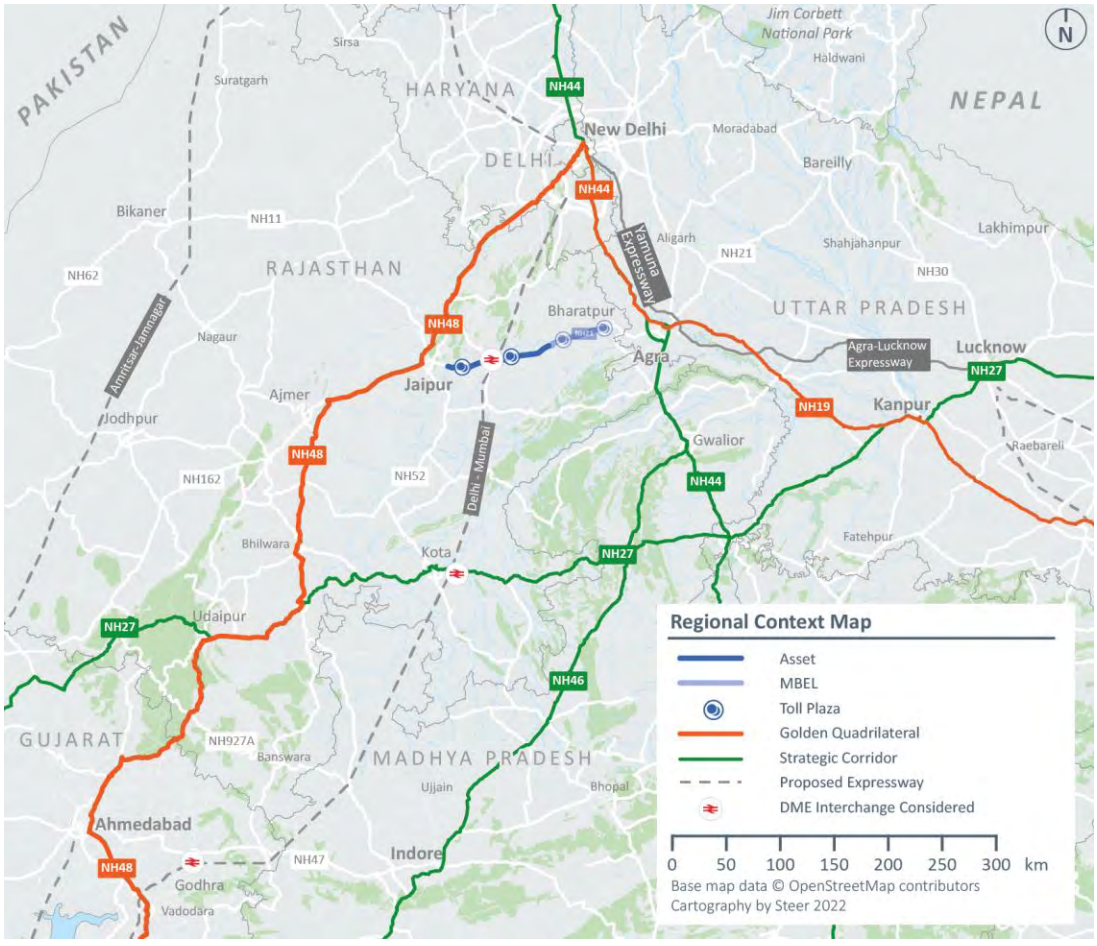
6.26 Recently a spur of DME between Jaipur and Dausa has been discussed and the tender has been awarded for construction. This spur will bypass the Asset and may lead to reduction in the traffic volume that used the DME and would have used the Asset. Since the construction of the DME spur has not yet started, we have assumed that by FY26 the spur will be operational, and the positive DME impact assumed above will be reduced by half to 50% of the full impact.

Diversion due to completion of pending sections on the Agra Ring Road

6.27 As shown in the map below, the Asset is part of a long-distance east-west corridor connecting southern Rajasthan (Udaipur, Bhilwara, Chittorgarh), Uttar Pradesh (Kanpur, Lucknow) and the east. While the route using the Asset passes through Jaipur (NH8), Jaipur-Mahua-Asset and Agra, the alternate route passes through NH27 via Kota and Jhansi. Currently, movements through Agra are limited due to the incomplete Agra ring road and entry restrictions for trucks to enter the city from 5 AM to 11 PM. Completion of the pending section of the Agra Ring Road is expected to improve connectivity for long-distance traffic.

6.28 For long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states, there is an alternative route along NH 27 that joins Udaipur to Kanpur via Chittorgarh-Kota-Jhansi. The completion of the Jaipur Ring Road, which is now operational, and Agra Ring Road improves the relative level of service on the Asset corridor and has a positive impact.

Figure 6.2: Asset location on long-distance route option between Udaipur/Chittorgarh and Kanpur



Source: Steer analysis and cartography

6.29 Based on our Generalised Journey Cost (GJC) based diversion analysis from the strategic route discussed above, we believe the upgrade to Agra Ring Road will result in a small positive impact on the Asset route, as summarised in the table below.

Table 6.9: Impact due to completion of pending section on Agra Ring Road

Vehicle type	FY25 onwards	
	TP1 Sikandra	TP2 Rajadhok
LCV	0.4%	0.2%
2A	1.8%	1.6%
3A	3.1%	2.7%
MAV	4.8%	3.3%

Source: Steer analysis of OD data, Client TMS data and publicly available information

Construction-related vehicles

6.30 Apart from network impacts, we have also separately identified the potential impact on the Asset of traffic related to the construction activities of large infrastructure projects in the short/medium term. Particularly, we have mapped regions with construction-related material being mined and produced (e.g. Dholpur, Dausa, Dadri, Saharanpur, Yamuna Nagar and Haldwani) for projects such as the Jewar Airport, Jewar Metro. Please note that these impacts are not included in the generic recovery of construction-related commodities due to government efforts in finding alternate sand reaches that comply with regulatory requirements.

6.31 The table below presents the above impacts for each infrastructure development foreseen in the short term. Understandably, impacts in the long term are already part of our background growth forecast and cannot be separated out.

Table 6.10: Impacts due to construction-related movement for specific upcoming infrastructure projects

Vehicle type	FY22	FY23	FY24	FY25	FY26
TP1 Sikandra					
Jewar Airport					
2A		2.4%	2.4%	2.4%	2.4%
3A		2.0%	2.0%	2.0%	2.0%
MAV		0.7%	0.7%	0.7%	0.7%
Jewar Metro					
2A			1.3%	1.3%	1.3%
3A			0.7%	0.7%	0.7%
MAV			0.3%	0.3%	0.3%

Source: Steer analysis of OD data, Client TMS data and publicly available information

Summary of impact assessments

6.32 The table below summarises the potential impacts on the Asset due to the various ongoing and planned road network changes, and other related regulatory developments.

Table 6.11: Summary of impact assessments, excluding construction-related vehicles

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Sikandra	TP2 Rajadhok
Easing of ban on sandmining:	FY23 onwards	Medium/Medium	3A+MAV: (+5.1%) And (+6.4%) FY24 onwards	3A+MAV: (+4.3%) And (+5.4%) FY24 onwards
Completion of Jaipur Ring Road: The ring road is expected to release capacity on existing bypass and improve level of service for trips with one end west/southwest of Jaipur.	FY23 onwards	High/Low	3A: (+0.4%) MAV: (+0.8%)	3A: (+0.3%) MAV: (+0.6%)
Completion of Delhi-Mumbai Expressway: Delhi-Jaipur connection through the expressway via Dausa interchange is expected to provide faster connectivity and improved level of service	FY23[a] onwards	High/High		*Base Impact:* CJV: (+24%) LCV: (+8%) Bus: (+40%) 2A: (+19%) 3A: (+34%) MAV: (+21%)
Construction of Jewar Airport	FY23 to FY26	Medium	2A: (+2.4%) 3A: +(2.0%) MAV: +(0.7%)	
Construction of Jewar Metro	FY24 to FY26	Medium	2A: (+1.3%) 3A: +(0.7%) MAV: +(0.3%)	
Positive diversion due to completion of Agra Ring Road: Completion of pending sections would improve connectivity – both seamless and without time restrictions	FY25 onwards	Medium/Medium	LCV: (+0.4%) 2A: (+2%) 3A: (+3%) MAV: (+5%)	LCV: (+0.2%) 2A: (+2%) 3A: (+3%) MAV: (+3%)

Source: Steer analysis of OD data, GJC analysis and Client TMS data and publicly available information;

Revenue forecasting assumptions

6.33 To forecast the revenues for a particular year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e., traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e. the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecasts.

Trip factors

6.34 The trip factors assumed remain consistent across each vehicle category. Due to the introduction of FASTag, the trip factor for all ticket types but Return and Monthly is assumed as 1, with Return having a trip factor of 2 and Monthly a trip factor of 45.

Toll segmentation and trip factors

6.35 As discussed in Chapter 3, segmentation trends have largely been stabilising over the years, with FY22 (shown in the following tables) indicating a significant reduction in the share of exemptions and violations due to better toll plaza management and FASTag implementation and increased penetration of FASTag. This has also led to an increase in the share of Single tickets in FY20 onwards compared to FY19 levels. For 3A/MAV category we believe high level of penetration levels have been achieved and therefore no significant change in segmentation is expected.

6.36 The table below provides the toll segmentation assumed for the period of forecast. We believe with FASTag penetration stabilising and reaching upto 100% in MAVs and minimal impact of COVID-19 during these months, Oct-Mar FY22 segmentation provide us with stable toll segmentation which can be used for the forecast years.

Table 6.12: Forecast toll segmentation, FY22 onwards- TP1 Sikandra

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	93.4%	94.5%	99.4%	89.3%	98.9%
Monthly	0.0%	0.0%	0.0%	0.0%	0.0%
Local commercial	0.3%	2.4%	0.4%	4.9%	0.7%
Local personal	2.1%	0.0%	0.0%	0.0%	0.0%
Exemptions	3.7%	2.6%	0.2%	5.7%	0.1%
Violations	0.4%	0.5%	0.0%	0.0%	0.3%

Source: Steer analysis of Client TMS data

Table 6.13: Forecast toll segmentation, FY22 onwards- TP2 Rajadhok

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	89.7%	76.9%	97.3%	77.7%	98.0%
Monthly	0.5%	5.1%	0.0%	0.0%	0.0%
Local commercial	2.1%	17.0%	2.6%	14.4%	1.9%
Local personal	5.4%	0.0%	0.0%	0.0.%	0.0%
Exemptions	2.3%	1.7%	0.1%	7.8%	0.2%
Violations	0.1%	0.2%	0.0%	0.1%	0.0%

Source: Steer analysis of Client TMS data

6.37 While the implementation of FASTag is not likely to directly impact toll revenues as there in no discount for using it, it is in the short-term (FY20/21) impacting toll segmentations. This was because as mandated by NHAI, users paying cash at toll plazas were only eligible for single tickets, and all other categories of tickets was only allowed under fast tag, therefore there has been a recent rise in single ticket proportions across the toll plazas and across categories. However, we believe that by the time the shift to FASTag is completed (described in the tables above), the toll segmentation will return to FY19 levels – which we believe represent a stable state.

6.38 We further believe that the full introduction of this ETC system will limit the number of exemptions recorded, with a subsequent shift of these vehicles to the discounted local personal/commercial categories.

6.39 There is no other toll category being charged, apart from the official list in the gazetted NHAI Revision of User fee rate w.e.f. 01.07.2021. This set of toll segmentation assumes that further changes in toll categories, unless specific discounts are offered, which is unlikely.

Overloading

6.40 Overloaded vehicles on the Asset are charged twice the toll fee they would otherwise pay for a Single ticket at the toll plaza. We have assumed that the Oct-Mar averaged FY22 overloading shares would continue in the forecast years. This is because the reported FY22 overloading shares on the Asset are higher than in FY20 where the traffic volume of these shares is significantly less in compared to total traffic. The table shows the assumptions for share of overloaded Single journey vehicles that are considered to pay twice the Single journey toll fee due to overloading.

Table 6.14: Overloading assumptions for forecast years FY22 onwards

Vehicle type	Single	Local Commercial
TP1 Sikandra		
LCV	5.9%	2.4%
Bus	1.7%	0.2%
2A	16.8%	4.3%
3A/MAV	7.3%	2.4%
TP2 Rajadhok		
LCV	4.7%	0.0%
Bus	0.2%	0.0%
2A*	20.8%	0.5%
3A/MAV	6.7%	4.6%

Source: Steer analysis of Client data, *2A volmes are low hence %age appears to be high

Toll evolution

6.41 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is July) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.42 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.15: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.55%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: Shared by Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Revenue reconciliation

6.43 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue against the modelled revenue. For the Asset we have reconciled reported revenue for the month of Feb 2022 with the modelled revenue based on Feb 2022 MADT and forecast assumptions on toll segmentation, trip factors and toll rates.

6.44 The comparison, as shown in the table below, shows that modelled revenue overall is within a variation of 0.01% from the reported revenue. This gives us confidence that the revenues estimated using the traffic data in our forecasts are accurately representing the revenues being reported from the Asset.

Table 6.16: Revenue reconciliation for Feb 2022

TP	Steer modelled daily revenue (INR cr)	Reported daily revenue (INR cr)	Difference (%)
TP1 Sikandra	0.28	0.29	0.01%
TP2 Rajadhok	0.22	0.23	0.01%

Source: Steer comparison between modelled and reported revenue for Feb 2022

Traffic and Revenue forecasts

6.45 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue for the forecast period for the Asset. The table below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.17: Traffic forecasts (with impacts) forecast for TP1 Sikandra

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	8,363	8,994	10,418	12,020	16,797
Mini LCV	982	1,004	1,051	1,098	1,217
LCV	421	430	452	472	523
Bus	1,409	1,462	1,576	1,695	2,009
2A	665	707	785	815	966
3A	645	706	801	849	1,032
MAV	3,362	3,695	4,359	4,822	6,252
OSV	7	7	8	9	12
AADT	**15,854**	**17,005**	**19,450**	**21,780**	**28,808**
PCU's	**31,579**	**34,042**	**39,062**	**43,183**	**55,819**

Source: Steer analysis

Table 6.18: Traffic forecasts (with impacts) CAGR (%) for TP1 Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	7.5%	7.6%	7.4%	7.2%
Mini LCV	2.3%	2.3%	2.2%	2.2%
LCV	2.3%	2.5%	2.2%	2.2%
Bus	3.8%	3.8%	3.7%	3.6%
2A	6.2%	5.4%	1.9%	3.8%
3A	9.5%	6.5%	2.9%	4.8%
MAV	9.9%	8.6%	5.2%	6.4%
OSV	5.7%	5.8%	5.6%	5.5%
AADT	**7.3%**	**6.9%**	**5.8%**	**6.2%**
PCU's	**7.8%**	**7.1%**	**5.1%**	**5.9%**

Source: Steer analysis

Table 6.19: Revenue forecast for TP1 Sikandra (INR crores)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	19.6	23.8	29.8	38.5	68.3
Mini LCV	2.3	2.7	3.0	3.5	5.0
LCV	1.8	2.1	2.5	2.9	4.0
Bus	12.2	14.2	17.5	20.7	30.6
2A	6.1	7.2	9.2	10.5	15.5
3A	8.7	10.8	13.9	16.4	24.9
MAV	48.9	60.5	81.1	100.1	161.8
OSV	0.1	0.1	0.1	0.2	0.3
Total	**99.8**	**121.4**	**157.2**	**192.9**	**310.5**

Source: Steer analysis

Table 6.20: Revenue growth CAGR (%) for TP1 Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	21.2%	11.9%	13.6%	13.3%
Mini LCV	15.3%	6.3%	8.2%	7.9%
LCV	14.3%	9.1%	8.5%	8.2%
Bus	15.9%	11.0%	9.0%	9.6%
2A	18.7%	12.7%	7.1%	9.8%
3A	23.4%	13.5%	8.7%	11.0%
MAV	23.9%	15.8%	11.1%	12.7%
OSV	19.1%	12.7%	11.5%	11.8%
Total	**21.6%**	**13.8%**	**10.8%**	**12.0%**

Source: Steer analysis

Table 6.21: Traffic forecast (with impacts) for TP2 Rajadhok

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9,913	11,399	15,193	15,705	21,593
Mini LCV	987	1,009	1,056	1,104	1,223
LCV	444	465	516	518	574
Bus	1,257	1,461	1,969	1,815	2,151
2A	443	485	597	591	701
3A	382	449	604	577	702
MAV	2,363	2,704	3,490	3,529	4,432
OSV	4	4	5	5	7
AADT	**15,793**	**17,977**	**23,429**	**23,844**	**31,383**

Vehicle Type	FY22	FY23	FY25	FY27	FY32
PCU's	**27,260**	**31,101**	**40,479**	**40,639**	**52,054**

Source: Steer analysis

Table 6.22: Traffic forecast (with impacts) CAGR (%) for TP2 Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	15.0%	15.4%	1.7%	8.1%
Mini LCV	2.3%	2.3%	2.2%	2.2%
LCV	4.8%	5.3%	0.2%	2.6%
Bus	16.2%	16.1%	(4.0%)	5.5%
2A	9.7%	10.9%	(0.5%)	4.7%
3A	17.3%	16.1%	(2.3%)	6.3%
MAV	14.4%	13.6%	0.5%	6.5%
OSV	4.9%	5.0%	4.9%	4.8%
AADT	**13.8%**	**14.2%**	**0.9%**	**7.1%**
PCU's	**14.1%**	**14.1%**	**0.2%**	**6.7%**

Source: Steer analysis

Table 6.23: Revenue forecast for TP2 Rajadhok (INR crores)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	21.0	27.5	42.3	49.0	85.5
Mini LCV	2.1	2.4	2.9	3.4	4.8
LCV	1.7	2.1	2.6	2.9	3.9
Bus	10.5	13.8	21.0	21.6	31.9
2A	3.8	4.7	6.5	7.2	10.6
3A	5.1	6.8	10.4	11.0	16.7
MAV	33.9	43.9	64.4	71.9	112.8
OSV	0.1	0.1	0.1	0.1	0.2
Total	**78.2**	**101.2**	**150.3**	**167.0**	**266.4**

Source: Steer analysis

Table 6.24: Revenue growth rates (%) for TP2 Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	30.8%	24.1%	7.6%	32.4%
Mini LCV	16.3%	9.9%	8.2%	18.3%
LCV	17.5%	11.9%	5.3%	17.7%
Bus	31.3%	23.6%	1.3%	24.9%
2A	23.8%	18.1%	5.0%	23.0%

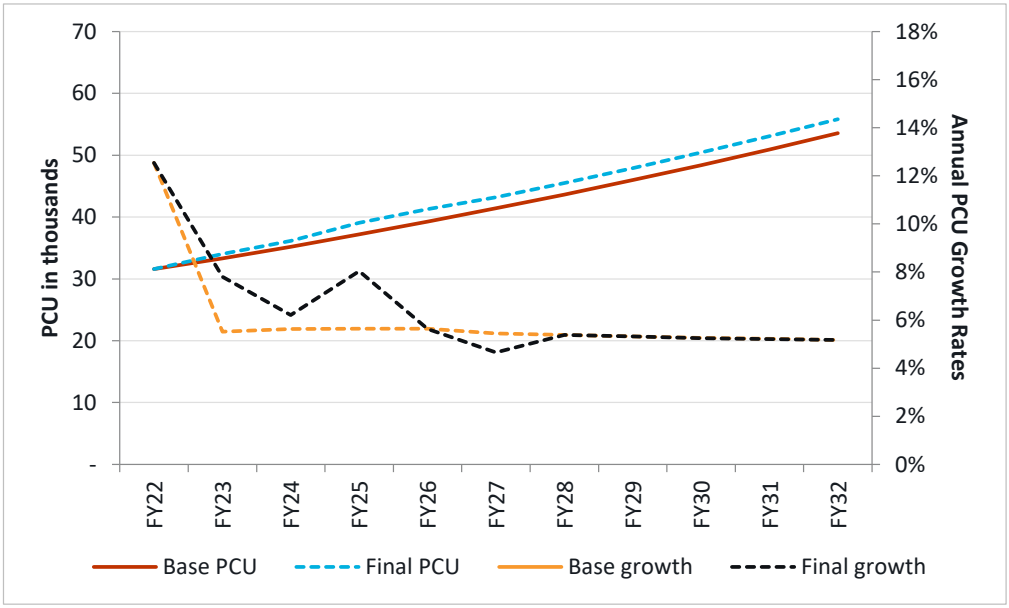
Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
3A	32.7%	23.7%	2.7%	26.6%
MAV	29.4%	21.1%	5.7%	27.2%
OSV	18.7%	12.0%	10.3%	23.2%
Total	**29.4%**	**21.9%**	**5.4%**	**27.8%**

Source: Steer analysis

6.46 As presented in the table above, CAGRs (FY22-FY32) in terms of PCUs for the Traffic forecasts (plus impacts) growth rates is 5.9% respectively at TP1 Sikandra, and 6.7% at TP2 Rajadhok. The major uplift in final growth rates is driven by:

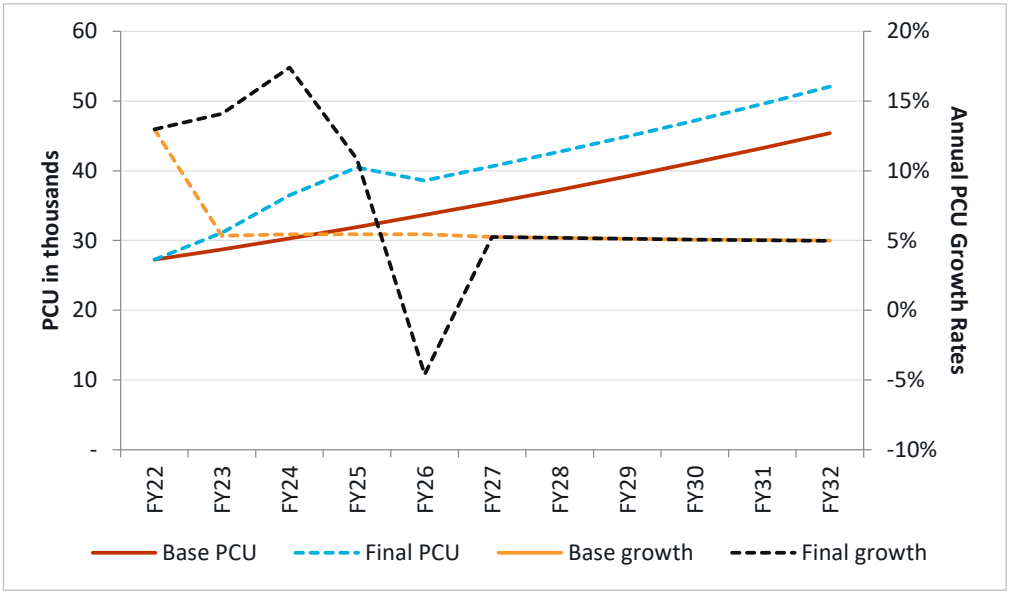
- Four impacts in the **FY21-FY23** period – easing of sandmining ban, completion of Jaipur Ring Road, Agra Ring Road and construction of Jewar Airport and Metro.
- One impact setting in **FY25** – positive diversion due to complete of pending section on Agra Ring Road.
- Impact in **FY23** (applicable only to TP2 Rajadhok) – positive diversion with the completion of Delhi-Mumbai Expressway. This is the primary reason for the much higher PCU CAGRs estimated at TP2 Rajadhok in the FY23-25 period.

Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP1 Sikandra



Source: Steer analysis

Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP2 Rajadhok



Source: Steer analysis

Upside and Downside Cases

6.47 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.48 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.49 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.25: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
JMTL	GDP/GSDP	+1% every year	-1% every year
JMTL	WPI	+1% every year	-1% every year
JMTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.50 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we

consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.51 The upside case impacts included in forecasts are summarised in below:

Table 6.26: Summary of impacts on the Assets

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Sikandra	TP2 Rajadhok
Easing of ban on sandmining:	FY23 onwards	Medium/Medium	3A+MAV: (+6.4%) And (+8.0%) FY24 onwards	3A+MAV: (+5.4%) And (+6.8%) FY24 onwards
Completion of Jaipur Ring Road	FY23 onwards	High/Low	3A: (+0.4%) MAV: (+0.8%)	3A: (+0.3%) MAV: (+0.6%)
Completion of Delhi-Mumbai Expressway	FY23			CJV: (+30%) LCV: (+10%) Bus: (+50%) 2A: (+24%) 3A: (+42%) MAV: (+26%)
Construction of Jewar Airport	FY23 to FY26	Medium	2A: (+3.0%) 3A: +(2.6%) MAV: +(0.8%)	
Construction of Jewar Metro	FY24 to FY26	Medium	2A: (+1.7%) 3A: +(0.9%) MAV: +(0.4%)	
Positive diversion due to completion of Agra Ring Road:	FY25 onwards	Medium/Medium	LCV: (+0.5%) 2A: (+2.3%) 3A: (+3.9%) MAV: (+6%)	LCV: (+0.3%) 2A: (+2.0%) 3A: (+3.3%) MAV: (+4.2%)

Source: Steer analysis of OD data, and publicly available information

6.52 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.53 The downside case impacts included in forecasts are summarised in below:

Table 6.27: Summary of impacts on the Assets

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Sikandra	TP2 Rajadhok
Easing of ban on sandmining:	FY23 onwards	Medium/Medium	3A+MAV: (+3.8%) And (+4.8%) FY24 onwards	3A+MAV: (+1.6%) And (+4.0%) FY24 onwards
Completion of Jaipur Ring Road:	FY23 onwards	High/Low	3A: (+0.4%) MAV: (+0.8%)	3A: (+0.3%) MAV: (+0.6%)

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Sikandra	TP2 Rajadhok
Completion of Delhi-Mumbai Expressway	FY23*			CJV: (+18.3%) LCV: (+6.3%) Bus: (+30%) 2A: (+14.2%) 3A: (+25.3%) MAV: (+15.7%)
Construction of Jewar Airport	FY23 to FY26	Medium	2A: (+1.8%) 3A: (+1.5%) MAV: (+0.5%)	
Construction of Jewar Metro	FY24 to FY26	Medium	2A: (+1.0%) 3A: +(0.5%) MAV: +(0.2%)	
Positive diversion due to completion of Agra Ring Road:	FY25 onwards	Medium/Medium	LCV: (+0.3%) 2A: (+1.4%) 3A: (+2.4%) MAV: (+3.6%)	LCV: (+0.2%) 2A: (+1.2%) 3A: (+2.0%) MAV: (+2.5%)

Source: Steer analysis of OD data, and publicly available information

6.54 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.55 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.56 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.28: Traffic forecast (With Upside Impacts) for TP1: Sikandra

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	8,363	9,149	10,967	13,092	19,880
Mini LCV	982	1,010	1,068	1,128	1,284
Bus	421	433	460	486	553
LCV	1,409	1,475	1,618	1,772	2,193
2A	665	717	817	856	1,059
3A	645	721	844	907	1,161
MAV	3,362	3,774	4,634	5,257	7,285
OSV	7	7	8	10	13
AADT	**15,854**	**17,286**	**20,417**	**23,507**	**33,427**
PCU's	**31,579**	**34,641**	**41,090**	**46,570**	**64,358**

Source: Steer analysis

Table 6.29: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	9.4%	9.5%	9.3%	8.7%	9.04%
Mini LCV	2.8%	2.8%	2.8%	2.6%	2.71%
Bus	2.8%	3.1%	2.9%	2.6%	2.76%
LCV	4.7%	4.7%	4.7%	4.4%	4.52%
2A	7.8%	6.7%	4.5%	4.4%	4.76%
3A	11.8%	8.1%	5.9%	5.1%	6.05%
MAV	12.3%	10.8%	8.6%	6.7%	8.04%
OSV	7.1%	7.2%	7.2%	6.7%	6.94%
AADT	**9.0%**	**8.7%**	**8.0%**	**7.3%**	**7.74%**
PCU's	**9.7%**	**8.9%**	**7.7%**	**6.7%**	**7.38%**

Source: Steer analysis

Table 6.30: Revenue forecast (With Upside Impacts) for TP1: Sikandra (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	19.6	24.2	33.3	44.2	87.7
Mini LCV	2.3	2.7	3.2	3.8	5.7
Bus	1.8	2.1	2.6	3.1	4.6
LCV	12.2	14.3	18.2	22.6	36.5
2A	6.1	7.3	9.7	11.5	18.6
3A	8.7	11.0	14.9	18.2	30.4
MAV	48.9	61.8	87.8	112.9	204.9
OSV	0.1	0.1	0.1	0.2	0.3
Total Revenue	**99.8**	**123.6**	**169.9**	**216.5**	**388.6**

Source: Steer analysis

Table 6.31: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	23.3%	17.2%	15.2%	14.7%	16.14%
Mini LCV	15.9%	10.1%	8.4%	8.3%	9.39%
Bus	14.9%	11.1%	9.3%	8.0%	9.57%
LCV	17.0%	12.9%	11.3%	10.1%	11.54%
2A	20.4%	15.1%	8.8%	10.0%	11.79%
3A	26.1%	16.3%	10.4%	10.9%	13.29%
MAV	26.5%	19.2%	13.4%	12.7%	15.41%
OSV	20.7%	15.3%	14.0%	12.7%	14.24%
Total	**23.9%**	**17.3%**	**12.9%**	**12.4%**	**14.56%**

Source: Steer analysis

Table 6.32: Traffic forecast (With Upside Impacts) for TP2: Rajadhok

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9,913	11,783	16,737	17,500	26,045
Mini LCV	987	1,015	1,073	1,134	1,290
Bus	444	471	534	538	612
LCV	1,257	1,514	2,166	1,976	2,446
2A	443	496	639	634	784
3A	382	466	667	635	813
MAV	2,363	2,790	3,809	3,879	5,166
OSV	4	4	5	6	8
AADT	**15,793**	**18,539**	**25,632**	**26,301**	**37,164**
PCU's	**27,260**	**32,082**	**44,252**	**44,679**	**61,031**

Source: Steer analysis

Table 6.33: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	18.9%	19.2%	2.3%	8.3%	10.14%
Mini LCV	2.8%	2.8%	2.8%	2.6%	2.71%
Bus	6.0%	6.6%	0.3%	2.6%	3.26%
LCV	20.4%	19.6%	(4.5%)	4.4%	6.88%
2A	12.1%	13.5%	(0.4%)	4.4%	5.89%
3A	21.8%	19.7%	(2.4%)	5.1%	7.84%
MAV	18.0%	16.9%	0.9%	5.9%	8.14%
OSV	6.2%	6.3%	6.2%	5.9%	6.07%
AADT	**17.4%**	**17.6%**	**1.3%**	**7.2%**	**8.93%**
PCU's	**17.7%**	**17.4%**	**0.5%**	**6.4%**	**8.39%**

Source: Steer analysis

Table 6.34: Revenue forecast (With Upside Impacts) for TP2: Rajadhok(In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	21.0	28.4	48.7	57.5	110.7
Mini LCV	2.1	2.4	3.1	3.7	5.5
Bus	1.7	2.1	2.7	3.1	4.6
LCV	10.5	14.3	23.5	24.2	39.3
2A	3.8	4.8	7.1	8.0	12.9
3A	5.1	7.1	11.7	12.6	21.1
MAV	33.9	45.3	71.5	82.4	142.9
OSV	0.1	0.1	0.1	0.1	0.2

Vehicle Type	FY22	FY23	FY25	FY27	FY32
Total Revenue	**78.2**	**104.4**	**168.5**	**191.6**	**337.3**

Source: Steer analysis

Table 6.35: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	35.2%	30.9%	8.6%	14.0%	18.07%
Mini LCV	17.0%	12.9%	9.2%	8.1%	10.11%
Bus	18.8%	14.5%	6.7%	8.1%	10.12%
LCV	36.0%	28.5%	1.5%	10.2%	14.14%
2A	26.6%	21.9%	5.8%	10.2%	13.07%
3A	37.7%	28.8%	3.8%	10.8%	15.16%
MAV	33.5%	25.7%	7.3%	11.7%	15.47%
OSV	20.1%	14.4%	12.9%	11.7%	13.27%
Total Revenue	**33.5%**	**27.0%**	**6.6%**	**12.0%**	**15.73%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.57 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.58 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.36: Traffic forecast (With Downside Impacts) for TP1: Sikandra

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	8,363	8,855	9,943	11,125	14,422
Mini LCV	982	999	1,036	1,072	1,160
Bus	421	428	445	461	499
LCV	1,409	1,450	1,538	1,628	1,857
2A	665	697	757	780	889
3A	645	692	763	798	928
MAV	3,362	3,621	4,116	4,452	5,437
OSV	7	7	8	8	10
AADT	**15,854**	**16,751**	**18,605**	**20,323**	**25,201**
PCU's	**31,579**	**33,496**	**37,275**	**40,306**	**49,091**

Source: Steer analysis

Table 6.37: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	5.9%	6.0%	5.8%	5.3%	5.60%

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
Mini LCV	1.8%	1.8%	1.7%	1.6%	1.68%
Bus	1.8%	1.9%	1.7%	1.6%	1.71%
LCV	2.9%	3.0%	2.9%	2.7%	2.80%
2A	4.8%	4.2%	1.5%	2.7%	2.94%
3A	7.3%	5.0%	2.3%	3.1%	3.70%
MAV	7.7%	6.6%	4.0%	4.1%	4.92%
OSV	4.4%	4.5%	4.4%	4.1%	4.24%
AADT	**5.7%**	**5.4%**	**4.5%**	**4.4%**	**4.74%**
PCU's	**6.1%**	**5.5%**	**4.0%**	**4.0%**	**4.51%**

Source: Steer analysis

Table 6.38: Revenue forecast (With Downside Impacts) for TP1: Sikandra (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	19.6	23.5	28.5	35.6	53.7
Mini LCV	2.3	2.6	3.0	3.4	4.3
Bus	1.8	2.1	2.4	2.7	3.5
LCV	12.2	14.1	16.6	19.3	26.0
2A	6.1	7.1	8.6	9.8	13.1
3A	8.7	10.6	13.1	14.9	20.6
MAV	48.9	59.3	76.0	89.1	129.3
OSV	0.1	0.1	0.1	0.2	0.2
Total Revenue	**99.8**	**119.4**	**148.4**	**175.1**	**250.8**

Source: Steer analysis

Table 6.39: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Sikandra

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	19.4%	10.1%	11.9%	8.6%	10.59%
Mini LCV	14.7%	5.8%	7.6%	4.7%	6.48%
Bus	13.7%	8.0%	5.5%	5.2%	6.68%
LCV	15.0%	8.7%	7.8%	6.1%	7.82%
2A	17.0%	10.0%	6.4%	6.1%	7.97%
3A	20.9%	11.5%	6.5%	6.7%	8.94%
MAV	21.4%	13.2%	8.3%	7.7%	10.22%
OSV	17.6%	10.9%	8.7%	7.7%	9.50%
Total Revenue	**19.6%**	**11.5%**	**8.6%**	**7.5%**	**9.65%**

Source: Steer analysis

Table 6.40: Traffic forecast (With Downside Impacts) for TP2: Rajadhok

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9,913	11,041	13,821	14,192	18,166
Mini LCV	987	1,004	1,041	1,077	1,166
Bus	444	460	498	500	542
LCV	1,257	1,411	1,784	1,671	1,906
2A	443	475	558	554	632
3A	382	432	546	526	611
MAV	2,363	2,624	3,200	3,225	3,843
OSV	4	4	5	5	6
AADT	**15,793**	**17,451**	**21,453**	**21,750**	**26,872**
PCU's	**27,260**	**30,178**	**37,065**	**37,164**	**44,954**

Source: Steer analysis

Table 6.41: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	11.4%	11.9%	1.3%	5.1%	6.24%
Mini LCV	1.8%	1.8%	1.7%	1.6%	1.68%
Bus	3.7%	4.0%	0.2%	1.6%	2.01%
LCV	12.2%	12.5%	(3.2%)	2.7%	4.25%
2A	7.3%	8.4%	(0.3%)	2.7%	3.63%
3A	13.1%	12.4%	(1.9%)	3.1%	4.81%
MAV	11.0%	10.4%	0.4%	3.6%	4.98%
OSV	3.8%	3.9%	3.8%	3.6%	3.71%
AADT	**10.5%**	**10.9%**	**0.7%**	**4.3%**	**5.46%**
PCU's	**10.7%**	**10.8%**	**0.1%**	**3.9%**	**5.13%**

Source: Steer analysis

Table 6.42: Revenue forecast (With Downside Impacts) for TP2: Rajadhok(In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	21.0	26.6	38.5	42.5	65.9
Mini LCV	2.1	2.4	2.9	3.2	4.2
Bus	1.7	2.0	2.5	2.7	3.4
LCV	10.5	13.3	18.8	19.1	26.0
2A	3.8	4.6	6.0	6.5	8.8
3A	5.1	6.6	9.3	9.7	13.4
MAV	33.9	42.6	57.9	63.4	89.8
OSV	0.1	0.1	0.1	0.1	0.1
Total Revenue	**78.2**	**98.2**	**135.9**	**147.1**	**211.7**

Source: Steer analysis

Table 6.43: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Rajadhok

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	26.7%	20.2%	5.1%	9.2%	12.10%
Mini LCV	15.8%	9.3%	5.5%	5.6%	7.28%
Bus	16.2%	10.1%	4.0%	5.2%	6.99%
LCV	26.8%	19.0%	0.8%	6.3%	9.51%
2A	21.2%	14.7%	3.8%	6.3%	8.85%
3A	27.9%	18.7%	2.2%	6.7%	10.05%
MAV	25.5%	16.7%	4.6%	7.2%	10.23%
OSV	17.4%	9.7%	8.2%	7.2%	8.89%
Total Revenue	**25.5%**	**17.7%**	**4.0%**	**7.6%**	**10.47%**

Source: Steer analysis

Summary outlook

6.59 Overall, passenger traffic on the Asset is driven by local movements connecting key urban centres of Jaipur, Agra, Alwar and Bharatpur. Tourism and leisure travel between Jaipur at one end and Bharatpur and Agra at the other also contributes to passenger and bus movements. The Asset is also part of the Golden Triangle corridor consisting of Delhi NCR, Agra and Jaipur which is a key tourism corridor in India. Even though the current ongoing pandemic has impacted the passenger traffic and in particular tourism related traffic, the trend of increased use of personal vehicles has seen good recovery of car traffic in recent months. The subdued level of bus movements is expected to recover as the pandemic recedes and tourism picks up.

6.60 Goods traffic are driven by agricultural commodities, construction-related traffic including stone and sand, apart from a good spread of consumption-related commodities meeting urban demand. The completion of large-scale construction activity in the vicinity of the Asset, combined with limited sand movement and network developments like the construction of the Delhi Mumbai Expressway had temporarily caused diversions which resulted in slowdown in the Asset's traffic growth. These effects have petered out in the recent years and as the economic recovery gathers pace the Asset is expected to see traffic growth aligned with the historical trends observed in the long term. The strong recovery in recent months has shown underlying strength in the traffic growth drivers along the Asset corridor which is expected to continue driving growth on this corridor.

6.61 With the completion of the Dausa-Lalsot road and Jaipur Ring Road in the immediate forecast period and the Agra Ring Road later, both medium-distance and long-distance traffic are slightly increased. The biggest positive impact is expected to be due to the Dausa interchange connecting the Delhi Mumbai expressway to Jaipur through TP2 Rajadhok.

6.62 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.63 With regards to the short-term background growth, we see the following risks:

- The nascent recovery from the pandemic could be subdued due stronger lockdowns being implemented and traffic growth not sustaining the coming months. However, as it was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. A similar trend has been repeated in FY22 with first quarter witnessing subdued trend and the following three quarter witnessing healthy recovery.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure have seen a passive growth in FY22 which expected strong recovery in FY23 onwards.

6.64 With regards to impacts, we see the following risks:

- The gain due to Delhi Mumbai Expressway link being completed could be delayed if the implementation of the expressway is delayed.
- Gain of long-distance traffic from NH27 road and the sand movement would depend on the successful completion of Agra Ring Road.

6.65 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Jaipur, Agra, Bharatpur, Alwar and Delhi NCR. It is also the primary route on the tourism corridor connecting Jaipur with Bharatpur and Agra. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Developments in sandmining

A.1 This appendix provides a chronological account of developments – policy, regulatory and judicial – in sandmining applicable across India and particularly in Rajasthan. Please note that this list is not exhaustive and is meant to gain a high-level understanding of the issues surrounding sandmining that affect movement of sand on the Asset.

Table A.1: History of policy and regulatory changes, and court judgements affecting sandmining

Event	Timeline
National	
Recommendations of MoEF core group	2010
SC ruling - Orders MoEF to formulate guidelines for sustainable sand - mining	Feb FY12
MoEFCC Sustainable Sand Mining Management Guidelines - Calls for site-specific surveys by district administration - Environmental clearance mandatory for all sand mines - DEAC and DEIAA committees for less than 5-hectare mines Stop of mining during monsoon months (June-September)	Mar FY16
Amendment of EIA Notification 2006 - EI clearance mandatory for all small-scale sand mines Treat cluster mines within 500 m as single mine	May FY17
SC ban on sandmining; prohibits 82 large sandmining lease holders	Nov FY18
SC refuses to remove ban	Jan, Aug FY19
Rajasthan	
Mining policy	2015
NGT: Even existing licence holders need to get environmental clearance	Jan FY15
Not clear if manufactured sand can meet demand and quality needs	FY19
"Mining ban give rise to sand mafia"	Oct FY19
SC stays Rajasthan HC order that allowed sandmining at mines with issued LoIs	May FY20
Manufactured sand policy being considered and licences for small plots being allowed	Sept FY19, Jul FY20
Replenishment study of sand mines to be taken up	Aug FY20
Rajasthan HC asks PS (RJ) to issue compounding fee on vehicle – apply consistent approach	Sept FY20
Rajasthan M-sand policy announced	25th Jan 2021

Source: Steer research

B Top 10 OD pairs

B.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Sikandra

Table B.1: CJV top 10 OD pair shares at TP1 Sikandra

	OD Pair	Share
1.	Agra-Jaipur	9.2%
2.	Bharatpur-Jaipur	9.1%
3.	Rest of Alwar-Jaipur	7.1%
4.	Dausa-Sikandra	5.3%
5.	Mahwa-Jaipur	4.5%
6.	Rest of Dausa-Jaipur	4.3%
7.	Jaipur-Sikandra	3.5%
8.	Rest of Mathura-Jaipur	3.1%
9.	Mahwa-Dausa	2.7%
10.	Bharatpur-Dausa	2.4%

Source: Steer analysis of OD data

Table B.2: MAV and OSV top 10 OD pair shares at TP1 Sikandra

	OD Pair	Share
1.	Agra-Jaipur	3.2%
2.	Bharatpur-Jaipur	2.7%
3.	Rest of Gujarat-Rest of Uttar Pradesh	2.1%
4.	Rest of Gujarat-West Bengal	2.0%
5.	Rest of Gujarat-Agra	1.8%
6.	Rest of Gujarat-Lucknow	1.5%
7.	Rest of Alwar-Jaipur	1.3%
8.	Kanpur Nagar-Jaipur	1.3%
9.	Lucknow-Jaipur	1.2%
10.	West Bengal-Jaipur	1.0%

Source: Steer analysis of OD data

TP2 Rajadhok

Table B.3: CJV top 10 OD pair shares at TP2 Rajadhok

	OD Pair	Share
1.	Dausa-Jaipur	40.5%
2.	Agra-Jaipur	8.3%
3.	Bharatpur-Jaipur	6.8%
4.	Rest of Alwar-Jaipur	6.6%
5.	Jaipur-Sikandra	2.7%
6.	Mahwa-Jaipur	2.6%
7.	Rest of Dausa-Jaipur	2.1%
8.	Saharanpur-Jaipur	1.9%
9.	Telangana-Jaipur	1.3%
10.	Dausa-Kanauta	1.3%

Source: Steer analysis of OD data

Table B.4: MAV and OSV top 10 OD pair shares at TP2 Rajadhok

	OD Pair	Share
1.	Dausa-Jaipur	11.2%
2.	Agra-Jaipur	7.4%
3.	Rest of Alwar-Jaipur	4.7%
4.	Bharatpur-Jaipur	4.0%
5.	Rest of Gujarat-Rest of Uttar Pradesh	2.9%
6.	Rest of Gujarat-Agra	2.7%
7.	Rest of Uttar Pradesh-Jaipur	2.1%
8.	Lucknow-Jaipur	1.9%
9.	Mahwa-Jaipur	1.5%
10.	Bassi-Dausa	1.3%

Source: Steer analysis of OD data

C Detailed forecasts

C.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts (with Impacts)

C.2 This section presents the detailed traffic forecasts for the forecast period until FY31, year of expected close of the concession. The following two tables show the traffic growth rates and AADT, respectively.

Table C.1: Traffic forecasts (base + impacts) traffic – TP1 Sikandra

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	8,363	982	421	1,409	665	645	3,362	7	**15,854**	**31,579**
FY23	8,994	1,004	430	1,462	707	706	3,695	7	**17,005**	**34,042**
FY24	9,681	1,027	440	1,518	743	746	3,942	8	**18,106**	**36,155**
FY25	10,418	1,051	452	1,576	785	801	4,359	8	**19,450**	**39,062**
FY26	11,206	1,075	462	1,635	815	836	4,610	8	**20,646**	**41,262**
FY27	12,020	1,098	472	1,695	815	849	4,822	9	**21,780**	**43,183**
FY28	12,879	1,122	482	1,755	844	883	5,085	9	**23,061**	**45,506**
FY29	13,783	1,145	493	1,817	874	919	5,359	10	**24,400**	**47,925**
FY30	14,734	1,169	503	1,879	904	956	5,644	10	**25,800**	**50,443**
FY31	15,738	1,193	513	1,943	935	993	5,942	11	**27,269**	**53,073**
FY32	16,797	1,217	523	2,009	966	1,032	6,252	12	**28,808**	**55,819**

Source: Steer analysis

Table C.2: Traffic forecasts (base + impacts) traffic – TP2 Rajadhok

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	9,913	987	444	1,257	443	382	2,363	4	**15,793**	**27,260**
FY23	11,399	1,009	465	1,461	485	449	2,704	4	**17,977**	**31,101**
FY24	13,613	1,032	495	1,788	549	540	3,127	5	**21,150**	**36,517**
FY25	15,193	1,056	516	1,969	597	604	3,490	5	**23,429**	**40,479**
FY26	14,690	1,080	507	1,751	571	554	3,366	5	**22,524**	**38,610**
FY27	15,705	1,104	518	1,815	591	577	3,529	5	**23,844**	**40,639**
FY28	16,770	1,127	529	1,880	613	601	3,697	6	**25,222**	**42,747**
FY29	17,889	1,151	540	1,946	634	625	3,871	6	**26,662**	**44,938**
FY30	19,061	1,175	551	2,013	656	650	4,052	6	**28,164**	**47,212**
FY31	20,296	1,199	563	2,081	678	676	4,238	6	**29,737**	**49,584**
FY32	21,593	1,223	574	2,151	701	702	4,432	7	**31,383**	**52,054**

Source: Steer analysis

Revenue forecasts (with Impacts)

C.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY41.

Table C.3: Forecasts revenue (INR crores) – TP1 Sikandra

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	19.2	2.3	1.8	12.1	6.0	8.7	48.8	0.1	**99.1**
FY23	23.3	2.6	2.1	14.0	7.1	10.8	60.4	0.1	**120.4**
FY24	25.9	2.8	2.3	15.7	8.1	12.3	69.7	0.1	**136.9**
FY25	29.1	2.9	2.5	17.3	9.1	13.9	81.1	0.1	**156.1**
FY26	33.2	3.2	2.7	18.9	9.9	15.4	90.9	0.2	**174.3**
FY27	37.6	3.4	2.9	20.6	10.4	16.4	100.0	0.2	**191.5**
FY28	42.6	3.7	3.1	22.6	11.4	17.9	110.7	0.2	**212.2**
FY29	47.7	4.0	3.3	24.4	12.4	19.4	121.6	0.2	**233.0**
FY30	53.5	4.2	3.5	26.2	13.3	21.1	133.5	0.2	**255.6**
FY31	59.8	4.5	3.7	28.2	14.3	22.9	147.2	0.3	**280.9**
FY32	66.8	4.8	4.0	30.3	15.4	24.9	161.7	0.3	**308.2**

Source: Steer analysis

Table C.4: Forecasts revenue (INR crores) – TP2 Rajadhok

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	21.0	2.1	1.7	10.5	3.8	5.1	33.9	0.1	78.2
FY23	27.5	2.4	2.1	13.8	4.7	6.8	43.9	0.1	101.2
FY24	35.8	2.7	2.4	18.2	5.7	8.9	54.8	0.1	128.5

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY25	42.3	2.9	2.6	21.0	6.5	10.4	64.4	0.1	150.3
FY26	43.4	3.2	2.7	19.7	6.6	10.1	65.3	0.1	150.9
FY27	49.0	3.4	2.9	21.6	7.2	11.0	71.9	0.1	167.0
FY28	55.2	3.7	3.1	23.5	7.8	12.1	79.6	0.1	185.2
FY29	61.7	4.0	3.3	25.3	8.5	13.2	87.0	0.1	203.1
FY30	68.9	4.2	3.5	27.3	9.1	14.3	95.0	0.1	222.5
FY31	76.7	4.5	3.7	29.4	9.8	15.5	103.5	0.1	243.2
FY32	85.5	4.8	3.9	31.9	10.6	16.7	112.8	0.2	266.4

Source: Steer analysis

D Data collection exercise

D.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table D.1: 7-day TVC counts at TP1 Sikandra

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
27-01-21	TP1	TVC	8,970	880	1,152	1,091	425	795	3,921	7	17,241
28-01-21	TP1	TVC	8,114	938	1,443	1,100	420	806	4,042	10	16,873
29-01-21	TP1	TVC	8,073	937	1,308	1,083	554	825	4,037	8	16,825
30-01-21	TP1	TVC	9,098	1,059	1,548	1,112	524	839	4,249	8	18,437
31-01-21	TP1	TVC	8,589	1,049	1,290	1,069	591	784	4,459	7	17,838
01-02-21	TP1	TVC	8,690	1,082	1,059	1,073	533	771	4,132	9	17,349
02-02-21	TP1	TVC	8,011	1,048	1,172	1,083	548	705	3,962	9	16,538

Source: Steer analysis

Table D.2: 7-day TVC counts at TP2 Rajadhok

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
27-01-21	TP1	TVC	10,362	898	711	1,130	341	456	2,967	5	10,362
28-01-21	TP1	TVC	9,684	1,007	835	1,163	400	499	2,913	1	9,684
29-01-21	TP1	TVC	9,574	983	830	1,122	424	508	2,988	9	9,574
30-01-21	TP1	TVC	10,672	1,181	949	1,151	420	546	3,220	2	10,672
31-01-21	TP1	TVC	10,276	897	733	1,105	463	513	3,306	10	10,276
01-02-21	TP1	TVC	10,689	1,039	706	1,138	343	499	3,062	10	10,689
02-02-21	TP1	TVC	9,469	1,037	789	1,146	409	425	2,850	1	9,469

Source: Steer analysis

Table D.3: Weekly average daily traffic of TVC vs TMS

Toll plaza	Source	CJV+MLCV	LCV	Bus	2 Axle	3A+MAV	OSV	Total
TP1 Sikandra	TVC	9,505	1,282	1,087	514	4,904	8	17,300
	TMS	8,407	731	1,866	222	4,965	-	16,191

Toll plaza	Source	CJV+MLCV	LCV	Bus	2 Axle	3A+MAV	OSV	Total
TP2 Rajadhok	TVC	11,110	793	1,136	400	3,536	5	16,981
	TMS	10,174	678	1,569	149	3,381	-	15,951

Source: Steer analysis, TMS=Traffic data shared by Client

Zone list

Table D.4: Zone list used for OD analysis

Zone No	Zone Name	State
1	Andaman & Nicobar Island	Andaman & Nicobar Island
2	Andhra Pradesh	Andhra Pradesh
3	Arunanchal Pradesh	Arunanchal Pradesh
4	Assam	Assam
5	Bihar	Bihar
6	Chandigarh	Chandigarh
7	Chhattisgarh	Chhattisgarh
8	Dadara & Nagar Havelli	Dadara & Nagar Havelli
9	Daman & Diu	Daman & Diu
10	Goa	Goa
11	Rest of Gujarat	Rest of Gujarat
12	Rest of Haryana	Rest of Haryana
13	Himachal Pradesh	Himachal Pradesh
14	Jammu & Kashmir	Jammu & Kashmir
15	Jharkhand	Jharkhand
16	Karnataka	Karnataka
17	Kerala	Kerala
18	Lakshadweep	Lakshadweep
19	Rest of Madhya Pradesh	Rest of Madhya Pradesh
20	Maharashtra	Maharashtra
21	Manipur	Manipur
22	Meghalaya	Meghalaya
23	Mizoram	Mizoram
24	Nagaland	Nagaland
25	Rest of NCT of Delhi	Rest of NCT of Delhi
26	Puducherry	Puducherry
27	Punjab	Punjab
28	Rest of Rajasthan	Rest of Rajasthan
29	Sikkim	Sikkim
30	Tamil Nadu	Tamil Nadu
31	Telangana	Telangana

Zone No	Zone Name	State
32	Tripura	Tripura
33	Rest of Uttar Pradesh	Rest of Uttar Pradesh
34	Uttarakhand	Uttarakhand
35	West Bengal	West Bengal
36	Odisha	Odisha
37	Jhalawar	Rajasthan
38	Rest of Agra	Uttar Pradesh
39	Jhansi	Uttar Pradesh
40	Ahmadabad	Gujarat
41	Sheopur	Madhya Pradesh
42	Jhunjhunun	Rajasthan
43	Jodhpur	Rajasthan
44	Rest of Ajmer	Rajasthan
45	Shivpuri	Madhya Pradesh
46	Junagadh	Gujarat
47	Shrawasti	Uttar Pradesh
48	Jyotiba Phule Nagar	Uttar Pradesh
49	Kachchh	Gujarat
50	Aligarh	Uttar Pradesh
51	Alirajpur	Madhya Pradesh
52	Siddharth Nagar	Uttar Pradesh
53	Kaithal	Haryana
54	Allahabad	Uttar Pradesh
55	Sidhi	Madhya Pradesh
56	Sikar	Rajasthan
57	Rest of Alwar	Rajasthan
58	Ambala	Haryana
59	Ambedkar Nagar	Uttar Pradesh
60	Singrauli	Madhya Pradesh
61	Amreli	Gujarat
62	Sirohi	Rajasthan
63	Sirsa	Haryana
64	Kannauj	Uttar Pradesh
65	Anand	Gujarat
66	Sitapur	Uttar Pradesh
67	Kanpur Dehat	Uttar Pradesh
68	Kanpur Nagar	Uttar Pradesh
69	Kansiram Nagar	Uttar Pradesh

Zone No	Zone Name	State
70	Anuppur	Madhya Pradesh
71	Sonbhadra	Uttar Pradesh
72	Ashoknagar	Madhya Pradesh
73	Sonipat	Haryana
74	Auraiya	Uttar Pradesh
75	South	NCT of Delhi
76	Karnal	Haryana
77	Azamgarh	Uttar Pradesh
78	Katni	Madhya Pradesh
79	Baghpat	Uttar Pradesh
80	South West	NCT of Delhi
81	Kaushambi	Uttar Pradesh
82	Bahraich	Uttar Pradesh
83	Balaghat	Madhya Pradesh
84	Sultanpur	Uttar Pradesh
85	Kheda	Gujarat
86	Ballia	Uttar Pradesh
87	Surat	Gujarat
88	Kheri	Uttar Pradesh
89	Balrampur	Uttar Pradesh
90	Surendranagar	Gujarat
91	Banas Kantha	Gujarat
92	Banda	Uttar Pradesh
93	Banswara	Rajasthan
94	The Dangs	Gujarat
95	Bara Banki	Uttar Pradesh
96	Baran	Rajasthan
97	Bareilly	Uttar Pradesh
98	Barmer	Rajasthan
99	Tikamgarh	Madhya Pradesh
100	Barwani	Madhya Pradesh
101	Basti	Uttar Pradesh
102	Kota	Rajasthan
103	Tonk	Rajasthan
104	Betul	Madhya Pradesh
105	Udaipur	Rajasthan
106	Kurukshetra	Haryana
107	Rest of Bharatpur	Rajasthan

Zone No	Zone Name	State
108	Bharuch	Gujarat
109	Kushinagar	Uttar Pradesh
110	Bhavnagar	Gujarat
111	Ujjain	Madhya Pradesh
112	Bhilwara	Rajasthan
113	Bhind	Madhya Pradesh
114	Umaria	Madhya Pradesh
115	Bhiwani	Haryana
116	Lalitpur	Uttar Pradesh
117	Unnao	Uttar Pradesh
118	Bhopal	Madhya Pradesh
119	Bijnor	Uttar Pradesh
120	Vadodara	Gujarat
121	Bikaner	Rajasthan
122	Valsad	Gujarat
123	Varanasi	Uttar Pradesh
124	Lucknow	Uttar Pradesh
125	Vidisha	Madhya Pradesh
126	Budaun	Uttar Pradesh
127	Bulandshahr	Uttar Pradesh
128	Maharajganj	Uttar Pradesh
129	Bundi	Rajasthan
130	Burhanpur	Madhya Pradesh
131	Mahendragarh	Haryana
132	West	NCT of Delhi
133	Mahesana	Gujarat
134	Central	NCT of Delhi
135	Mahoba	Uttar Pradesh
136	Mainpuri	Uttar Pradesh
137	West Nimar	Madhya Pradesh
138	Chandauli	Uttar Pradesh
139	Mandla	Madhya Pradesh
140	Mandsaur	Madhya Pradesh
141	Rest of Mathura	Uttar Pradesh
142	Chhatarpur	Madhya Pradesh
143	Yamunanagar	Haryana
144	Mau	Uttar Pradesh
145	Chhindwara	Madhya Pradesh

Zone No	Zone Name	State
146	Jind	Haryana
147	Rest of Dausa	Rajasthan
148	Rest of Karauli	Rajasthan
149	Meerut	Uttar Pradesh
150	Sawai Madhopur	Rajasthan
151	Mewat	Haryana
152	Mirzapur	Uttar Pradesh
153	Chitrakoot	Uttar Pradesh
154	Chittaurgarh	Rajasthan
155	Moradabad	Uttar Pradesh
156	Churu	Rajasthan
157	Morena	Madhya Pradesh
158	Tapi	Gujarat
159	Muzaffarnagar	Uttar Pradesh
160	Damoh	Madhya Pradesh
161	Rest of Nagaur	Rajasthan
162	Datia	Madhya Pradesh
163	Deoria	Uttar Pradesh
164	Dewas	Madhya Pradesh
165	Narmada	Gujarat
166	Narsimhapur	Madhya Pradesh
167	Dhar	Madhya Pradesh
168	Navsari	Gujarat
169	Dhaulpur	Rajasthan
170	Neemuch	Madhya Pradesh
171	New Delhi	NCT of Delhi
172	North	NCT of Delhi
173	Dindori	Madhya Pradesh
174	North East	NCT of Delhi
175	Dohad	Gujarat
176	North West	NCT of Delhi
177	Dungarpur	Rajasthan
178	East	NCT of Delhi
179	Pali	Rajasthan
180	Palwal	Haryana
181	Panch Mahals	Gujarat
182	Panchkula	Haryana

Zone No	Zone Name	State
183	East Nimar	Madhya Pradesh
184	Panipat	Haryana
185	Panna	Madhya Pradesh
186	Etah	Uttar Pradesh
187	Etawah	Uttar Pradesh
188	Faizabad	Uttar Pradesh
189	Faridabad	Haryana
190	Patan	Gujarat
191	Farrukhabad	Uttar Pradesh
192	Fatehabad	Haryana
193	Fatehpur	Uttar Pradesh
194	Firozabad	Uttar Pradesh
195	Pilibhit	Uttar Pradesh
196	Porbandar	Gujarat
197	Gandhinagar	Gujarat
198	Pratapgarh	Rajasthan
199	Ganganagar	Rajasthan
200	Pratapgarh	Uttar Pradesh
201	Rest of Gautam Buddha Nagar	Uttar Pradesh
202	Ghaziabad	Uttar Pradesh
203	Ghazipur	Uttar Pradesh
204	Rae Bareli	Uttar Pradesh
205	Gonda	Uttar Pradesh
206	Gorakhpur	Uttar Pradesh
207	Raisen	Madhya Pradesh
208	Rajgarh	Madhya Pradesh
209	Guna	Madhya Pradesh
210	Rajkot	Gujarat
211	Rajsamand	Rajasthan
212	Gurgaon	Haryana
213	Gwalior	Madhya Pradesh
214	Hamirpur	Uttar Pradesh
215	Rampur	Uttar Pradesh
216	Hanumangarh	Rajasthan
217	Harda	Madhya Pradesh
218	Ratlam	Madhya Pradesh

Zone No	Zone Name	State
219	Hardoi	Uttar Pradesh
220	Mahamaya Nagar	Uttar Pradesh
221	Rewa	Madhya Pradesh
222	Rewari	Haryana
223	Rohtak	Haryana
224	Hisar	Haryana
225	Hoshangabad	Madhya Pradesh
226	Sabar Kantha	Gujarat
227	Sagar	Madhya Pradesh
228	Saharanpur	Uttar Pradesh
229	Indore	Madhya Pradesh
230	Jabalpur	Madhya Pradesh
231	Rest of Jaipur	Rajasthan
232	Jaisalmer	Rajasthan
233	Jalaun	Uttar Pradesh
234	Sant Kabir Nagar	Uttar Pradesh
235	Sant Ravi Das Nagar(bhadohi)	Uttar Pradesh
236	Jalor	Rajasthan
237	Satna	Madhya Pradesh
238	Jamnagar	Gujarat
239	Sehore	Madhya Pradesh
240	Seoni	Madhya Pradesh
241	Shahdol	Madhya Pradesh
242	Jaunpur	Uttar Pradesh
243	Jhabua	Madhya Pradesh
244	Shahjahanpur	Uttar Pradesh
245	Jhajjar	Haryana
246	Shajapur	Madhya Pradesh
247	Agra	Uttar Pradesh
248	Fatehpur Sikri	Uttar Pradesh
249	Vrindavan	Uttar Pradesh
250	Mehandipur	Rajasthan
251	Bharatpur	Rajasthan
252	Mandwar	Rajasthan
253	Jaipur	Rajasthan
254	Mahwa	Rajasthan

Zone No	Zone Name	State
255	Balaheri	Rajasthan
256	Bandikui	Rajasthan
257	Banetha	Rajasthan
258	Banskho	Rajasthan
259	Bhangarh	Rajasthan
260	Brahmbad	Rajasthan
261	Chandrana	Rajasthan
262	Chomu	Rajasthan
263	Dhanawar	Rajasthan
264	Dhiradi	Rajasthan
265	Dolika	Rajasthan
266	Hindaun	Rajasthan
267	Kherli	Rajasthan
268	Kumher	Rajasthan
269	Merta	Rajasthan
270	Nadoti	Rajasthan
271	Neemrana	Rajasthan
272	Nihalpura	Rajasthan
273	Paparda	Rajasthan
274	Rajgarh	Rajasthan
275	Arauda	Rajasthan
276	Bagrana	Rajasthan
277	Bamanpura	Rajasthan
278	Banskho	Rajasthan
279	Bassi	Rajasthan
280	Baswa	Rajasthan
281	Bayana	Rajasthan
282	Bhainsa	Rajasthan
283	Bhandana	Rajasthan
284	Bhandrej	Rajasthan
285	Bhot	Rajasthan
286	Bhusawar	Rajasthan
287	Binua	Rajasthan
288	Chainpura	Rajasthan
289	Chaksu	Rajasthan
290	Dausa	Rajasthan

Zone No	Zone Name	State
291	Deeg	Rajasthan
292	Doodhli	Rajasthan
293	Dopur	Rajasthan
294	Dopur	Rajasthan
295	Dubbi	Rajasthan
296	Geejgarh	Rajasthan
297	Halena	Rajasthan
298	Helak	Rajasthan
299	Jaipur	Rajasthan
300	Jasota	Rajasthan
301	Jhar	Rajasthan
302	Jhera	Rajasthan
303	Kalera	Rajasthan
304	Kanauta	Rajasthan
305	Kanjoli	Rajasthan
306	Khairwal	Rajasthan
307	Khan Bhankri	Rajasthan
308	Kharkara	Rajasthan
309	Kishangarh	Rajasthan
310	Kolwa	Rajasthan
311	Kumha	Rajasthan
312	Lalwas	Rajasthan
313	Lotwara	Rajasthan
314	Lulhara	Rajasthan
315	Luniawas	Rajasthan
316	Madoli	Rajasthan
317	Mahwa	Rajasthan
318	Mariyada	Rajasthan
319	Mehandipur	Rajasthan
320	Mitrapura	Rajasthan
321	Nadbai	Rajasthan
322	Paharsar	Rajasthan
323	Paota	Rajasthan
324	Pipalkhera	Rajasthan
325	Ramshighpura	Rajasthan
326	Raniwas	Rajasthan

Zone No	Zone Name	State
327	Rohtaspura	Rajasthan
328	Sainthal	Rajasthan
329	Sikindra	Rajasthan
330	Sindoli	Rajasthan
331	Singwara	Rajasthan
332	Sinpini	Rajasthan
333	Somara	Rajasthan
334	Sujanpura	Rajasthan
335	Sukhawali	Rajasthan
336	Todabhim	Rajasthan
337	Vamanpura	Rajasthan
338	Weir	Rajasthan
339	Rajadhok	Rajasthan
345	Sikandra	Rajasthan
340	Myanmar	Myanmar
341	Nepal	Nepal
342	Bangladesh	Bangladesh
344	Kasna / Noida	Uttar Pradesh

Source: Steer Analysis

Direction-wise commodity distribution

Table D.5: Commodity distribution towards Jaipur for TP1 Sikandara

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	20%	26%	22%	27%
Construction	3%	2%	2%	3%
Stone	1%	3%	1%	2%
Groceries	7%	11%	12%	14%
Minerals	1%	1%	1%	1%
Manufacturing	27%	20%	25%	18%
Petroleum	1%	4%	3%	2%
Chemical	-	-	-	-
Miscellaneous	6%	6%	5%	6%
Machinery	0%	-	-	1%
Container	-	-	-	-
Empty	28%	27%	25%	25%
Sand	4%	1%	4%	2%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Table D.6: Commodity distribution towards Agra for TP1 Sikandara

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	32%	18%	11%	10%
Construction	7%	10%	11%	21%
Stone	6%	8%	9%	14%
Groceries	12%	13%	14%	12%
Minerals	2%	3%	3%	3%
Manufacturing	14%	17%	20%	19%
Petroleum	6%	11%	14%	9%
Chemical	-	-	-	-
Miscellaneous	7%	7%	6%	5%
Machinery	2%	4%	2%	2%
Container	-	-	-	0%
Empty	11%	5%	7%	4%
Sand	2%	2%	2%	2%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Table D.7: Commodity distribution towards Jaipur for TP2 Rajadhok

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	36%	33%	28%	26%
Construction	6%	6%	8%	6%
Stone	4%	5%	4%	6%
Groceries	6%	6%	9%	10%
Minerals	1%	3%	2%	1%
Manufacturing	23%	20%	18%	16%
Petroleum	1%	2%	1%	1%
Chemical	-	-	-	-
Miscellaneous	1%	2%	3%	2%
Machinery	-	0%	-	0%
Container	0%	-	-	-
Empty	15%	21%	22%	28%
Sand	7%	3%	6%	3%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Table D.8: Commodity distribution towards Agra for TP1 Rajadhok

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	17%	11%	8%	7%
Construction	9%	20%	13%	24%
Stone	12%	9%	20%	19%
Groceries	8%	6%	11%	13%
Minerals	1%	2%	3%	1%
Manufacturing	13%	15%	15%	11%
Petroleum	5%	14%	16%	10%
Chemical	-	-	-	-
Miscellaneous	9%	4%	1%	4%
Machinery	1%	1%	-	1%
Container	-	-	-	-
Empty	24%	18%	12%	8%
Sand	1%	0%	0%	1%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Trip length distribution

Table D.9:Trip length frequency for TP1 Sikandra

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	17%	7%	10%	4%	2%	2%
65-300 km	60%	67%	41%	40%	30%	22%
300-500 km	6%	8%	13%	14%	13%	13%
500-1000 km	10%	13%	18%	17%	18%	20%
>1000 km	8%	5%	18%	26%	36%	44%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Table D.10: Trip length frequency for TP2 Rajadhok

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	47%	27%	40%	22%	17%	13%
65-300 km	38%	53%	30%	36%	29%	29%
300-500 km	3%	5%	6%	8%	6%	8%

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
500-1000 km	7%	10%	14%	16%	25%	20%
>1000 km	5%	6%	10%	17%	24%	30%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre, Vatika Triangle, MG Road, Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Author/originator

Chanda Malhotra

Reviewer/approver

Samhita Indurkar

Other contributors

Vaibhav Gupta, Wasey Khan, Serbjeet Kohli, Anshika Saxena, Aditya Karan

Distribution

Client: Cube Highways Pvt.Steer: Ltd

Version control/issue number

V1.1

Date

April 2022

steer

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence
Kotwa-Muzaffarpur Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304

steer

Report
April 2022

Project Transit: Traffic Due Diligence Kotwa-Muzaffarpur Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Contents

Disclaimer v

Glossary Items i

1 Introduction 0

The assignment 0

Our approach 1

Evolution of COVID-19 pandemic in India in FY21 and FY22 2

Contents of this report 4

2 The Asset 5

Introduction 5

Strategic network 5

Concession and tolling details 7

Key economic activities 8

Alternate Routes 9

3 Traffic Description 10

Introduction 10

Historical trends 10

Key findings of the TVC data analysis 17

Key findings of origin-destination analysis 18

Overview 18

Conclusions 25

4 Socio economic context and traffic growth 27

Introduction 27

Population growth 27

Economic growth 28

5 Traffic Growth Analysis 30

Estimation of background elasticities 30

Overview 30

Forecasts for growth drivers 32

6 Forecast: Base year AADT and Impacts 34

Introduction 34
Base year FY22 AADT estimates 35
Analysis of potential network/developmental impacts 35
Revenue forecasting assumptions 36
Traffic and Revenue forecasts 39
Upside and Downside Cases 41
Traffic and Revenue Forecasts-Upside case 42
Traffic and Revenue Forecasts-Downside case 44
Target revenues and modification of concession period 45
Summary Outlook 46

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 3
Figure 2.1: Asset location in the regional network context 5
Figure 2.2: Asset Context 6
Figure 2.3: Typical cross-sections and toll plazas on the Asset 7
Figure 3.1: Vehicle share at TP1 Parsoni Khem 12
Figure 3.2: Ticket-segmentation for CJV at TP1 15
Figure 3.3: Ticket-segmentation for MAV at TP1 15
Figure 3.4: Comparison between TVC and TMS daily traffic data on TP1 Parsoni Khem 17
Figure 3.5: Comparison between vehicle shares from TVC and TMS WADTs 18
Figure 3.6: Zonal influence at TP1 Parsoni Khem 20
Figure 3.7: Internal-external distribution at TP1 Parsoni Khem 21
Figure 3.8: Commodity distribution at TP1 Parsoni Khem (Total) 23
Figure 3.9: Commodity distribution at TP1 Parsoni Khem (towards Muzaffarpur) 23
Figure 3.10: Commodity distribution at TP1 Parsoni Khem (towards Motihari) 24
Figure 3.11: Trip length distribution TP1 Parsoni Khem 25
Figure 4.1: Evolution of Bihar's state GDP and National GDP 29
Figure 5.1: GDP-GSDP forecast 33
Figure 6.1: Forecast PCUs and growth rates at TP1 Parsoni Khem 41

Tables

Table 1.1: Scope of work and sources of data 0
Table 1.2-1: Summary of Concession 7
Table 2-2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022 8
Table 3-1: PCU factors 10
Table 3-2: Quarterly Traffic Levels at TP1 Parsoni Khem 11
Table 3-3: Revenue (INR Lakhs) by vehicle type at TP1 Parsoni Khem , and AADC (average annual daily collection) 12
Table 3.4: Typical ticket types sold at NHAI plazas 13
Table 3.5: Timeline of national ETC implementation 14
Table 3.6: Percentage of Traffic via FASTag, March 2022 14
Table 3.7: Ticket-segmentation for LCV, Bus and 2A Categories at TP1 Parsoni Khem 16
Table 3-8: Data collection schedule 16
Table 3-9: WADT from TVC counts 17
Table 3-10: sample rates for OD data 19
Table 3-11: Zone aggregations for zonal influence analysis 19
Table 3.12: Commodity categories 22
Table 4-1: CAGR of population in India 27
Table 4-2: Population Growth in India (2001 – 2011) 28
Table 5-1: Identified growth drivers to model traffic growth 31
Table 5-2: Elasticity recommendations for the Asset (Lucknow-Raebarelli) 31
Table 6-1: Adopted SCF for the Asset based on benchmarks 34
Table 6-2: Monthly MADT and Adopted AADT for FY22-TP1 Parsoni Khem 35
Table 6-3: Impact of 6 laning LOS improvement 36
Table 6-4: Trip factors at TP1 Parsoni Khem 37
Table 6-5: Toll segmentation for FY22, TP1 Parsoni Khem (Oct-21 to Mar-22) 37
Table 6-6: Overloading assumptions from FY23 onwards 38
Table 6-7: WPI growth forecast assumptions 38
Table 6-8: FY22 Revenue reconciliation summary (INR Lakhs) 39
Table 6-9: Traffic forecast (with impacts) for TP1 Parsoni Khem 39
Table 6-10: Traffic CAGR (%) for TP1 Parsoni Khem 39
Table 6-11: Revenue forecast (with impacts) for TP1 Parsoni Khem (INR crores) 40
Table 6-12: Revenue growth CAGR (%) for TP1 Parsoni Khem 40

Table 6.13: Summary of Macro Assumptions for upside and downside cases 41
Table 6.14: Summary of impacts on the Assets..... 42
Table 6.15: Summary of impacts on the Assets..... 42
Table 6.16: Traffic forecast (With Upside Impacts) for TP1: Parsoni Khem 42
Table 6.17: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Parsoni Khem..... 43
Table 6.18: Revenue forecast (With Upside Impacts) for TP1: Parsoni Khem (In Cr)..... 43
Table 6.19: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Parsoni Khem..... 43
Table 6.20: Traffic forecast (With Dowside Impacts) for TP1: Parsoni Khem..... 44
Table 6.21: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Parsoni Khem .. 44
Table 6.22: Revenue forecast (With Downside Impacts) for TP1: Parsoni Khem (In Cr)..... 44
Table 6.23: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Parsoni Khem 45
Table 6-24: Target Revenues for Extension 1 45
Table 6-25: Target Revenues for Extension 2 45

Appendices

A Top 10 OD pairs

B Detailed Forecasts

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pvt. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a “pandemic”. As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre- COVID-19and post-COVID-19views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Oversized vehicles
PCU	Passenger Car Unit: it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an Asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get normalised AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on Kotwa-Muzaffarpur Toll Road ("Asset").

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by the client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from Assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination (OD) surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI, and WPI line based on forecasts provided by the client

1.3 This report presents our T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and toll plaza data made available by client. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - Toll Plaza (TMS data) from October 2020 to March 2022
  - Concession agreement and toll notifications
  - Previous studies
  - Bid and Lender studies.
- Steer-commissioned TVC counts from 27th January to 3rd February 2021
- OD data collected from Steer-commissioned surveys which were conducted from 27th January to 28th January 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the Annual Average Daily Traffic (AADT) reported for each of the toll plaza.

1.7 The estimation of future traffic demand on the Asset was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of concession period.

- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset against our Steer knowledge base (e.g., similar Asset types in the same state or on the same corridor), to derive appropriate elasticities.
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.8 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until 03rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery etc.

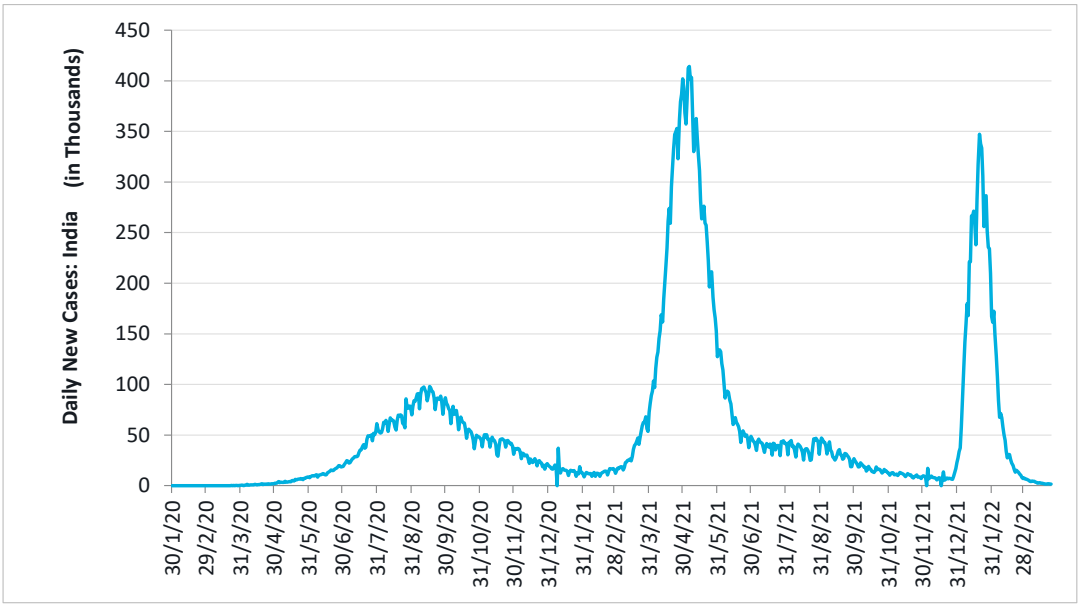
1.9 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

1.10 As the TMS data for the Asset is available from Oct 2020, the observation is that the traffic volumes have ramped up in the Q3FY21 and Q4FY21, which can be driven by following factors - a release of pent-up demand in certain vehicle categories, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network as well as the stabilization of the tolling systems on the Asset. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 14th October 2021.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, **https://data.COVID19india.org/**

1.13 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for first quarter. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but the fatality rate experienced in the third wave was lesser as compared to the former two, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.15 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus services. This considerable shift in mode choice is expected to sustain for longer periods. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely

that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this report

1.16 The report has been divided into 6 chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 and 6 summarise our approach and results on estimating background traffic demand growth along with our key forecasting assumptions, assessment of network impacts, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

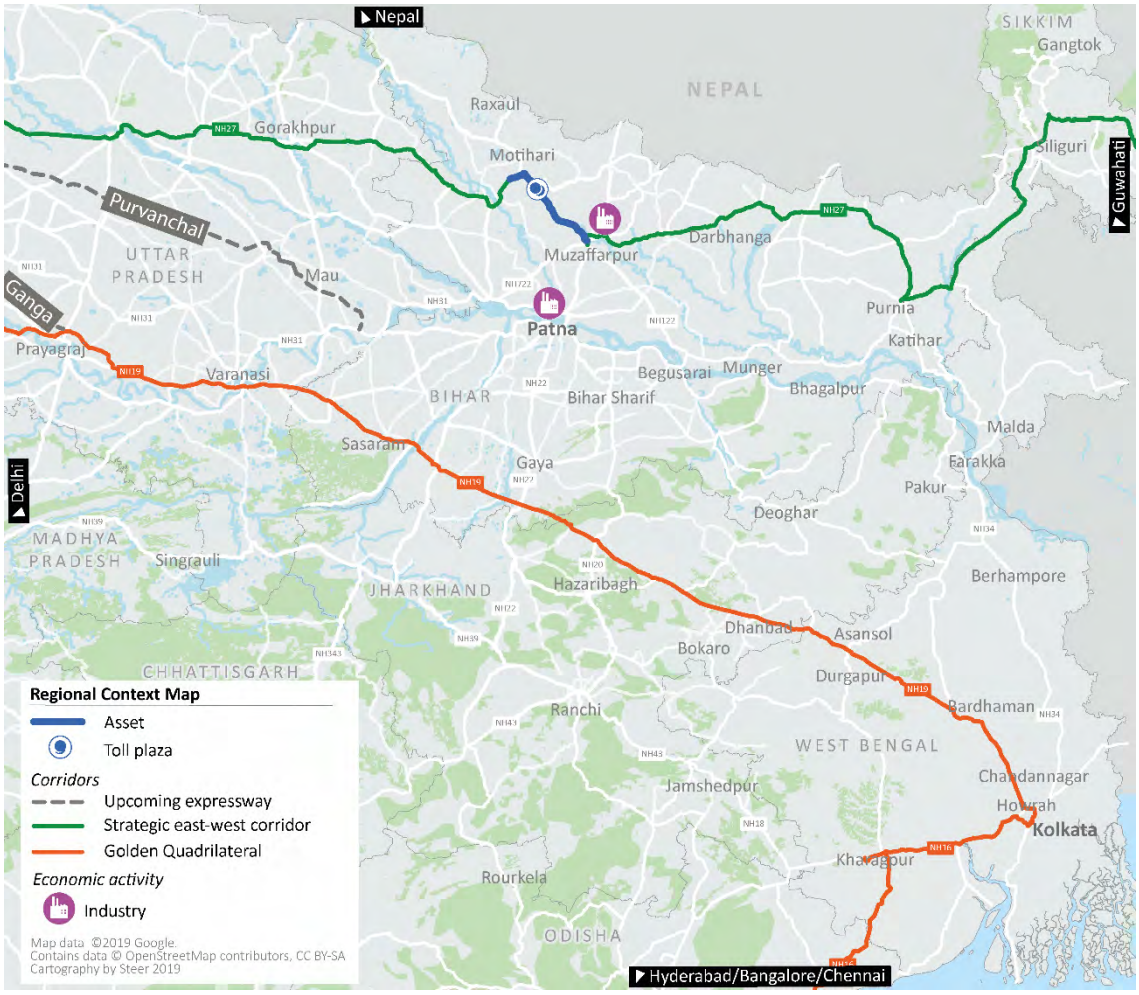
Introduction

2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Bihar, connecting the two cities of Muzaffarpur and Kotwa in the north-west part of Bihar. The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to three different types of strategic movements:

- **Short to medium distance trips** made by cars for local movement between places such as Motihari, Chakia, Motipur and other local destinations mostly for work related purpose.
- **Medium-distance trips** made by light and heavy goods vehicles covering places such as Patna in the southern part of the state and Raxaul near the India-Nepal border thereby catering to the heavy movement of trucks between the two countries for trade purpose.
- **Long-distance trips** made by heavy goods vehicles to provide the east-west connectivity between states such as Uttar Pradesh, Uttarakhand and Delhi, and West Bengal and North-eastern states. The Asset also caters to movement of trucks to countries such as Bangladesh and Bhutan.

2.4 The Asset is an 80 km toll road which forms part of the NH 27 in Bihar. It is a four-lane road with one toll plaza, namely, Parsoni Khem (TP1) at Km 468 + 700 (closer to Kotwa). The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset Context

Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plaza on the Asset has been operational since December 2012 and the client took over the operations in October 2020. There are still 29 years left in the concession period which ends in FY51. The following table presents a summary of the Asset.

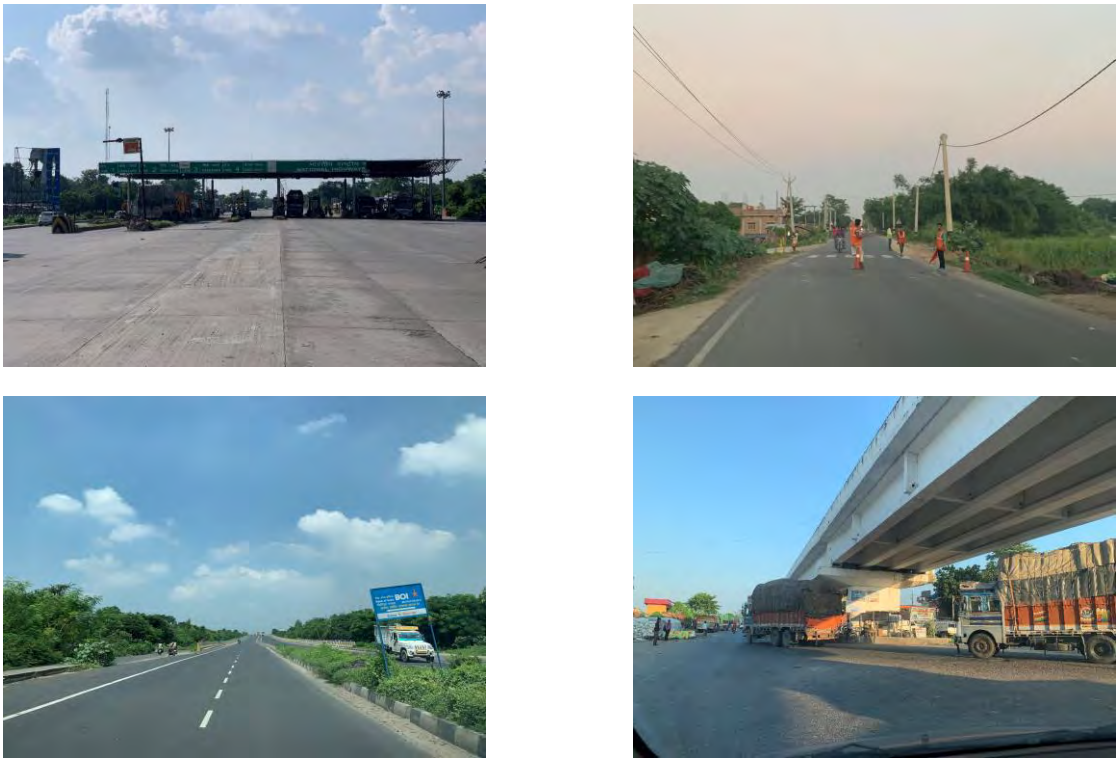
Table 1.2-1: Summary of Concession

Particulars	Details
State	Bihar
Highway and lane configuration	NH 28, four lane
Toll plazas	TP1: Parsoni Khem
Length (km) as per concession agreement, applicable	TP1: 80 km
Commencement of operations	TP1: December 2012
Operated by Client since	October 2020
Concession period	30 years
Last year of concession	FY51

Source: Client data

2.6 The figure below shows a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross-sections and toll plazas on the Asset



Source: Steer site visit

2.7 The tolls on the Asset are collected for the following vehicle categories with rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2-2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022

Type of Vehicle	Single Journey Fee
	TP1 Parsoni Khem
CJV	105
LCV	170
Bus/Truck	360
3A	390
HCM/EME/MAV	560
OSV	685

Source: NHAI Revision of User Fee Rate w.e.f 01.04.2022

2.8 Apart from single tickets, the typical NHAI ticket categories like return, monthly, local personal and local commercial passes are also available on the Asset.

Key economic activities

2.9 Bihar, the third most populous state in India, has agriculture production as one of its major economic activities wherein more than 80% of the state's population is employed in this sector. Sugar is one of the most prominent industries in the state with food processing, dairy, sugar, manufacturing & healthcare as some of the fast-growing industries. The state also has a rich cultural heritage with Bodhgaya and Nalanda as some of the important tourist destinations.

2.10 The Asset lies between the East Champaran and Muzaffarpur districts with Motihari, Chakia, Madhuban, Motipur, Kanti and Muzaffarpur as some of the key settlements along the Asset stretch, along with other traffic generators such as Bettiah, Gopalganj, Patna and Raxual.

2.11 Muzaffarpur, situated on one end of the Asset and considered to be the commercial hub of north Bihar, is majorly an agriculture and food processing led region with rice as the main crop grown here followed by maize. It is also famous for its Lichi and Mangoes which are supplied all over the country. Some of the key large-scale industries in the region includes a thermal power plant in Kanti, Bharat Wagon Workshop plant and Indian Drug Pharmaceutical Limited long with other medium to small scale industries producing biscuits, cloths, flours etc. East Champaran district, located on the other end of the Asset, is largely an agricultural area with presence small scale industries like fisheries industry, agro-based industry and the pearl button industry at Mehsi, located at a distance of 20 km from the toll plaza. The town of Raxaul, situated about 60 km from Kotwa is India's gateway to Nepal as it's the only point in India which is connected to Nepal through railways.

2.12 The Asset provides connectivity between industrial cities of Uttar Pradesh, Uttarakhand, Punjab, Haryana and West Bengal, Bihar and north-eastern states along with providing connectivity with Nepal border at Raxaul, Bihar. Nearly 40% of vehicles on the Asset are cars, which are predominantly commuters between Motihari, Muzaffarpur, Patna and other local destinations along the Asset. The commercial vehicles on the Asset cover a mix of medium and long-distance traffic which are a mix of trucks within Bihar, as well as from north and northeast India.

Alternate Routes

2.13 SH74 acts as an alternate connection between Muzaffarpur and NH27. SH74 is state highway with towns and villages on-route. We believe that the traffic movement patterns on the Asset and the alternate have already been matured. Therefore, the availability of this alternate is not expected to impact the traffic currently plying on the Asset.

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year Monthly Average Daily Traffic (MADT) is established. This data is typically provided by the Client and independently analysed and validated by us using Traffic Volume Count (TVC) information.

PCU Factor assumption

3.4 The PCU values have been taken from '*IRC 64:1990- Guidelines for Capacity of Roads in Rural Areas'*. For MAV, based on the discussion with the Client, we have referred to the rigid and trailer splits in the TVC counts for calculating the effective PCU for MAVs. For rigid trailer trucks we have assumed a PCU factor of 3, whereas for trailer trucks we have assumed a PCU factor of 4.5.

Table 3-1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV*	3.5
OSV	4.5

Source: Steer analysis, * Based on Rigid-Trailer split

Historical trends

3.5 The following table explains the quarterly recorded traffic by vehicle class, over the period of 17 months from October 2020 to March 2022 (as provided by the client).

3.6 The Asset has an even mix of passenger and goods vehicles, the share of the CJVs on the Asset is around 41% while the share of 3A and MAVs is around 48% in FY22. The Asset is a part of the strategic east-west network and provides a critical link for the freight traffic generating from/to Northeast states, West Bengal, New Delhi, Uttar Pradesh and Uttarakhand generating high volumes of heavy trucks on the Asset. The presence of urban settlements like Motihari, Muzaffarpur, Chakia, Motipur etc. in the vicinity of the Asset are the key CJV traffic generators and attractors.

Table 3-2: Quarterly Traffic Levels at TP1 Parsoni Khem

	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	3,750	3,376	3,677	3,197	3,482	4,160	3,857	3,647	3,999	8.8%
LCV	649	615	635	501	490	510	476	492	493	(22.4%)
Bus	636	596	646	775	447	475	391	533	433	(32.9%)
2A	1,062	1,056	1,056	902	1,021	1,073	1,037	998	1,055	(0.1%)
3A	1,051	1,126	1,095	911	992	1,126	1,129	1,027	1,127	2.9%
MAV	2,553	2,445	2,511	2,218	2,156	2,444	2,379	2,294	2,411	(3.9%)
Total	**9,700**	**9,215**	**9,620**	**8,505**	**8,589**	**9,788**	**9,268**	**8,991**	**9,519**	(1.0%)
PCU	**21,953**	**21,241**	**21,856**	**19,521**	**19,187**	**21,549**	**20,614**	**20,133**	**21,073**	(3.6%)

Source: Steer analysis of Client data. FY22# is the average traffic from Oct-21 to Mar-22.

3.7 There is lack of long-term historical data available on the Asset since tolling was started by the client only in October 2020 and both the available years of data, FY21 and FY22 were impacted by COVID-19 related restrictions on traffic movement, therefore a reasonable estimate of historical growth cannot be made on the Asset.

3.8 For a like to like comparison we have compared Q3 and Q4 FY21 with Q3 and Q4 FY22. The MAVs have registered a negative 4% growth in the two quarters of FY22 as compared to FY21. This can be attributed to the two COVID-19 waves in Q1FY22 and Q4FY22 and the above average rainfall across the Asset, and more importantly the average higher MAV traffic Q3 FY21 is influenced by the pent-up demand, which was also observed across other Assets in the country. Overall MAV volumes on the Asset have remained in the range of 2200-2400 trucks. However, 3A trucks have registered a modest growth of 3% over FY21.

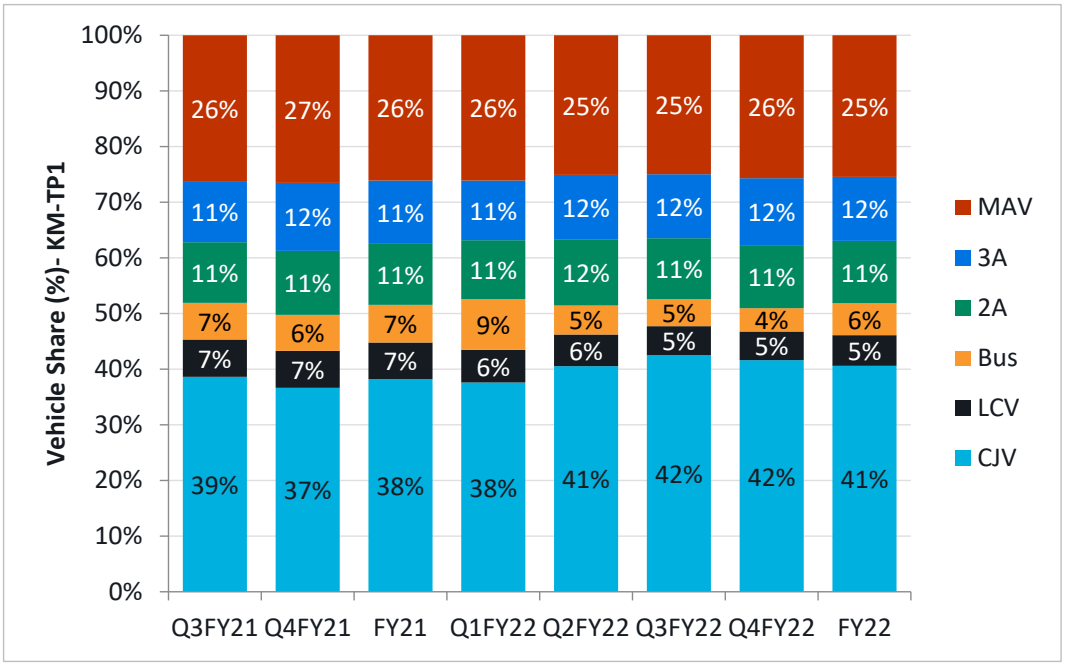
3.9 CJV volumes have registered an 9% growth over FY21, this can be explained by the growth in choice for personal mobility due to COVID-19 related change in user patterns and also can be attributed to bus and train volumes not returning back to pre-pandemic levels. Since, the COVID-19 related effects on user behaviour has now been witnessed for over 24 months now, these shift to personal mobility are believed to be more permanent and we expect will continue in the future.

3.10 LCV's have seen a significant reduction in volumes in FY22 as compared to historical volumes observed on the Asset. This can be explained partly by a reclassification of a number of LCVs into Mini-LCV, which are now reported under the CJV category. This reclassification is driven by the mandatory implementation of FASTag starting Feb-21, where several Mini-LCV's which were being tolled as LCV's are now being tolled under the Mini-LCV category. As per the vehicle classes defined by National Electronic Toll Collection (NETC) and Motor Vehicle act, if the Gross Vehicle Weight (GVW) of the vehicle does not exceed 7,500kg should be classified as a “Light Motor Vehicle (LMV)”. Hence, the mini-LCVs which were being classified as the LCVs

are now being reported under the CJV category, hence, the reduction of the LCVs can be seen from the historical data presented above of the Asset.

3.11 The figure below depicts the category-wise share of traffic at the toll plazas from October 2020 to March 2022. The CJVs have the highest share in the overall traffic and are more or less stable over the dataset followed by MAVs which have a share of around 26% in traffic and contributes to approximately half of the revenue generated on the Asset.

Figure 3.1: Vehicle share at TP1 Parsoni Khem



Source: Steer analysis of Client data

3.12 The following table shows the revenue (in INR Lakhs) by each vehicle type at the toll plaza for FY21 and FY22.

Table 3-3: Revenue (INR Lakhs) by vehicle type at TP1 Parsoni Khem , and AADC (average annual daily collection)

Time Period	Total revenue (INR lakhs)	AADC (INR lakhs)
FY21*	**4,396**	**27**
FY22	**9,044**	**25**

Source: Steer analysis of revenue reported by Client. * FY21 collection started 12th Oct 2020 onwards

3.13 The MAVs are the biggest revenue contributor on the Asset followed by 3As. The CJVs which have the highest share in traffic, contribute 11% in terms of revenue. The average daily revenue observed at the toll plaza from October 2020 to March 2021 was INR 27 lakhs compared to INR 25 lakhs in FY22. The reduction is average revenue in FY22 can be attributed to multiple factors— the effect of two COVID-19 waves in the FY22, above average monsoon witnessed in FY22 and the dataset for FY21 being partial and more importantly of the period which had a pent-up demand post first wave of COVID-19.

Toll Frequencies

3.14 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculated the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.15 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets as long haul trips are attributed to this vehicle category. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the Asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.16 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows for a return journey within a day with a 50% discount on the return trip
Monthly Pass	Discounted single entry ticket for users who intend to undertake multiple trips through the toll plaza in any given month. 50 trips allowed under a monthly pass.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.17 Further, the toll plazas also record violations which are non-paying users, who are not officially allowed under exemptions category but are forced exemptions. For the Asset, the segmentation discussed below reports Exemption and violations together.

3.18 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

Impact of FASTag implementation

3.19 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via “FASTag”. The timeline of ETC implementation is presented in the following table.

Table 3.5: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.20 With the FASTag implementation in December 2019, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls.

3.21 On the Asset, the FASTag penetration has increased to around 96% overall by March FY22. It has increased from 79% in March 21 to 87% in March 22 for CJVs while for MAV category it has reached almost 100%. The increased use of FASTag in FY20-21 ensured efficient tolling operations as well as increased compliance. These high penetration levels have led to improvement in overall service levels of the toll plaza and reduction in the transaction time.

Table 3.6: Percentage of Traffic via FASTag, March 2022

Toll Plaza	CJV	LCV	Bus	MAV
Parsoni khem toll plaza	87%	97%	99%	100%

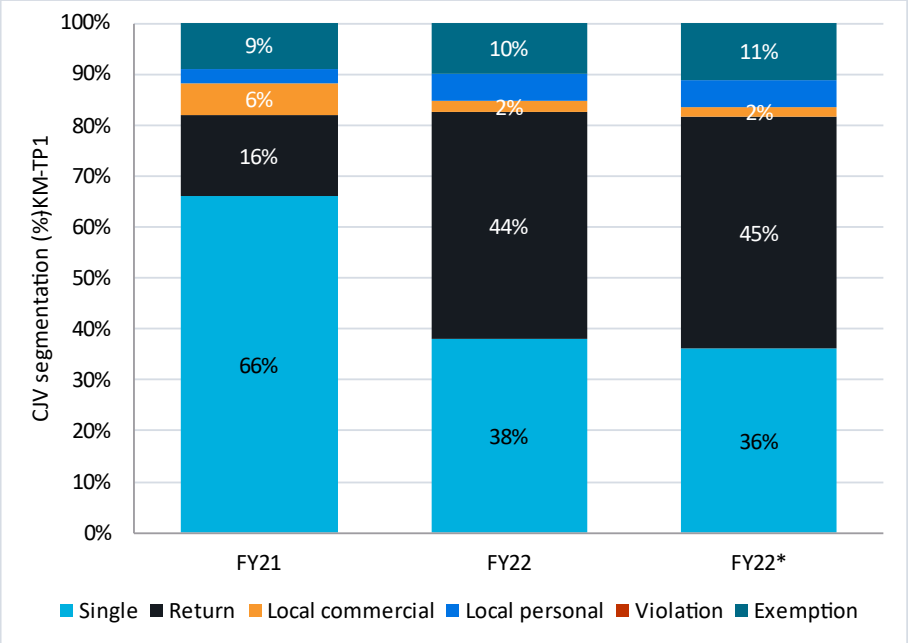
Source: Steer Analysis

Share of traffic by payment type

3.22 FY21 was a partial year in terms of operation of the toll plaza. Further, there was a change in ticket patterns due to the mandatory implementation of FASTag as a mode of payment (share of single tickets increased in FY21). FY22 was also impacted by 2nd wave of COVID-19 in Q1 and Q2 of FY22. Hence during this period travel patterns were also disrupted, with more shorter trips being undertaken since several states implemented state entry barriers, resulting in an increase in the proportion of short distance trips. By Q3FY22 travel patterns returned to normal levels and hence, it is assumed that an average of segmentation from Oct-21 up to Mar-22 can be considered to follow normal travel behaviour on the Asset. Hence the resultant segmentation has been assumed as the forecast segmentation as well.

3.23 The figures below show ticket segmentation for CJV and MAV categories, for FY21, full FY22 and Oct-Mar average of FY22 or FY22*.

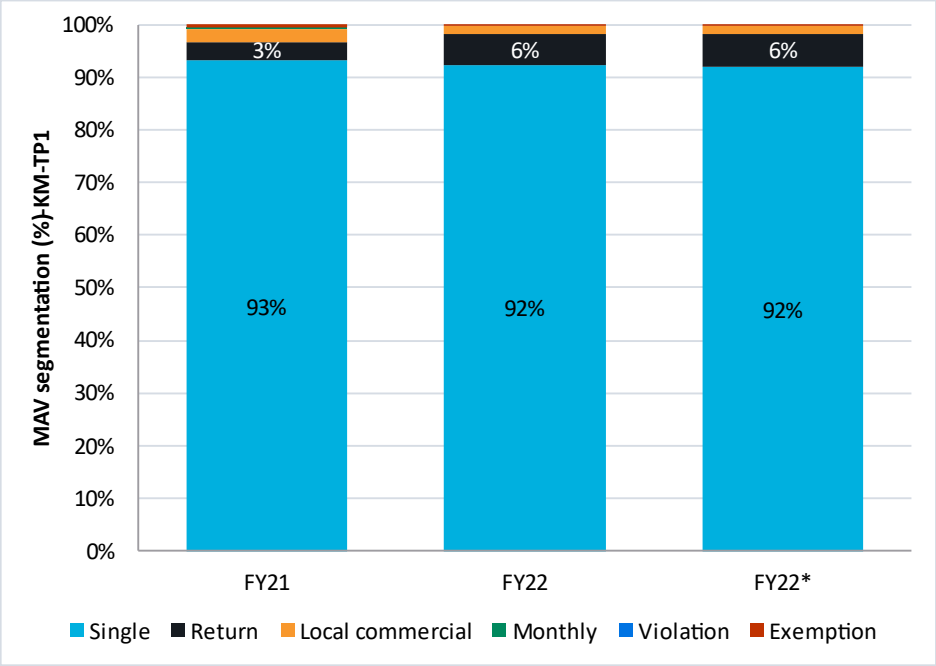
Figure 3.2: Ticket-segmentation for CJV at TP1



Source: Steer analysis of Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

3.24 As shown in the chart above, from the period of Oct-20 to Mar-21, over 60% of the CJVs paid for single journeys with the remainder ticket-share being made up of return tickets, local passes, and exemptions. However, in FY22 the segmentation of CJV category has stabilised with single reduction in single journey and increase in return journeys, this shift of the segmentation can be attributed to the greater adoption of FASTag by users and trip patterns returning to normal levels.

Figure 3.3: Ticket-segmentation for MAV at TP1



Source: Steer analysis of Client data (FY21 represents Oct-20 to Mar-21 data, FY22* represents Oct-21 to Mar-22 data)

3.25 MAVs are observed to have high share of single tickets which is aligned to observation of MAVs doing medium to long distance trips on the Asset. As discussed, and validated from the OD data, around 70% on the Asset travel >500 kms. A slight increase in return tickets is visible due to implementation of FASTag, allowing trucks to avail return journey discounts if they return within 24 hrs.

3.26 The following table depicts the FY22 segmentation for LCV, Bus and 2A category for the Parsoni Khem toll plaza.

Table 3.7: Ticket-segmentation for LCV, Bus and 2A Categories at TP1 Parsoni Khem

Ticket Category	LCV	Bus	2A
Single	36%	50%	72%
Return	53%	48%	25%
Local commercial	7%	2%	3%
Monthly	0%	0%	0%
Local personal	0%	0%	0%
Violation	0%	0%	0%
Exemption	4%	0%	1%

Source: Steer analysis

3.27 The share of return trips for the LCV category is around 53% compared to 25% for 2As, as 2As travel longer distance. This has been discussed in detail in the subsequent sections.

Data Collection exercise

3.28 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. While OD survey data were provided by the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3-8: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	State time
TP1 Parsoni Khem	27 Jan 2021	03 Feb 2021	0000-2359	27 Jan 2021	0900 hours

Source: Steer analysis

3.29 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.30 Taking an average of the seven-day TVC counts (27th Jan – 3rd Feb 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Table 3-9: WADT from TVC counts

Toll Plaza	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
Parsoni Khem	3,088	698	648	771	776	1,061	2,334	-	9,374

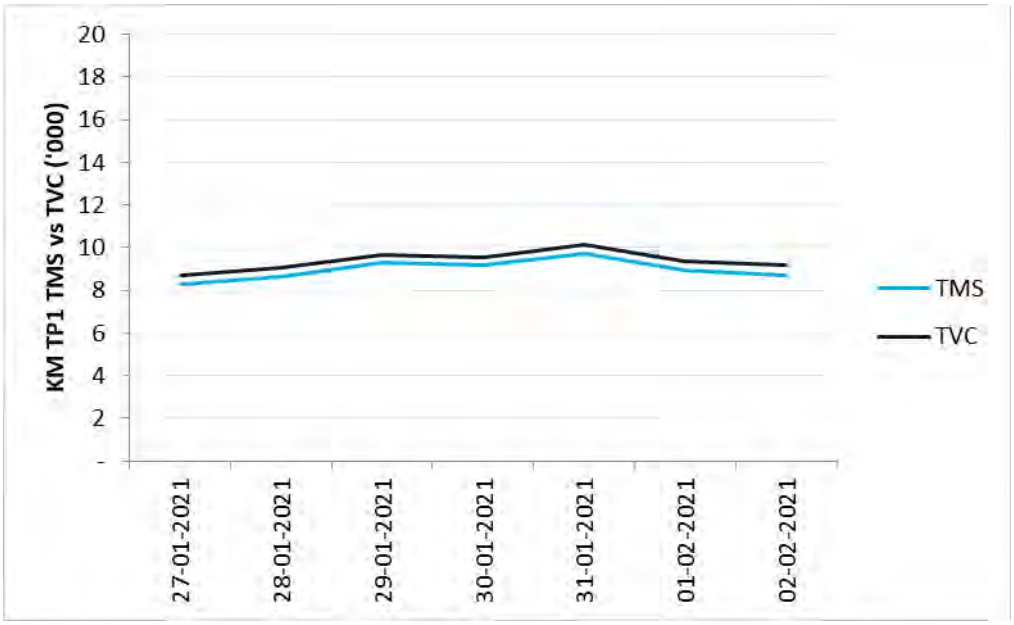
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.31 As we use the TMS data to estimate the base year MADT, we have used our TVC data to validate the TMS data on those days, as provided by the Client.

3.32 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas.

Figure 3.4: Comparison between TVC and TMS daily traffic data on TP1 Parsoni Khem



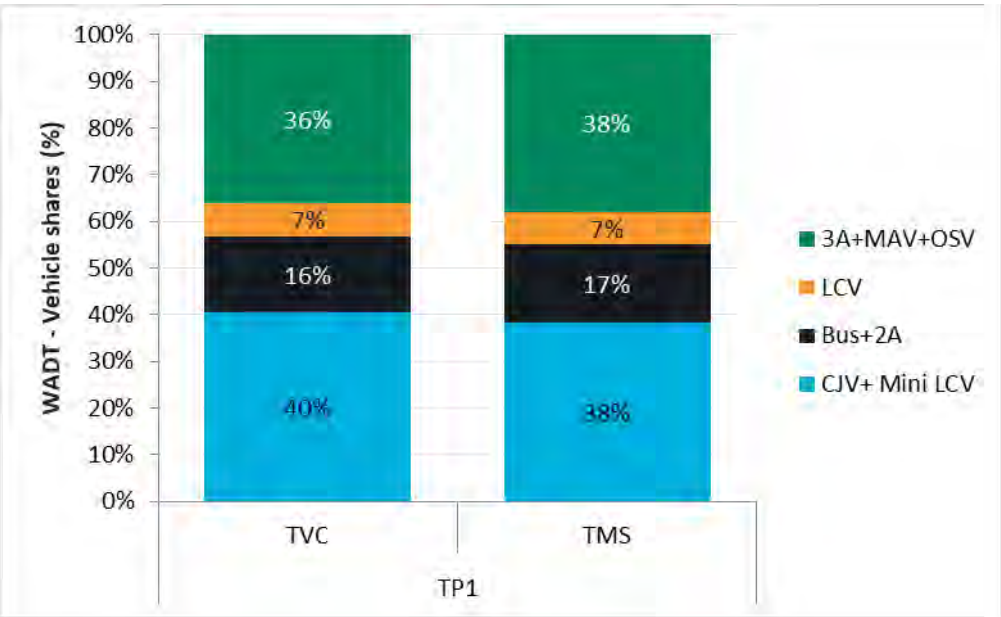
Source: Steer analysis of TVC and Client TMS data

3.33 The figure above shows that the total WADT count as provided by TVC data is 5% higher than those reported by the TMS data. This difference is mainly because of the difference in the data for CJV+Mini LCV which could be attributed to technical differences between the two mechanisms used to obtain the volumes and common misclassification of vehicle categories.

3.34 The figure below compares the shares of vehicle types as observed through the TVC and TMS data. As can be seen, whilst the share of CJV+ Mini LCV is higher for TVC compared to TMS, it is vice-versa for other vehicle categories except for LCV where it's an exact match between TVC and TMS data. This difference can be attributed to common misclassification of vehicle categories.

3.35 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Figure 3.5: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.36 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.37 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.38 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of

analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples by the TVC count observed on the same date for each vehicle category at the toll plaza. Table 3-10 below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3-10: sample rates for OD data

Vehicle type	TP1 Parsoni Khem
CJV	24%
Mini Bus + Bus	152%
Mini LCV + LCV	23%
2A	78%
3A	99%
MAV + OSV	83%
Total	62%

Source: Steer analysis of OD data

Zone Categories

3.39 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3-11: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Bihar	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Delhi NCR	Delhi NCR
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central India	Madhya Pradesh, Chhattisgarh
West India	Gujarat and Maharashtra
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states
Outside India	Nepal, Bhutan and Bangladesh

Source: Steer analysis

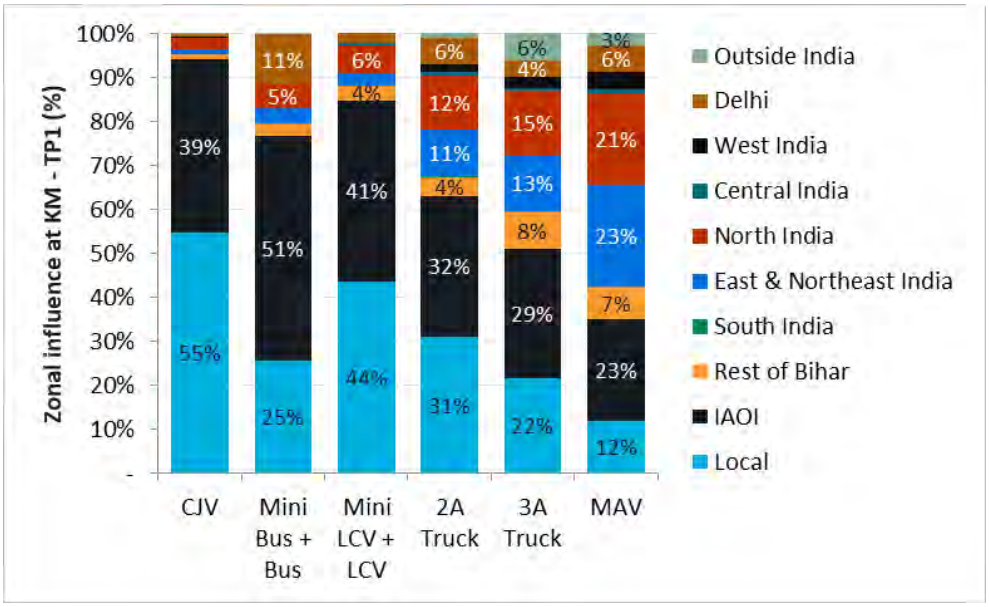
Zonal influence

3.40 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[1] at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.41 As can be seen from the figure below, there is a higher share of local trips for both the passenger and commercial vehicles wherein Local and IAOI zones such as Muzaffarpur, Chakia, Motipur etc have the greatest influence on CJV, Buses and LCV, with more than 80% of the total share. These shares decrease with axle numbers, indicating that majority of the local movement is led by smaller vehicles. This analysis is further supported by the result of the top 10 OD pairs as given in the appendices which shows that the majority of the trips originate and end in local and IAOI areas for passenger traffic whereas for the goods traffic, places such as Assam, Delhi, Bangladesh and Uttar Pradesh feature at the top of the OD pair list.

3.42 Outside Bihar, it is seen that places in North India such as Delhi, Gorakhpur, Kanpur, Dehradun, Punjab and Jaipur, and those in East & Northeast India like Siliguri, Guwahati, Kolkata and Haldia have a significant influence of around 20% on the heavy goods traffic thereby highlighting that the Asset plays an integral part in catering to the long-distance movement of traffic. There is also an influence of 6% and 3% for 3A and MAVs respectively from areas outside the country such as Nepal and Bangladesh signifying the importance of the Asset in international trade as well.

Figure 3.6: Zonal influence at TP1 Parsoni Khem



Source: Steer analysis of OD data

[1] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Internal External analysis

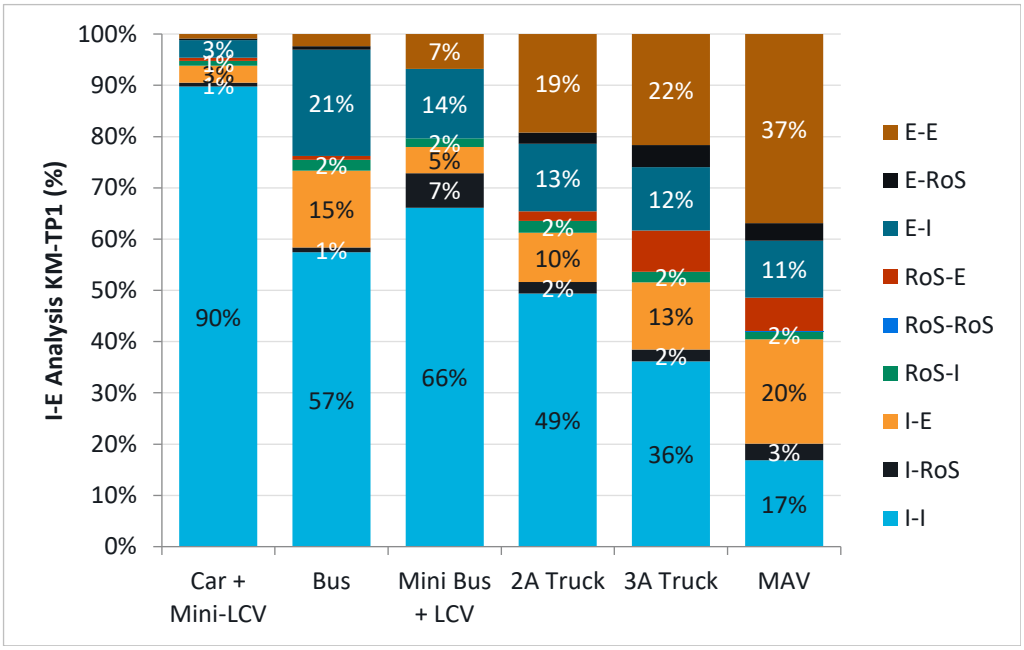
3.43 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e., through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

3.44 The figure below shows the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

3.45 In line with our understanding from zonal influence analysis above and site visits, more than 50% of the passenger traffic have trips both originating and ending within the internal zones highlighting the significant movement of cars and buses within local areas. There is almost negligible movement of traffic from and to places in the rest of the state i.e, areas within Bihar which are located outside the local/IAOI zones.

3.46 The long-distance nature of the 3A and MAV traffic is reflected in this analysis as around 22% and 37% of the trips for 3A and MAV respectively both originate and end in areas lying outside the state.

Figure 3.7: Internal-external distribution at TP1 Parsoni Khem



Source: Steer analysis of OD data

Commodity distribution

3.47 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.12: Commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN
Cement	CMT	CMT

Source: Steer Analysis

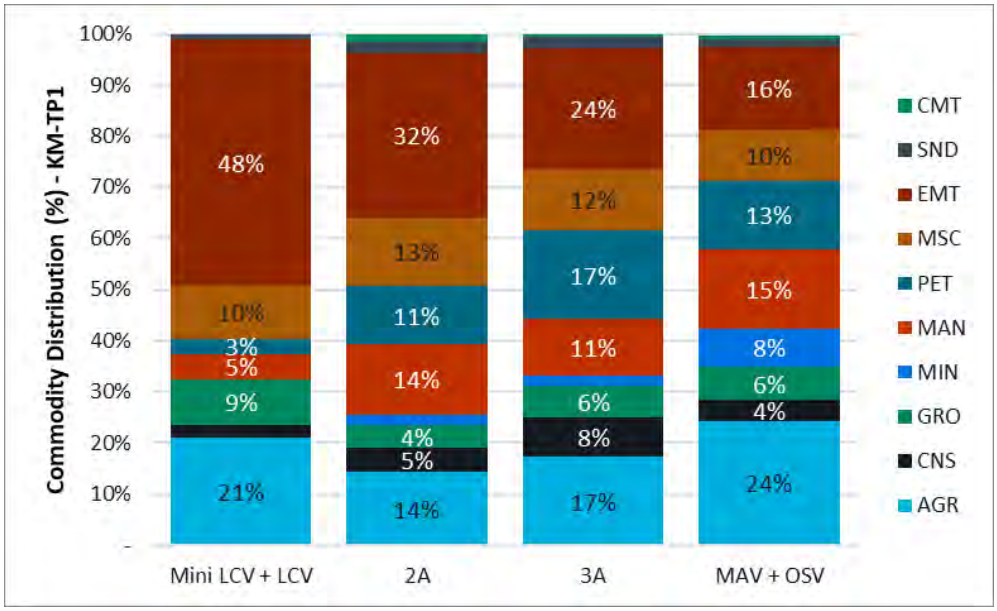
3.48 The following figures present the commodity distribution for goods vehicles at the two toll plazas, at the total level and also split by direction, towards Motihari and towards Muzaffarpur.

3.49 Agricultural items such as rice, wheat, maize and sugarcane were the top commodity category carried by both 3A and MAV traffic with a 17% and 24% share respectively. This was followed by 15% of the MAV's carrying manufacturing goods such as rubber, plastic and medicine and 17% of the 3A vehicles transporting petroleum products like oil, gas and diesel. The light goods vehicle shows a similar mix of commodities with agricultural items taking the lead share given that Bihar is a largely agrarian state, followed by manufacturing and petroleum goods. A large number of industries are located in Muzaffarpur, contributing to high share of manufacturing and finished commodities carried on the Asset.

3.50 Looking by direction, a slightly higher share of vehicles across all categories are empty moving in the direction of Muzaffarpur compared to those moving towards Motihari, including 58% empty LCVs. A relatively higher share of petroleum products is carried by the goods traffic

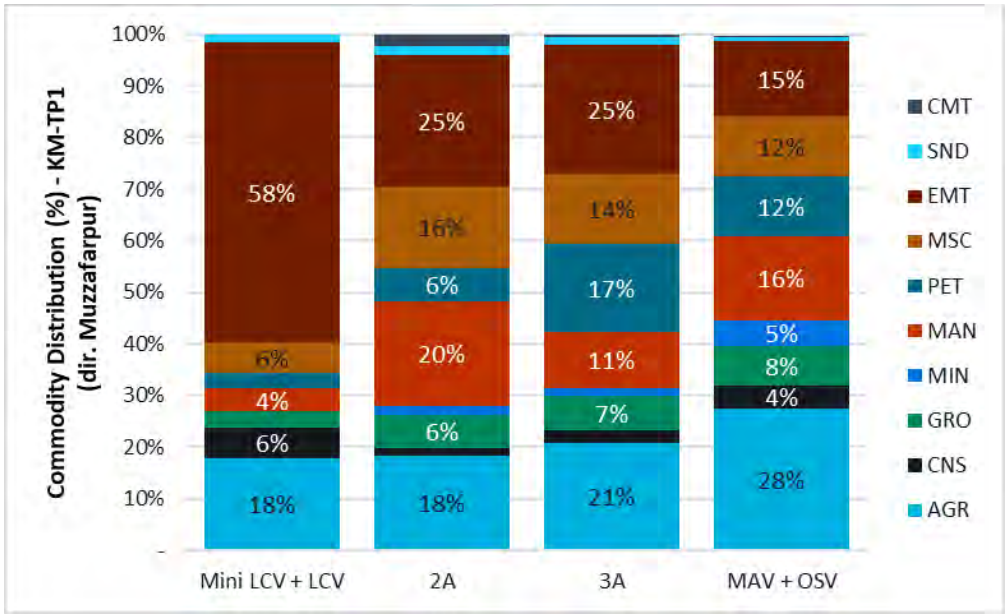
moving in the direction of Motahari, wherein the share of 2A traffic carrying petroleum products was 9% higher than those going towards Muzaffarpur, originating from places such as Patna, Haldia and Barauni, which is an industrial town in Bihar and home to the Barauni refinery. Also, share of traffic carrying agriculture products in the direction of Muzaffarpur is relatively higher which could be attributed to the agriculture items being transported from rich agrarian states like Uttar Pradesh and Punjab.

Figure 3.8: Commodity distribution at TP1 Parsoni Khem (Total)



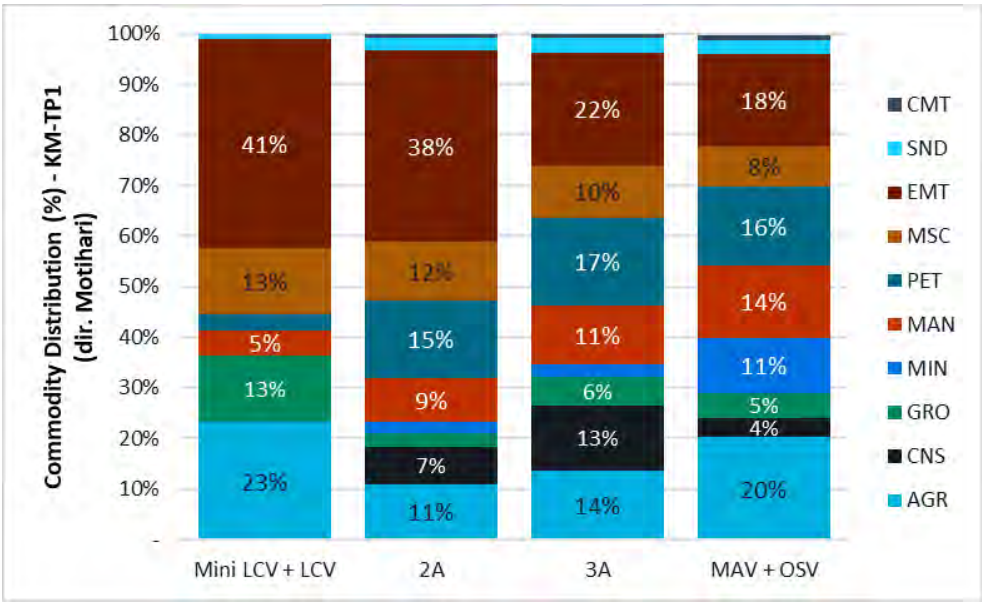
Source: Steer analysis of OD data

Figure 3.9: Commodity distribution at TP1 Parsoni Khem (towards Muzaffarpur)



Source: Steer analysis of OD data

Figure 3.10: Commodity distribution at TP1 Parsoni Khem (towards Motihari)



Source: Steer analysis of OD data

Trip length analysis

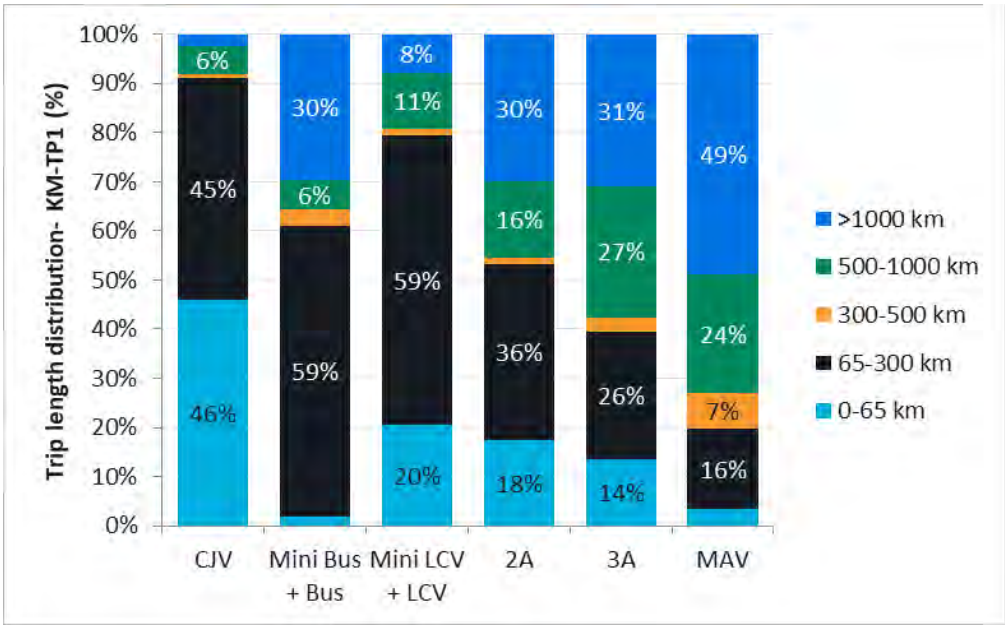
3.51 Trip-length distribution provides the distance-based profile of various vehicle types. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[2]

3.52 Supporting the observations made in zonal & internal-external analysis in the previous sections, the figure below highlights that more than 90% of CJVs travel shorter distances up to 300 kms, contributing to the local movements on the Assets. Further, more than 50% of the bus/mini bus travel up to 300 kms, however a significant share (30%) also travel longer distances of more than 1000 kms to places such as Delhi, Jaipur, Ahmedabad and Punjab.

3.53 As expected, the Asset caters to the long-distance movement for a significant proportion of commercial traffic as around 60-70% of the 3A and MAVs cover distances ranging from 500 km to more than 1000 km.

[2] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.11: Trip length distribution TP1 Parsoni Khem



Source: Steer analysis of OD data

Conclusions

3.54 In summary, as per the traffic volume data, CJVs contribute to the highest share in traffic around 38% followed by MAVs with 26% share and 3As with an average of 11% share, rest of the volumes are contributed by LCV, Bus and 2A. Even though CJVs make up for the highest share in traffic, MAVs are the biggest revenue contributor.

3.55 The analysis on ticket-segmentation shows that for both CJVs and MAVs, single journey tickets accounts for the most dominant ticket category. The Asset has observed up to 100% of transactions via ETC for MAV by Mar-22.

3.56 The TVC-TMS analysis highlights minor variation between the two datasets wherein at the total level, TVC is approximately 5% higher than the TMS data wherein the difference in CJV+Mini LCV contributes the most to the overall delta, which could be due to technical differences between the two mechanisms used to obtain the volumes. However, the difference is minor for the larger revenue generating categories (3A, MAV, and OSV combined), 1% at a total level.

3.57 The OD analysis found that in terms of zonal influence, the passenger and commercial traffic is heavily influenced by local areas such Muzaffarpur, Chakia, Motipur with the influence ranging from 94% for CJVs, 35% for MAVs and 51% for 3A vehicles, which is also in line with our understanding gained from the site visit. There is also an influence of 6% and 3% for 3A and MAVs respectively from areas outside the country such as Nepal and Bangladesh signifying the importance of the Asset in international trade as well.

3.58 The key commodities transported on the Asset includes agricultural items such as rice, wheat, maize and sugarcane by both the heavy goods and light goods vehicle followed by manufacturing goods such as rubber, plastic and medicine and petroleum products like oil, gas and diesel. It is also observed that a slightly higher share of vehicles across all categories are empty moving in the direction of Muzaffarpur compared to those moving towards Motihari. Further, a relatively higher share of petroleum products is carried by the goods traffic moving

in the direction of Motahari and share of traffic carrying agriculture products in the direction of Muzaffarpur is relatively more which could be attributed to the agriculture items being transported from rich agrarian states like Uttar Pradesh and Punjab.

3.59 The internal external distribution highlights the short distance nature of the passenger vehicle share on the Asset with more than 50% of the traffic both originating and ending within the internal zones. Whereas around 22% and 37% of the trips for 3A and MAV respectively both originate and end in areas lying outside the state thereby highlighting the long-distance nature of the 3A and MAV traffic. This is further supported by the top 10 OD pairs for this Asset as well as the trip length distribution which shows that more than 90% of cars travel shorter distances up to 300 kms whereas a significant 30% bus/mini bus travel longer distances of more than 1000 kms to places such as Delhi, Jaipur, Ahmedabad and Punjab, and around 60-70% of the 3A and MAVs cover distances ranging from 500 km to more than 1000 km.

3.60 Therefore, analysing the vehicle share on the Asset and understanding the OD analysis, CJVs make up for the highest share of traffic and significantly contributed to the local traffic share, however the largest contribution to the revenue share is made by MAV and 3A traffic, wherein agriculture is the top commodity category transported on the Asset by both the heavy and light goods vehicles.

4 Socio economic context and traffic growth

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the roads are in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the region where the Asset is located and the country. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Asset.

4.2 In turn, the change in the relative competitive position of the Asset (and thus of the traffic capture they can achieve) derives from how the relative offer for the roads changes, i.e. the service offered, and the tolls charged on the project roads, in comparison to that on competing roads; and whether any competing road facilities are planned.

4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the regions surrounding the Asset.

Population growth

4.4 We have analysed the key socioeconomic drivers of the background traffic demand in the Bihar state, where the Asset is located.

National level

4.5 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4-1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth.

State level

4.6 The following table shows the evolution of population in Bihar state compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, the state has grown at a significantly higher rate than the country average, in the decade between 2001 and 2011.

Table 4-2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Bihar	83.0	74.3	8.7	104.1	92.3	11.8	2.3%	2.2%	3.1%
India	1,028.7	742.6	286.1	1,210.9	833.7	377.1	1.6%	1.2%	2.8%

Source: Ministry of Housing and Urban Affairs – Census Data,
http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf

4.7 Due to the complexities of the patterns in which urbanisation takes place, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide a socio-economic context of the trend in the region in which the Asset is located.

Economic growth

GDP and GSDP Growth

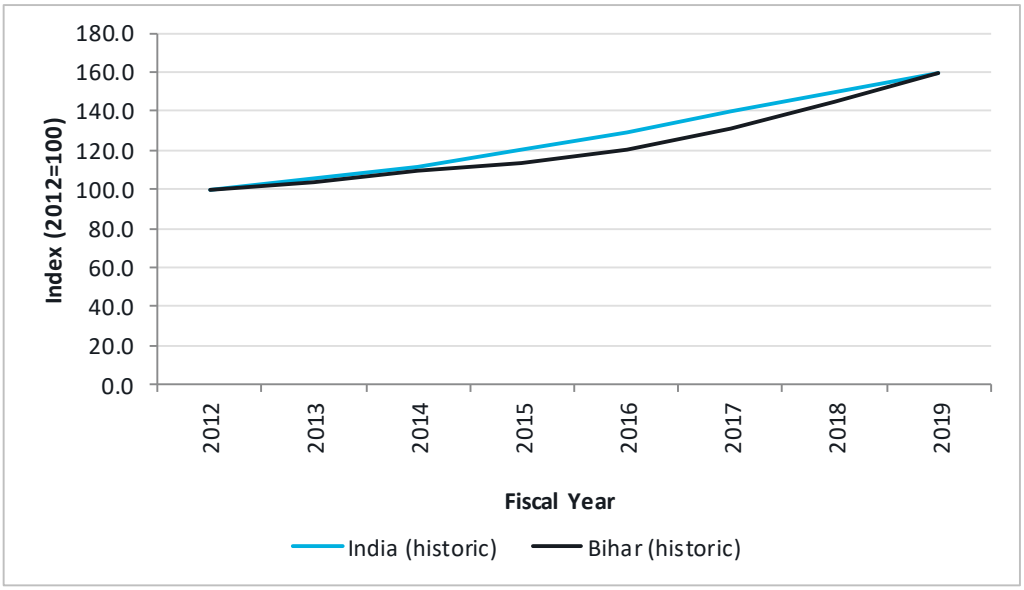
4.8 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.9 The economic performance of Bihar has been weaker than the country as a whole in the last decade. However, lately in FY19, the state which was one considered a laggard has picked up the growth impetus and has begun to catch up with the national trends. The state contributes approximately 3% to India's GDP.

4.10 Bihar is considered to be largely an agrarian state, with around 80% of population dependent upon agriculture as a livelihood. The state is one of the largest producers of vegetables and fruits in the country, especially, sugarcane, banana, mango and eggplant.

4.11 The following figures illustrates the evolution of Bihar's GSDP during FY12-FY19.

Figure 4.1: Evolution of Bihar's state GDP and National GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

5 Traffic Growth Analysis

Introduction

5.1 In this section, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 In the absence of historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

Overview

5.5 For brownfield assets, where sufficient historical traffic evolution is available, it is common practice to use regression model analysis to determine the relationship, expressed as elasticity, between traffic growth and key socioeconomic drivers. This relationship is then applied to assumptions of future socio-economic evolution to estimate future traffic growth.

5.6 As for the Asset under consideration, long time series data is not available. Some inferences of a historical trend could be drawn from the Indian Highway Management Company Limited (IHMCL) data, however, none of the datasets were robust enough to perform a trend analysis. Therefore, we undertook a benchmark in order to estimate our forecast elasticities from Bid and Lender studies.

5.7 In terms of selection of growth drivers for vehicle types, in general we have assumed state GDP as the key driving factor for the passenger traffic given this traffic is generally driven by the local economies of the cities and state containing the Asset. The heavier commercial vehicles generally ply long-distance, and the underlying growth is governed by the general economies of several states or nation as whole.

5.8 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

5.9 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5-1: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP Bihar
Car		100%
LCV		100%
Bus		100%
2A		100%
3A	100%	
MAV	100%	

Source: Steer

5.10 The sections below detail out the reasoning for selection of respective growth driver(s) for each vehicle category.

Table 5-2: Elasticity recommendations for the Asset (Lucknow-Raebarelli)

Vehicle Category	Growth Driver	Elasticity	Comments
CJV	GSDP Bihar	1.0	CJV cater to local movement between Motihari, Muzaffarpur, Kotwa, and Patna. Around 94% of the trips have one end of their trip in Bihar. Strong traffic growth is benchmarked to reference Assets
Buses	GSDP Bihar	0.3	Buses tend to grow as the intercity connections improve. With Bihar being a state, which is growing, buses tend to play an important role linking key cities in the state. Around 80-90% of trips are within 65-300 km.
LCV	GSDP Bihar	0.4	LCV/2A categories cater to local movement within the state, contributing to the local consumption demand of these cities. 2A growth is lower than MAV growth as the goods being transported on this corridor are travelling long distance and carrying manufacturing or agriculture, which are more efficient to move using heavy trucks
2A	GSDP Bihar	0.4	
3A	GDP	0.6	3A/MAV: Agri and groceries are the prime commodities carried from northern parts of the country to northeast and eastern states. A significant portion of heavy truck movement dependent upon Muzaffarpur industries as well.
MAV	GDP	1.0	

Vehicle Category	Growth Driver	Elasticity	Comments
			The Asset also caters to movements in regions outside India, such as Nepal, Bangladesh and Bhutan which represent 10% of 3A/MAV shares.

Source: Steer

Forecasts for growth drivers

5.11 In the following sections we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. In particular, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.12 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 being 4%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.13 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in Figure 5.1.

5.14 Based on that, GDP is forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 5.5% by FY50.

5.15 The India GDP growth provided by the Client is in line with other independent forecasts available from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

State GSDP

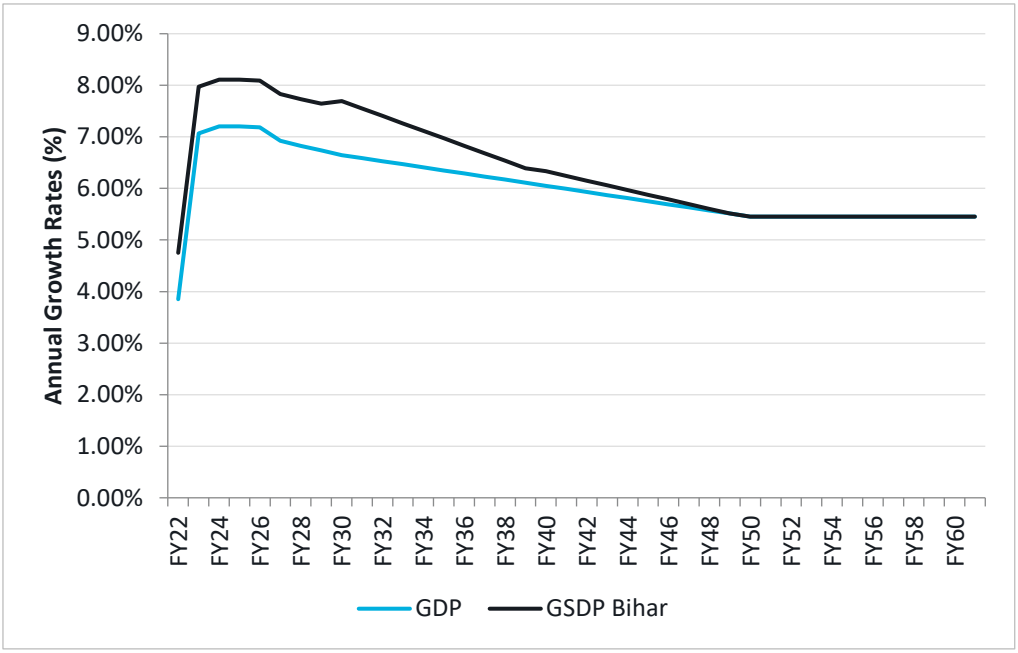
5.16 As per Client projections, Bihar's GSDP growth assumes to continue outpacing the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.17 There are significant investments expected to take place as part of the state's plan and Bihar is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher than expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Bihar's state economy.

5.18 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.19 The GDP-GSDP lines are expected to converge by FY48. The chart below shows the forecast growth lines for GDP and Bihar GSDP.

Figure 5.1: GDP-GSDP forecast



Source: GDP and GSDP forecast provided by Client

6 Forecast: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of background growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years

Seasonal Correction Factors

6.2 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.3 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.4 Historical traffic data was available for all toll vehicle categories starting October 2020 up-to March 2022. Therefore, in absence of longer-term historical data to arrive at the SCF, we have benchmarked our SCF from various sources:

- Assets in the vicinity, south or north of the Asset carrying very similar traffic profiles
- SCF assumptions assumed during the Bid by the Client, and
- Site observations and information provided by the toll plaza manager.

6.5 The below table presents the SCF assumed to estimate the AADT:

Table 6-1: Adopted SCF for the Asset based on benchmarks

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.96	0.99	0.88	1.00	1.08	1.15	1.09	0.95	1.09	1.07	0.97	0.90
LCV	1.04	1.04	0.91	0.99	1.10	0.99	1.07	0.90	1.07	0.97	1.01	1.00

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Bus	0.97	0.97	0.96	1.03	1.09	1.06	1.05	0.91	1.04	1.07	1.01	0.91
2A	1.03	0.99	0.99	0.98	1.09	1.00	0.97	0.99	1.04	1.09	0.96	0.97
3A	1.05	1.01	1.08	1.14	1.10	1.06	0.93	0.90	0.97	1.04	0.96	0.96
MAV	1.05	1.01	1.08	1.14	1.10	1.06	0.93	0.90	0.97	1.04	0.96	0.96

Source: Steer analysis of various sources

Base year FY22 AADT estimates

FY22 AADT estimation

6.6 As discussed earlier in chapter 1 and 3, The second wave of COVID-19 infections peaked in the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away however, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.7 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.8 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6-2: Monthly MADT and Adopted AADT for FY22-TP1 Parsoni Khem

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-21	FY22 Adopted AADT (FY22*)
CJV	3,584	4,775	4,120	3,356	4,330	3,885	4,118
LCV	514	507	509	429	486	511	483
Bus	424	507	495	364	409	402	439
2A	1,141	1,047	1,032	949	1,051	1,112	1,042
3A	1,144	1,087	1,147	1,079	1,141	1,166	1,083
MAV	2,285	2,372	2,675	2,377	2,413	2,346	2,349
Total AADT	**9,093**	**10,296**	**9,980**	**8,555**	**9,832**	**9,425**	**9,514**
PCU#	**20,523**	**21,805**	**22,319**	**19,539**	**21,354**	**20,948**	**20,801**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV

Analysis of potential network/developmental impacts

6.9 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous Chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6 laning LOS improvement

6.10 As per the concession agreement as soon as the Asset hits 40,000 PCU's the Asset is eligible for capacity augmentation. The PCU level need to be maintained above the 40,000 levels for 4 consecutive years and 1 year will be earmarked for DPR preparation. After that a three-year period is factored in for construction, during which the Year 1 of construction toll rates will be maintained at 75% and will remain flat at 75% for the duration of construction. After the construction is over the toll rates will be calculated as normal, as they should have been in that year.

6.11 On the Asset, it is expected based on our forecasts that traffic volumes will go beyond the 40,000 PCUs mark in FY34, thus breaching the capacity requirements set out in the concession agreement, thus leading to capacity augmentation on the Asset. We expect the level of service on the Asset to improve post capacity augmentation. To calculate this impact, we have employed a GJC based approach.

6.12 A comparison of generalised journey costs (GJC) estimates how different elements of cost and time affect traffic. This comparison was done for both light and heavy vehicles. Lower GJCs correspond to higher induced traffic. Based on Steer's studies and research in India, we have found that for every 1% reduction in the GJCs, the traffic increases by a factor of 0.3. We then applied the difference of GJCs to the elasticity of 0.3 to get net influence on the traffic.

6.13 The improvement in travel costs or GJC is translated into the impact on that share of local + IAOI OD movements using a linear inverse relationship. Therefore, the GJC influence is applied on the corresponding shares of traffic, which were extracted from OD data.

6.14 The table below shows the extent of the LOS impact.

Table 6-3: Impact of 6 laning LOS improvement

Vehicle category	FY43
CJV	2.9%
Mini LCV	0.6%
Buses	0.6%
LCV	0.6%
2A	1.0%
3A	1.1%
MAV	0.5%

Source: Steer analysis

Revenue forecasting assumptions

6.15 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e., traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e., the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.16 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY22 data available and listed in the table below:

Table 6-4: Trip factors at TP1 Parsoni Khem

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	45	45	50	50	45	45	45
Local commercial	1	1	1	1	1	1	1
Local Personal	15	20	20	20	20	20	20

Source: Steer analysis of Client TMS data

Toll segmentation

6.17 We have analysed the historical TMS data split by ticket categories, to understand trends, as shown in Chapter 3. The travel trends observed during the Q3 and Q4FY22 are devoid of any significant events, and we believe the travel patterns (segmentation) observed are reasonable reflection of the normal segmentation, hence, Oct-Mar average for FY22 has been adopted for forecast segmentation.

6.18 The table below provides the toll segmentation assumed for the period of forecast.

Table 6-5: Toll segmentation for FY22, TP1 Parsoni Khem (Oct-21 to Mar-22)

Ticket type	CJV/Mini-LCV	LCV	Bus	2A	3A	MAV
Single	36.3%	36.0%	45.5%	72.0%	78.8%	92.0%
Return	45.3%	53.0%	52.0%	23.9%	12.3%	6.3%
Monthly	0%	0.2%	0%	0%	1.9%	0%
Local commercial	1.9%	7.0%	2.0%	3.1%	5.5%	1.5%
Local personal	5.3%	0%	0%	0%	0%	0%
Exemptions	11.2%	3.8%	0.5%	0.9%	1.5%	0.3%
Violations	0%	0%	0%	0%	0%	0%

Source: Steer analysis of Client TMS data

Overloading

6.19 As per our discussion with the client, on the Asset there is a requirement under the CA to install Weigh in Motion (WIM) apparatus and static weighbridge to charge overloading. In our experience, overloading is a common practice and is expected to continue at low levels. It is further known that except few specific assets, concessionaires are only able to charge out up to 2 times the toll rate as overloading charges. Therefore, we assume that the overloaded vehicles on the Asset will be charged twice the toll fee they would otherwise pay for their

ticket type at the toll plaza. The table shows the assumptions for share of overloaded vehicles that are considered to pay twice the toll fee due to overloading.

Table 6-6: Overloading assumptions from FY23 onwards

Vehicle type	Single
2A	2.0%
3A	3.0%
MAV	3.0%

Source: Assumptions based on discussions with client

Toll evolution

6.20 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five decimals to estimate the final toll rate charged to users.

6.21 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6-7: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.27%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by the Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Revenue reconciliation

6.22 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset.

6.23 To reconcile we have used the segmentation Oct-Mar FY22 average, MADT of the month and compared it with the reported revenue for that month. The exercise was undertaken for Feb and Mar 2022. The Steer revenue calculations have been built up from monthly raw traffic data files, containing monthly data and ticket type information; and the toll notifications – all shared by the client. The comparison, as shown in the table below, depicts the difference between modelled revenue and the reported revenue is within 0.4%, which gives us confidence in the historical traffic and revenue provided by the Client. This further validates our segmentation and trip factor assumptions.

Table 6-8: FY22 Revenue reconciliation summary (INR Lakhs)

Vehicle Category	Modelled Feb-22	Actual Feb-22	Difference (%)	Modelled Mar-22	Actual Mar-22	Difference (%)
Total	**730**	**727**	**0.4%**	**795**	**794**	**0.12%**

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.24 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the concession length of the Asset. The table below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the concession period.

Table 6-9: Traffic forecast (with impacts) for TP1 Parsoni Khem

Vehicle Type	FY22*	FY27	FY32	FY42	FY51
CJV	3,359	4,939	7,124	13,562	23,002
Mini LCV	759	889	1,033	1,343	1,655
Bus	439	494	553	674	790
LCV	483	565	657	854	1,052
2A	1,042	1,220	1,417	1,843	2,282
3A	1,083	1,335	1,624	2,340	3,191
MAV	2,349	3,312	4,573	8,344	13,741
AADT	**9,514**	**12,755**	**16,982**	**28,959**	**45,713**
PCU's	**20,801**	**27,481**	**36,020**	**60,121**	**93,380**

Source: Steer analysis, FY22* is normalised traffic (AADT).

Table 6-10: Traffic CAGR (%) for TP1 Parsoni Khem

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	8.0%	7.6%	6.6%	6.9%
Mini LCV	3.2%	3.0%	2.7%	2.7%
Bus	2.4%	2.3%	2.0%	2.0%
LCV	3.2%	3.0%	2.7%	2.7%
2A	3.2%	3.0%	2.7%	2.7%
3A	4.3%	4.0%	3.7%	3.8%
MAV	7.1%	6.7%	6.2%	6.3%

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
OSV	7.1%	6.7%	6.2%	6.3%
AADT	**6.0%**	**5.9%**	**5.5%**	**5.6%**
PCU's	**5.7%**	**5.6%**	**5.3%**	**5.3%**

Source: Steer analysis

Table 6-11: Revenue forecast (with impacts) for TP1 Parsoni Khem (INR crores)

Vehicle Type	FY22	FY23	FY28	FY33	FY38	FY51
CJV	9.1	9.4	18.8	33.9	100.6	257.0
Mini LCV	2.1	2.1	3.4	4.9	9.9	18.4
Bus	7.2	4.9	7.5	10.6	20.1	35.3
LCV	3.1	2.4	3.8	5.6	11.3	20.9
2A	12.3	12.5	20.1	29.6	59.8	110.8
3A	13.7	14.2	24.4	37.7	84.4	171.9
MAV	46.7	46.8	92.6	161.0	457.6	1,128.0
OSV	0.0	0.0	0.0	0.0	0.0	0.0
Total revenue	**94.3**	**92.3**	**170.6**	**283.3**	**743.7**	**1,742.3**

Source: Steer analysis

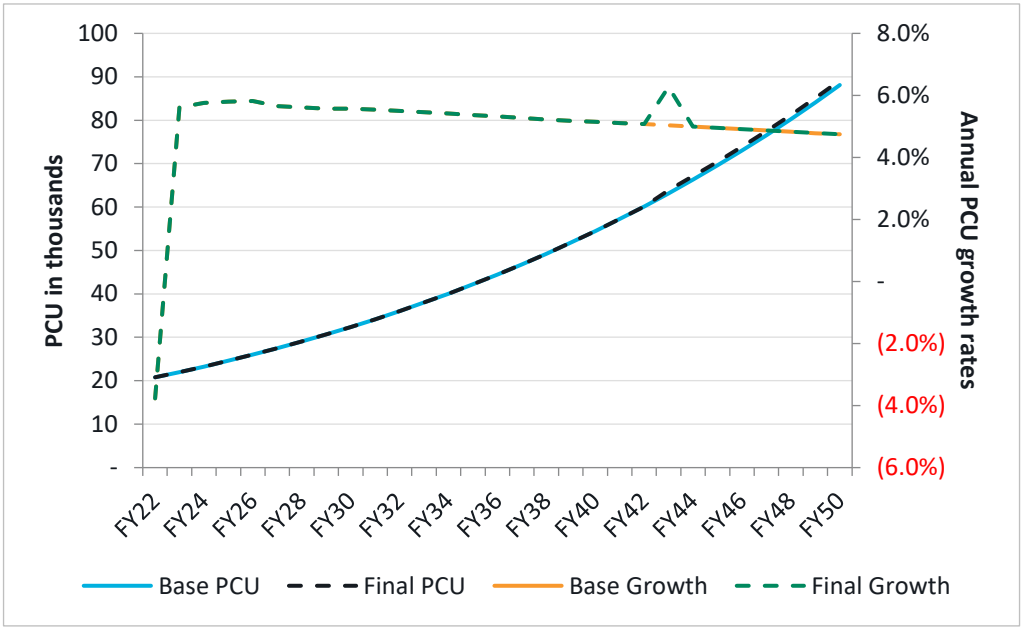
Table 6-12: Revenue growth CAGR (%) for TP1 Parsoni Khem

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	14.9%	12.6%	11.5%	12.1%
Mini LCV	9.8%	7.8%	7.3%	7.8%
Bus	8.8%	7.2%	6.6%	7.0%
LCV	9.8%	8.1%	7.2%	7.8%
2A	9.9%	8.1%	7.3%	7.8%
3A	11.4%	9.0%	8.4%	9.0%
MAV	14.6%	11.7%	11.0%	11.6%
Total revenue	**13.1%**	**10.7%**	**10.1%**	**10.7%**

Source: Steer analysis

6.25 As presented in the tables above, traffic CAGRs (PCUs) for the traffic forecast (with impacts) on the Asset over the concession period is around 5.3% and corresponding revenue CAGR is around 12.1%. This growth is majorly driven by CJVs and MAVs, as discussed in the historical section, this Asset has an even mix of CJVs and MAVs. The CJVs on the Asset are expected to grow with increasing per capita income levels of the region and are expected to grow at a healthy rate for a longer period, given the low car ownership levels in the state.

Figure 6.1: Forecast PCUs and growth rates at TP1 Parsoni Khem



Source: Steer analysis

Upside and Downside Cases

6.26 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.27 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.28 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.13: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
KMTL	GDP/GSDP	+1% every year	-1% every year
KMTL	WPI	+1% every year	-1% every year
KMTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.29 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside

(optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.30 The upside case impacts included in forecasts are summarised in below:

Table 6.14: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning of the Asset)
Year	**FY40**
TP-1	CJV:3.6%, LCV/Bus:0.7%, 2A:1.3%, 3A:1.4%, MAV:0.7%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.31 The downside case impacts included in forecasts are summarised in below:

Table 6.15: Summary of impacts on the Assets

Impact	LoS Improvement
Year	**FY46**
TP-1	CJV:2.2%, LCV/Bus:0.4%, LCV:0.4%, 2A:0.8%, 3A:0.8%, MAV:0.4%

Source: Steer analysis of OD data, and publicly available information

6.32 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.33 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.34 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.16: Traffic forecast (With Upside Impacts) for TP1: Parsoni Khem

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	3,359	3,690	5,390	8,470	19,686	37,369
Mini LCV	759	789	922	1,111	1,557	2,024
Bus	439	452	508	584	755	920
LCV	483	502	587	706	991	1,287
2A	1,042	1,083	1,266	1,524	2,150	2,794
3A	1,083	1,141	1,406	1,799	2,901	4,267

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
MAV	2,349	2,557	3,602	5,399	11,643	21,953
AADT	**9,514**	**10,215**	**13,680**	**19,593**	**39,684**	**70,614**
PCU's	**20,801**	**22,260**	**29,408**	**41,363**	**81,125**	**142,526**

Source: Steer analysis

Table 6.17: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Parsoni Khem

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	9.9%	9.9%	9.5%	8.8%	8.6%
Mini LCV	3.9%	4.0%	3.8%	3.4%	3.4%
Bus	3.0%	3.0%	2.8%	2.6%	2.6%
LCV	3.9%	4.0%	3.8%	3.4%	3.4%
2A	3.9%	4.0%	3.8%	3.5%	3.4%
3A	5.3%	5.4%	5.1%	4.9%	4.8%
MAV	8.9%	8.9%	8.4%	8.0%	8.0%
AADT	**7.4%**	**7.6%**	**7.4%**	**7.3%**	**7.1%**
PCU's	**7.0%**	**7.2%**	**7.1%**	**7.0%**	**6.9%**

Source: Steer analysis

Table 6.18: Revenue forecast (With Upside Impacts) for TP1: Parsoni Khem (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	9.4	11.3	21.1	43.4	169.0	525.8
Mini LCV	2.1	2.4	3.6	5.7	13.3	28.4
Bus	4.9	5.6	7.9	12.0	26.1	51.8
LCV	2.4	2.8	4.1	6.4	15.2	32.1
2A	12.5	14.5	21.5	34.0	81.0	171.1
3A	14.2	17.1	26.5	44.5	121.2	290.2
MAV	46.8	58.0	103.4	202.9	738.7	2,271.6
Total Revenue	**92.3**	**111.7**	**188.0**	**348.9**	**1,164.5**	**3,371.1**

Source: Steer analysis

Table 6.19: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Parsoni Khem

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	20.3%	16.9%	15.6%	14.6%	14.7%
Mini LCV	13.8%	10.6%	9.6%	8.9%	9.2%
Bus	13.7%	9.2%	8.6%	8.1%	8.3%
LCV	16.2%	10.2%	9.4%	9.0%	9.2%
2A	16.2%	10.3%	9.6%	9.1%	9.2%
3A	20.4%	11.5%	11.0%	10.5%	10.6%

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
MAV	23.9%	15.6%	14.4%	13.8%	14.0%
Total	**21.0%**	**13.9%**	**13.2%**	**12.8%**	**12.9%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.35 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.36 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.20: Traffic forecast (With Dowside Impacts) for TP1: Parsoni Khem

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	3,359	3,569	4,562	6,088	9,997	14,842
Mini LCV	759	778	860	967	1,183	1,382
Bus	439	447	482	526	613	689
LCV	483	495	547	615	752	879
2A	1,042	1,068	1,181	1,328	1,624	1,904
3A	1,083	1,119	1,274	1,481	1,954	2,461
MAV	2,349	2,477	3,070	3,937	6,219	9,021
AADT	**9,514**	**9,954**	**11,977**	**14,943**	**22,342**	**31,178**
PCU's	**20,801**	**21,710**	**25,859**	**31,840**	**46,767**	**64,453**

Source: Steer analysis

Table 6.21: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Parsoni Khem

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	6.3%	6.3%	5.9%	5.1%	5.2%
Mini LCV	2.5%	2.5%	2.4%	2.0%	2.1%
Bus	1.9%	1.9%	1.8%	1.5%	1.6%
LCV	2.5%	2.5%	2.4%	2.0%	2.1%
2A	2.5%	2.5%	2.4%	2.0%	2.1%
3A	3.3%	3.3%	3.1%	2.8%	2.9%
MAV	5.5%	5.5%	5.1%	4.7%	4.7%
AADT	**4.6%**	**4.7%**	**4.5%**	**4.1%**	**4.2%**
PCU's	**4.4%**	**4.5%**	**4.2%**	**3.9%**	**4.0%**

Source: Steer analysis

Table 6.22: Revenue forecast (With Downside Impacts) for TP1: Parsoni Khem (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	9.4	10.9	16.8	27.3	64.3	132.9

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
Mini LCV	2.1	2.4	3.2	4.3	7.6	12.3
Bus	4.9	5.5	7.1	9.5	15.9	24.7
LCV	2.4	2.7	3.6	4.9	8.6	13.9
2A	12.5	14.3	18.9	26.0	45.7	74.0
3A	14.2	16.6	22.7	32.1	61.0	106.2
MAV	46.8	55.7	83.1	129.9	295.6	593.7
Total Revenue	**92.3**	**108.1**	**155.3**	**234.1**	**498.8**	**957.7**

Source: Steer analysis

Table 6.23: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Parsoni Khem

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	16.3%	11.5%	10.2%	8.9%	9.3%
Mini LCV	12.2%	7.5%	6.5%	5.8%	6.1%
Bus	12.0%	6.6%	6.0%	5.3%	5.5%
LCV	12.2%	7.6%	6.4%	5.8%	6.1%
2A	14.3%	7.1%	6.6%	5.8%	6.0%
3A	16.7%	8.1%	7.2%	6.6%	6.9%
MAV	19.1%	10.5%	9.4%	8.6%	8.8%
Total	**17.1%**	**9.5%**	**8.6%**	**7.9%**	**8.1%**

Source: Steer analysis

Target revenues and modification of concession period

6.37 As per the concession agreement, the target revenue for TP1 should be 14.2 Cr for the month of March 2030 first calculation of target revenue and 23.2Cr for the month of March 2040 for the second calculation of target revenue. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual revenue.' If the target revenue for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6-24: Target Revenues for Extension 1

Asset	Target Month	Target Revenue Cr	Estimated Revenue			Average Revenue	Variation (%)
			2029	2030	2031		
KM	Mar-30	14.22	18.71	20.70	22.88	20.76	46%

Source: Steer analysis

Table 6-25: Target Revenues for Extension 2

Asset	Target Month	Target Revenue Cr	Estimated Revenue			Average Revenue	Variation (%)
			2039	2040	2041		
KM	Mar-40	23.1	37.46	39.43	41.5	39.46	70.7%

Source: Steer analysis

6.38 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have applied seasonality of March month to adjust for seasonal trends and arrive at March traffic from AADT traffic, which is then segmented according to the forecast toll segmentation and trip factors and multiplied with respective estimated toll rates to get to a monthly revenue collection.

6.39 As seen from the table above, the target revenue forecast for the Asset is higher than the Concession Agreement target revenue by a rounded 38% for target date 1 and 83% for target date 2. As the difference lies above the permitted threshold of 20% and 30% for target date 1 and 2 respectively, a change in the length of the concession is expected. As per the Concession Agreement, for every 1% excess target revenue, the concession period shall be decreased by 1.5%, with a capping at 20%. Therefore, for the excess traffic on these toll plazas, the concession period, originally 30 years, is expected to reduce by 5 years from FY51, potentially changing the concession end to FY46 from FY51.

Summary Outlook

6.40 Passenger movement on the Asset is largely local in nature, connecting the cities of Patna, Muzaffarpur to Champaran, Chakia and other nearby towns. Cars are expected to see a healthy growth on the Asset following the overall behavioural shift of users away from public transport.

6.41 The Asset benefits from its strategic location connecting the east-west movement of goods from Uttar Pradesh and Delhi NCR towards Bihar, West Bengal and Northeast states. Moreover, the Nepal border near the city if Raxaul is also an important destination of a significant proportion of traffic on the Asset. The 3A/MAV traffic on the Asset largely covers very long-distance routes with about 75% of the users covering more than 500Km. This portion of traffic is assumed to see a strong growth relationship with the national GDP.

6.42 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.43 With regards to the short-term background growth, we see the following risk:

- It was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. It can be seen from the FY22 traffic data that the traffic is following the similar trends as seen in the Q3 and Q4FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure has seen a major comeback in the second part of FY22 resulting in increased activity in the corridor.

6.44 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Delhi NCR, Lucknow, Patna all the way to East and North-East India. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Top 10 OD Pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Parsoni Khem

Table A.1: CJV, Bus and Mini Bus top 10 OD pair shares at TP1 Parsoni Khem

	OD Pair	Share
1.	Motihari-Muzaffarpur	14%
2.	Bettiah-Patna	9%
3.	Muzaffarpur-NCT of Delhi	7%
4.	Bettiah-Muzaffarpur	6%
5.	Motihari-Patna	6%
6.	Motihari-Chakia	5%
7.	Pipra-Chakia	5%
8.	Patna-NCT of Delhi	4%
9.	Gopalganj-Muzaffarpur	2%
10.	Raxaul-Patna	2%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Parsoni Khem

	OD Pair	Share
1.	Assam-Uttar Pradesh	5%
2.	Assam-NCT of Delhi	4%
3.	Barauni-Bangladesh	4%
4.	Uttar Pradesh-West Bengal	4%
5.	Muzaffarpur-Uttar Pradesh	3%
6.	Motihari-Muzaffarpur	3%
7.	Assam-Maharashtra	2%
8.	Bettiah-Muzaffarpur	2%
9.	Muzaffarpur-NCT of Delhi	2%
10.	Motihari-Chakia	2%

Source: Steer analysis of OD data

B Detailed Forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY31, year of expected close of the concession. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Traffic Forecast (with impacts) over horizon years at TP1 Parsoni Khem

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	3,359	759	439	483	1,042	1,083	2,349	**9,514**	**20,801**
FY23	3,626	783	449	498	1,075	1,129	2,515	**10,077**	**21,969**
FY24	3,920	809	460	514	1,110	1,178	2,696	**10,688**	**23,234**
FY25	4,238	835	471	531	1,146	1,229	2,890	**11,341**	**24,580**
FY26	4,581	862	483	548	1,183	1,282	3,098	**12,037**	**26,010**
FY27	4,939	889	494	565	1,220	1,335	3,312	**12,755**	**27,481**
FY28	5,321	917	506	583	1,258	1,390	3,538	**13,512**	**29,024**
FY29	5,727	945	517	601	1,296	1,446	3,777	**14,309**	**30,642**
FY30	6,168	974	529	619	1,336	1,503	4,027	**15,157**	**32,351**
FY31	6,633	1,003	541	638	1,377	1,563	4,293	**16,048**	**34,143**
FY32	7,124	1,033	553	657	1,417	1,624	4,573	**16,982**	**36,020**
FY33	7,641	1,063	565	676	1,459	1,687	4,869	**17,960**	**37,985**
FY34	8,185	1,093	577	695	1,500	1,752	5,181	**18,983**	**40,041**
FY35	8,756	1,123	589	715	1,542	1,819	5,510	**20,053**	**42,190**
FY36	9,353	1,154	601	734	1,584	1,887	5,856	**21,170**	**44,435**
FY37	9,978	1,185	613	754	1,626	1,958	6,221	**22,335**	**46,779**
FY38	10,630	1,216	625	773	1,669	2,030	6,605	**23,549**	**49,223**
FY39	11,310	1,247	637	793	1,712	2,105	7,008	**24,811**	**51,770**
FY40	12,026	1,279	650	813	1,755	2,181	7,432	**26,135**	**54,436**
FY41	12,776	1,310	662	833	1,799	2,260	7,877	**27,517**	**57,218**
FY42	13,562	1,343	674	854	1,843	2,340	8,344	**28,959**	**60,121**
FY43	14,800	1,383	690	880	1,907	2,449	8,880	**30,989**	**63,893**
FY44	15,683	1,416	702	901	1,953	2,534	9,396	**32,585**	**67,086**
FY45	16,604	1,449	715	922	1,999	2,621	9,937	**34,247**	**70,411**
FY46	17,565	1,483	727	943	2,045	2,711	10,502	**35,976**	**73,871**
FY47	18,565	1,517	740	965	2,092	2,803	11,093	**37,773**	**77,470**
FY48	19,605	1,551	752	986	2,138	2,896	11,711	**39,640**	**81,210**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY49	20,685	1,585	764	1,008	2,186	2,992	12,357	**41,577**	**85,095**
FY50	21,813	1,619	777	1,030	2,233	3,090	13,030	**43,593**	**89,135**
FY51	23,002	1,655	790	1,052	2,282	3,191	13,741	**45,713**	**93,380**

Source: Steer Analysis

Table B.2: Forecasts (with impacts) for AADT growth rates (%) at TP1 Parsoni Khem

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	8.6%	8.6%	(33.6%)	(23.2%)	(1.5%)	2.1%	(3.3%)	**(1.2%)**	**(3.8%)**
FY23	8.0%	3.2%	2.4%	3.2%	3.2%	4.2%	7.1%	**5.9%**	**5.6%**
FY24	8.1%	3.2%	2.4%	3.2%	3.2%	4.3%	7.2%	**6.1%**	**5.8%**
FY25	8.1%	3.2%	2.4%	3.2%	3.2%	4.3%	7.2%	**6.1%**	**5.8%**
FY26	8.1%	3.2%	2.4%	3.2%	3.2%	4.3%	7.2%	**6.1%**	**5.8%**
FY27	7.8%	3.1%	2.3%	3.1%	3.1%	4.2%	6.9%	**6.0%**	**5.7%**
FY28	7.7%	3.1%	2.3%	3.1%	3.1%	4.1%	6.8%	**5.9%**	**5.6%**
FY29	7.6%	3.1%	2.3%	3.1%	3.1%	4.0%	6.7%	**5.9%**	**5.6%**
FY30	7.7%	3.1%	2.3%	3.1%	3.1%	4.0%	6.6%	**5.9%**	**5.6%**
FY31	7.5%	3.0%	2.3%	3.0%	3.0%	4.0%	6.6%	**5.9%**	**5.5%**
FY32	7.4%	3.0%	2.2%	3.0%	3.0%	3.9%	6.5%	**5.8%**	**5.5%**
FY33	7.3%	2.9%	2.2%	2.9%	2.9%	3.9%	6.5%	**5.8%**	**5.5%**
FY34	7.1%	2.8%	2.1%	2.8%	2.8%	3.8%	6.4%	**5.7%**	**5.4%**
FY35	7.0%	2.8%	2.1%	2.8%	2.8%	3.8%	6.3%	**5.6%**	**5.4%**
FY36	6.8%	2.7%	2.0%	2.7%	2.7%	3.8%	6.3%	**5.6%**	**5.3%**
FY37	6.7%	2.7%	2.0%	2.7%	2.7%	3.7%	6.2%	**5.5%**	**5.3%**
FY38	6.5%	2.6%	2.0%	2.6%	2.6%	3.7%	6.2%	**5.4%**	**5.2%**
FY39	6.4%	2.6%	1.9%	2.6%	2.6%	3.7%	6.1%	**5.4%**	**5.2%**
FY40	6.3%	2.5%	1.9%	2.5%	2.5%	3.6%	6.0%	**5.3%**	**5.1%**
FY41	6.2%	2.5%	1.9%	2.5%	2.5%	3.6%	6.0%	**5.3%**	**5.1%**
FY42	6.1%	2.5%	1.8%	2.5%	2.5%	3.6%	5.9%	**5.2%**	**5.1%**
FY43	9.1%	3.0%	2.4%	3.0%	3.5%	4.6%	6.4%	**7.0%**	**6.3%**
FY44	6.0%	2.4%	1.8%	2.4%	2.4%	3.5%	5.8%	**5.2%**	**5.0%**
FY45	5.9%	2.4%	1.8%	2.4%	2.4%	3.5%	5.8%	**5.1%**	**5.0%**
FY46	5.8%	2.3%	1.7%	2.3%	2.3%	3.4%	5.7%	**5.0%**	**4.9%**
FY47	5.7%	2.3%	1.7%	2.3%	2.3%	3.4%	5.6%	**5.0%**	**4.9%**
FY48	5.6%	2.2%	1.7%	2.2%	2.2%	3.3%	5.6%	**4.9%**	**4.8%**
FY49	5.5%	2.2%	1.7%	2.2%	2.2%	3.3%	5.5%	**4.9%**	**4.8%**
FY50	5.5%	2.2%	1.6%	2.2%	2.2%	3.3%	5.5%	**4.8%**	**4.7%**
FY51	5.5%	2.2%	1.6%	2.2%	2.2%	3.3%	5.5%	**4.9%**	**4.8%**

Source: Steer Analysis

Revenue forecasts

Table B.3: Revenue forecast (INR Crores), for TP1 Parsoni Khem

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY21	9.1	2.1	7.2	3.1	12.3	13.7	46.7	**94.3**
FY22	9.4	2.1	4.9	2.4	12.5	14.2	46.8	**92.3**
FY23	11.1	2.4	5.5	2.7	14.4	16.8	57.0	**109.9**
FY24	12.9	2.6	6.0	3.0	15.7	18.5	64.7	**123.4**
FY25	14.5	2.9	6.5	3.2	17.1	20.3	72.4	**136.9**
FY26	16.4	3.1	7.0	3.5	18.5	22.3	82.1	**152.9**
FY27	18.8	3.4	7.5	3.8	20.1	24.4	92.6	**170.6**
FY28	21.1	3.6	8.1	4.1	21.8	26.7	103.8	**189.2**
FY29	23.9	3.9	8.7	4.5	23.6	29.2	116.0	**209.7**
FY30	26.9	4.2	9.3	4.8	25.4	31.7	129.6	**231.9**
FY31	30.4	4.6	9.9	5.2	27.4	34.5	144.4	**256.4**
FY32	33.9	4.9	10.6	5.6	29.6	37.7	161.0	**283.3**
FY33	38.2	5.3	11.3	6.0	31.7	40.8	178.9	**312.2**
FY34	42.8	5.7	12.1	6.4	34.1	44.2	198.9	**344.2**
FY35	47.5	6.1	12.9	6.9	36.6	48.0	221.6	**379.6**
FY36	53.3	6.6	13.8	7.5	39.4	52.3	246.9	**419.7**
FY37	59.4	7.0	14.7	8.0	42.3	56.4	272.9	**460.7**
FY38	66.1	7.5	15.6	8.6	45.3	61.3	303.0	**507.4**
FY39	55.4	6.1	12.5	6.9	36.3	49.8	252.4	**419.3**
FY40	59.0	6.3	12.7	7.1	37.4	51.7	268.4	**442.6**
FY41	62.6	6.4	12.9	7.2	38.2	53.4	283.7	**464.5**
FY42	100.6	9.9	20.1	11.3	59.8	84.4	457.6	**743.7**
FY43	115.3	10.7	21.5	12.1	64.7	92.1	509.7	**826.4**
FY44	128.4	11.6	23.0	13.1	69.5	100.0	565.0	**910.5**
FY45	141.8	12.3	24.4	13.9	74.3	108.1	623.0	**997.9**
FY46	156.6	13.2	26.0	14.9	79.4	116.6	689.2	**1,095.9**
FY47	173.2	14.1	27.6	15.9	84.9	126.2	760.6	**1,202.5**
FY48	191.6	15.1	29.4	17.1	91.0	136.8	841.7	**1,322.7**
FY49	210.3	16.1	31.3	18.2	97.2	147.7	926.3	**1,447.0**
FY50	232.2	17.2	33.2	19.5	103.8	159.4	1,022.0	**1,587.5**
FY51	257.0	18.4	35.3	20.9	110.8	171.9	1,128.0	**1,742.3**

Source: Steer Analysis

C Data Collection Exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1 Parsoni Khem

Date	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
27-01-21	TVC	2,892	628	595	717	762	964	2,163	-	**8,721**
28-01-21	TVC	2,967	738	635	757	762	967	2,210	-	**9,036**
29-01-21	TVC	2,986	841	663	794	822	1,137	2,411	-	**9,654**
30-01-21	TVC	3,122	738	665	791	784	1,042	2,407	-	**9,549**
31-01-21	TVC	3,961	654	627	765	808	1,132	2,189	-	**10,136**
01-02-21	TVC	2,905	634	635	798	765	1,157	2,478	-	**9,372**
02-02-21	TVC	2,781	653	715	772	728	1,026	2,477	-	**9,152**

Source: Steer Analysis

Table C.2: WADT TVC vs TMS

Toll plaza	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
TP1	TVC	3,088	698	648	771	776	1,061	2,334	-	**9,374**
	TMS	3,431	-	603	525	994	1,059	2,351	2	**8,965**

Source: Steer Analysis

Zone List

Table C.3: Zone list used for OD analysis

Zone No	Zone name	Type of zone
1	Sitamarhi	Bihar
2	Sheohar	Bihar
3	Samastipur	Bihar
4	Muzaffarpur	Bihar
5	Gopalganj	Bihar
6	East Champaran	Bihar
7	Darbhanga	Bihar
8	west champaran	Bihar

Zone No	Zone name	Type of zone
9	Araria	Bihar
10	Aurangabad	Bihar
11	Banka	Bihar
12	Begusarai	Bihar
13	Bhagalpur	Bihar
14	Bhojpur	Bihar
15	Buxar	Bihar
16	Gaya	Bihar
17	Jamui	Bihar
18	Kaimur (bhabua)	Bihar
19	Katihar	Bihar
20	Khagaria	Bihar
21	Kishanganj	Bihar
22	Lakhisarai	Bihar
23	Madhepura	Bihar
24	Madhubani	Bihar
25	Munger	Bihar
26	Nalanda	Bihar
27	Nawada	Bihar
28	Patna	Bihar
29	Purnia	Bihar
30	Rohtas	Bihar
31	Saharsa	Bihar
32	Saran (chhapra)	Bihar
33	Sheikhpura	Bihar
34	Siwan	Bihar
35	Supaul	Bihar
36	Vaishali	Bihar
37	Arwal	Bihar
38	Jehanabad	Bihar
39	Barauli	Bihar
40	Raxaul	Bihar
41	Lalganj	Bihar
42	Sahebganj	Bihar
43	Hussaini	Bihar
44	Barauni	Bihar
45	Lala Chhapra	Bihar
46	Turki	Bihar
47	Tikuliya	Bihar
48	Sahebganj	Bihar
49	Raniganj Mohalla	Bihar
50	Pipra Kothi	Bihar
51	Pipra	Bihar
52	phenhara	Bihar
53	Pasrampur	Bihar
54	Pakridayal	Bihar
55	Nauzamin	Bihar
56	Nankar Parsauni Khem	Bihar
57	Motipur	Bihar
58	Motihari	Bihar

Zone No	Zone name	Type of zone
59	Mirzapur	Bihar
60	Mehsi	Bihar
61	Matkan	Bihar
62	Math Parmeshwar	Bihar
63	Mahuawa	Bihar
64	Madhuban Bediban	Bihar
65	Madhuban	Bihar
66	Kundia	Bihar
67	Kunarpur	Bihar
68	Kuahi	Bihar
69	Kotwa	Bihar
70	Koir Gawan	Bihar
71	Khalilpur	Bihar
72	Kesariya	Bihar
73	Katha	Bihar
74	Kanti	Bihar
75	Jiwdhara	Bihar
76	jasauli Patti	Bihar
77	Jahingara	Bihar
78	Harsher	Bihar
79	Hardiyabad	Bihar
80	Halimpur	Bihar
81	Gariba	Bihar
82	Dipau	Bihar
83	Dhobauliya	Bihar
84	Darmaha	Bihar
85	Damodarpur	Bihar
86	Chintamanpur	Bihar
87	Chand Saraia	Bihar
88	Chakia	Bihar
89	Chakia	Bihar
90	Chak Bara	Bihar
91	Chaita	Bihar
92	Bir Chhapra	Bihar
93	Bettiah	Bihar
94	Belwadih	Bihar
95	Bathna	Bihar
96	Baruraj	Bihar
97	Bardaha	Bihar
98	Baisaha	Bihar
99	Alaula	Bihar
100	Alakhbani	Bihar
101	Ahiraulia	Bihar
102	Muzaffarpur	Bihar
103	Ababkarpur	Bihar
104	Patna	Bihar
105	Begusarai	Bihar
106	Darbhanga	Bihar
107	Bodh gaya, Gaya	Bihar
108	Andaman & Nicobar Island	Andaman & Nicobar Island

Zone No	Zone name	Type of zone
109	Andhra Pradesh	Andhra Pradesh
110	Arunanchal Pradesh	Arunanchal Pradesh
111	Assam	Assam
112	Chandigarh	Chandigarh
113	Chhattisgarh	Chhattisgarh
114	Dadara & Nagar Havelli	Dadara & Nagar Havelli
115	Daman & Diu	Daman & Diu
116	Goa	Goa
117	Gujarat	Gujarat
118	Haryana	Haryana
119	Himachal Pradesh	Himachal Pradesh
120	Jammu & Kashmir	Jammu & Kashmir
121	Jharkhand	Jharkhand
122	Karnataka	Karnataka
123	Kerala	Kerala
124	Lakshadweep	Lakshadweep
125	Madhya Pradesh	Madhya Pradesh
126	Maharashtra	Maharashtra
127	Manipur	Manipur
128	Meghalaya	Meghalaya
129	Mizoram	Mizoram
130	Nagaland	Nagaland
131	NCT of Delhi	NCT of Delhi
132	Puducherry	Puducherry
133	Punjab	Punjab
134	Rajasthan	Rajasthan
135	Sikkim	Sikkim
136	Tamil Nadu	Tamil Nadu
137	Telangana	Telangana
138	Tripura	Tripura
139	Uttar Pradesh	Uttar Pradesh
140	Uttarakhand	Uttarakhand
141	West Bengal	West Bengal
142	Malda	West Bengal
143	Behrampur	West Bengal
144	Sahibganj	West Bengal
145	Pakur	West Bengal
146	Odisha	Odisha
147	Nepal	Nepal
148	Bangladesh	Bangladesh
149	Bhutan	Bhutan

`Source: Steer analysis

Direction-wise commodity distribution

Table C.4: Commodity distribution towards Motihari for TP1 Parsoni Khem

Commodity Code	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	23.2%	11.0%	13.7%	20.2%
Construction	-	7.4%	12.9%	3.9%

Commodity Code	Mini LCV + LCV	2A	3A	MAV + OSV
Groceries	13.1%	2.8%	5.6%	4.9%
Mining Minerals	-	2.1%	2.5%	10.8%
Manufacturing	5.1%	8.6%	11.4%	14.4%
Petroleum	3.0%	15.3%	17.5%	15.5%
Miscellaneous	13.1%	11.7%	10.4%	8.0%
Container	-	-	0.2%	0.2%
Empty	41.4%	37.7%	22.2%	18.2%
Sand	1.0%	2.5%	2.9%	2.6%
Cement	-	0.9%	0.6%	1.2%

Source: Steer Analysis

Table C.5: Commodity distribution towards Muzaffarpur for TP1 Parsoni Khem

Commodity Code	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	17.9%	18.4%	20.9%	27.6%
Construction	6.0%	1.5%	2.3%	4.3%
Groceries	3.0%	6.4%	6.9%	7.7%
Mining Minerals	-	1.9%	1.5%	4.9%
Manufacturing	4.5%	20.2%	10.9%	16.4%
Petroleum	3.0%	6.4%	16.9%	11.6%
Miscellaneous	6.0%	15.7%	13.8%	11.5%
Container	-	-	-	0.3%
Empty	58.2%	25.5%	24.8%	14.6%
Sand	1.5%	1.9%	1.5%	0.7%
Cement	-	2.2%	0.6%	0.3%

Source: Steer Analysis

Trip length distribution

Table C.6: Trip length frequency for TP1 Parsoni Khem

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV	3A+MAV
0-65 km	45.9%	2.0%	20.5%	17.5%	13.6%	3.4%	7.0%
65-300 km	45.2%	59.0%	59.0%	35.8%	25.7%	16.3%	19.6%
300-500 km	0.7%	3.3%	1.2%	1.3%	3.0%	7.3%	5.8%
500-1000 km	5.8%	6.2%	11.4%	15.5%	26.8%	24.2%	25.1%
>1000 km	2.4%	29.6%	7.8%	29.8%	30.8%	48.8%	42.6%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer Analysis

D Impact Analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the Asset.

D.2 Please find below the table for improvement in level of service due to six-laning on the Asset

Table D.1: GJC comparison for level of service improvement

	Asset		
	CJV	2A	MAV
Existing Toll rates	105	345	545
Length	80	80	80
Existing GJC	694	2,173	4,596
GJC post improvement	649	2,020	4,119

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

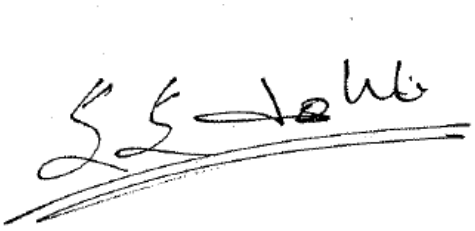
Client contract/project number

Transit

Author/originator

Vaibhav Gupta

Reviewer/approver



Serbjeet Kohli

Other contributors

Akshat Arya, Aditya Karan, Chanda Malhotra

Distribution

Client: Steer:

Version control/issue number

V1.0

Date

April 2022

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence of Lucknow-Raebareli Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence of Lucknow-Raebareli Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Contents

Disclaimer i

Glossary Items iii

1 Introduction 1

The assignment 1

Our approach 2

Evolution of Covid19 pandemic in India in FY21 and FY22 3

Contents of this report 5

2 The Assets 6

Introduction 6

Strategic network 6

Concession and tolling details 8

Key economic activities 9

Alternate Routes 10

3 Traffic description 11

Introduction 11

PCU Factor assumption for reporting 11

Historical Trends 12

Key findings of the TVC data analysis 17

Key findings of origin-destination analysis 19

Conclusions 26

4 Socio economic context and traffic growth 28

Introduction 28

Population growth 28

Economic growth 29

5 Traffic Growth Analysis 31

Estimation of background elasticities 31

Overview 31

Forecasts for growth drivers 33

6 Forecast: Base year AADT and Impacts 35

Introduction 35
Base year FY22 AADT estimates 36
Analysis of potential network/developmental impacts 37
Revenue forecasting assumptions 38
Traffic and Revenue forecasts 40
Upside and Downside Cases 42
Traffic and Revenue Forecasts-Upside case 44
Traffic and Revenue Forecasts-Downside case 45
Target revenues and modification of concession period 47
Summary outlook 47

Figures

Figure 1.1: Daily Reported Covid19 cases in India 4
Figure 2.1: Asset location in the regional network context 6
Figure 2.2: Asset context 7
Figure 2.3: Typical cross-sections and toll plazas on the Asset 8
Figure 3.1: Vehicle share at TP1 13
Figure 3.2: Vehicle wise Revenue share at TP1 13
Figure 3.3:Ticket-segmentation for CJV at TP1 Dakhina Sekhpur 15
Figure 3.4: Ticket-segmentation for MAV at TP1 Dakhina Sekhpur 16
Figure 3.5: Data collection schedule 17
Figure 3.6: WADT from TVC counts 17
Figure 3.7: Comparison between TVC and TMS daily traffic data on TP1 Dakhina Sekhpur 18
Figure 3.8: Comparison between vehicle shares from TVC and TMS WADTs 18
Figure 3.9: Zonal influence at TP1 Dakhina Sekhpur 21
Figure 3.10: Internal-external distribution at TP1 Dakhina Sekhpur 22
Figure 3.11: Commodity distribution at TP1 Dakhina Sekhpur (Total) 24
Figure 3.12: Commodity distribution at TP1 Dakhina Sekhpur (towards Lucknow) 24
Figure 3.13: Commodity distribution at TP1 Dakhina Sekhpur (towards Raebareli) 25
Figure 3.14: Trip length distribution TP1 Dakhina Sekhpur 26
Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP 30
Figure 5.1: GDP-GSDP forecast 34

Figure 6.1: Forecast PCUs and growth rates at TP1 Dakhina Sekhpur 42

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Summary of concession 8
Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022 9
Table 3.1: PCU factors 11
Table 3.2: Quarterly Traffic levels at TP1 Dakhina Sekhpur 12
Table 3.3: Revenue (in INR lakhs) at TP1 Dakhina Sekhpur, and AADC (average annual daily collection) 12
Table 3.4: Typical ticket types sold at NHAI plazas 14
Table 3.5: %age of Transactions via Fast Tag, Mar 2022 14
Table.6: Ticket-segmentation for MAV at TP1 Dakhina Sekhpur 16
Table 3.7: Ticket segmentation for LCV, Bus AND 2A at TP1 Dakhina Sekhpur 16
Table 3.8: Sample rates for OD data 19
Table 3.9: Zone aggregations for zonal influence analysis 19
Table 4.1: CAGR of population in India 28
Table 4.2: Population Growth in India (2001 – 2011) 29
Table 5.1: Identified growth drivers to model traffic growth 32
Table 5.2: Elasticity recommendations for the Asset (Lucknow-Raebarelli) 32
Table 6.1: Adopted SCF for the Asset based on benchmarks 36
Table 6.2: Monthly MADT and Adopted AADT for FY22 (Oct-21 to March-22 FY22N) 36
Table 6.3: Impact of 6 laning LOS improvement 37
Table 6.4: Improvement of Sultanpur-Jaunpur-Varanasi 38
Table 6.5: Development of Purvanchal Expressway 38
Table 6.6: Trip factors at TP1 Dakhina Sekhpur 39
Table 6.7: Toll segmentation for FY22, TP1 Dakhina Sekhpur 39
Table 6.8: WPI growth forecast assumptions 39
Table 6.9: FY22 Revenue reconciliation summary 40
Table 6.10: Forecast traffic forecast for TP1 Dakhina Sekhpur 40
Table 6.11: Forecast Traffic CAGR (%) for TP1 Dakhina Sekhpur 41
Table 6.12: Forecast Revenue for TP1 Dakhina Sekhpur (INR crores) 41

Table 6.13: Forecast Revenue growth CAGR (%) for TP1 Dakhina Sekhpur 41
Table 6.14: Summary of Macro Assumptions for upside and downside cases 43
Table 6.15: Summary of impacts on the Assets 43
Table 6.16: Summary of impacts on the Assets 43
Table 6.17: Traffic forecast (With Upside Impacts) for TP1 44
Table 6.18: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1 44
Table 6.19: Revenue forecast (With Upside Impacts) for TP1 (In Cr) 44
Table 6.20: Revenue growth (With Upside Impacts) CAGR (%) for TP1 45
Table 6.21: Traffic forecast (With Dowside Impacts) for TP1 45
Table 6.22: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1 46
Table 6.23: Revenue forecast (With Downside Impacts) for TP1 (In Cr) 46
Table 6.24: Revenue growth (With Downside Impacts) CAGR (%) for TP1 46
Table 6.25: Target Revenues for Extension 1 47
Table 6.26: Target Revenues for Extension 2 47
Table 6.27: Trip length frequency for TP1 Dakhina Sekhpur 61

Appendices

A Top 10 OD Pairs

B Detailed Forecasts

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID- 19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometre
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Oversized vehicles
PCU	Passenger Car Unit: it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September

Acronym	Meaning
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on the Asset.

1.2 Our scope of work for the traffic and revenue forecasts process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line based on forecast published by Consensus and RBI (FY23)

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - Toll Plaza (TMS data) from October 2020 to March 2022
  - Concession agreement and toll notifications
  - Previous studies
  - Bid and Lender studies.
- Steer-commissioned TVC counts from 27th January to 3rd February 2021
- OD data collected from Steer-commissioned surveys which were conducted from 27th January to 28th January 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the Annual Average Daily Traffic (AADT) reported for each of the toll plaza.

1.7 The estimation of future traffic demand on the Asset was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset

against our Steer knowledge base (e.g., similar Asset types in the same state or on the same corridor), to derive appropriate elasticities.
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of Covid19 pandemic in India in FY21 and FY22

1.8 In the light of the global Covid19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until 03rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery etc.

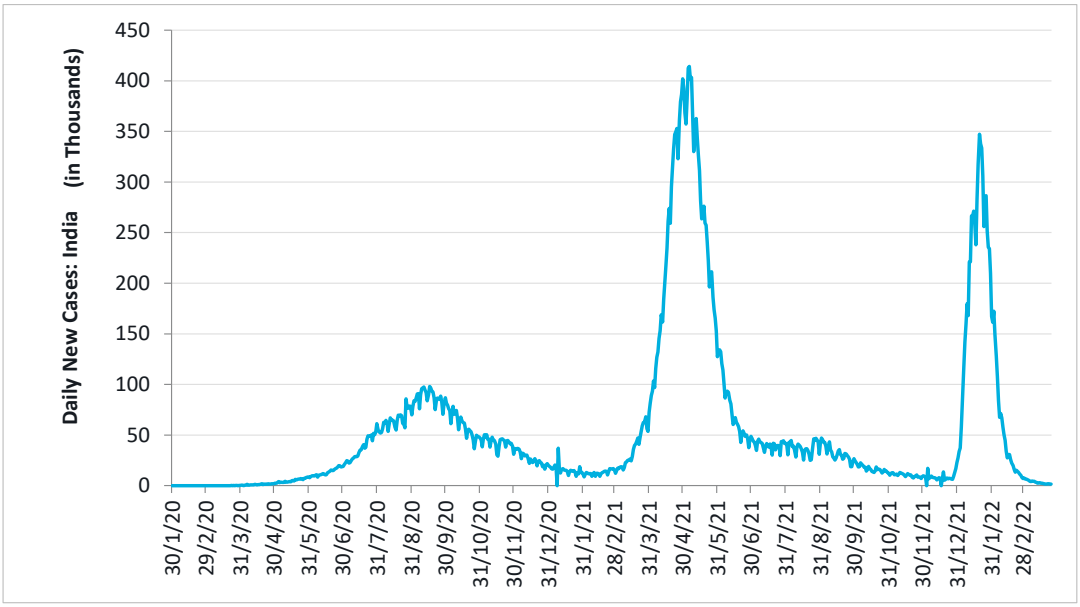
1.9 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. Q4 FY21 was largely unimpacted by Covid19 and toll plazas reported stabilised traffic numbers for the quarter.

1.10 As the TMS data for the Asset is available from Oct 2020, the observation is that the traffic volumes have ramped up in the Q3FY21 and Q4FY21, which can be driven by following factors - a release of pent-up demand in certain vehicle categories, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network as well as the stabilization of the tolling systems on the Asset. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021 onwards, another spike in Covid19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported Covid19 cases in India up-to Feb-2022.

Figure 1.1: Daily Reported Covid19 cases in India



Source: Steer analysis, **https://data.COVID19india.org/**

1.13 This second wave of Covid19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of Covid19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for first quarter. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of Covid19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of Covid19 had a much higher infection rate than both earlier waves of Covid19, but the fatality rate experienced in the third wave was lesser as compared to the former two, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.15 Now that Covid19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus services. This considerable shift in mode choice is expected to sustain for longer periods. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely

that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this report

1.16 The report has been divided into 6 chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 and 6 summarise our approach and results on estimating background traffic demand growth along with our key forecasting assumptions, assessment of network impacts, and presents our traffic and revenue forecasts for the Asset.

2 The Assets

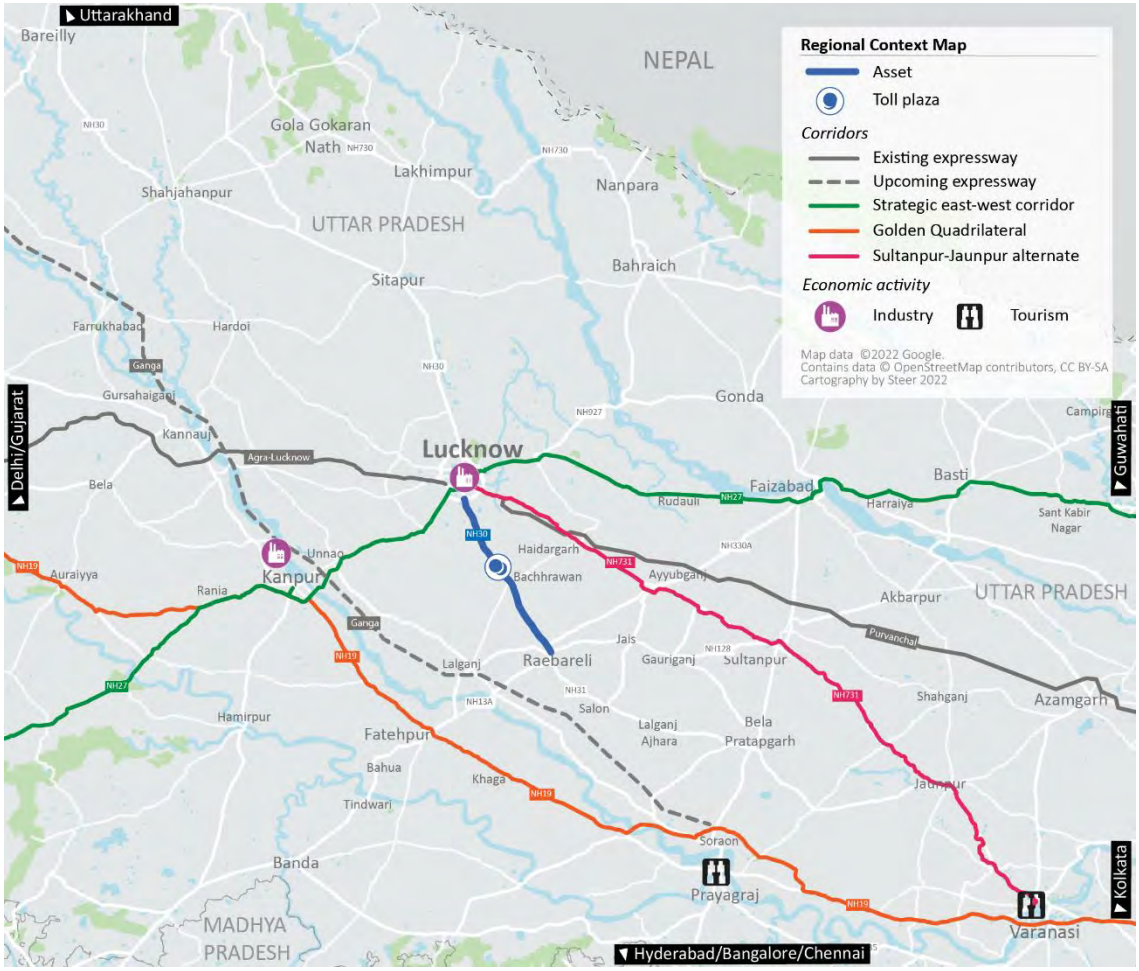
Introduction

2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Uttar Pradesh, connecting the state capital Lucknow to Raebareli in the southern-central part of Lucknow. The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



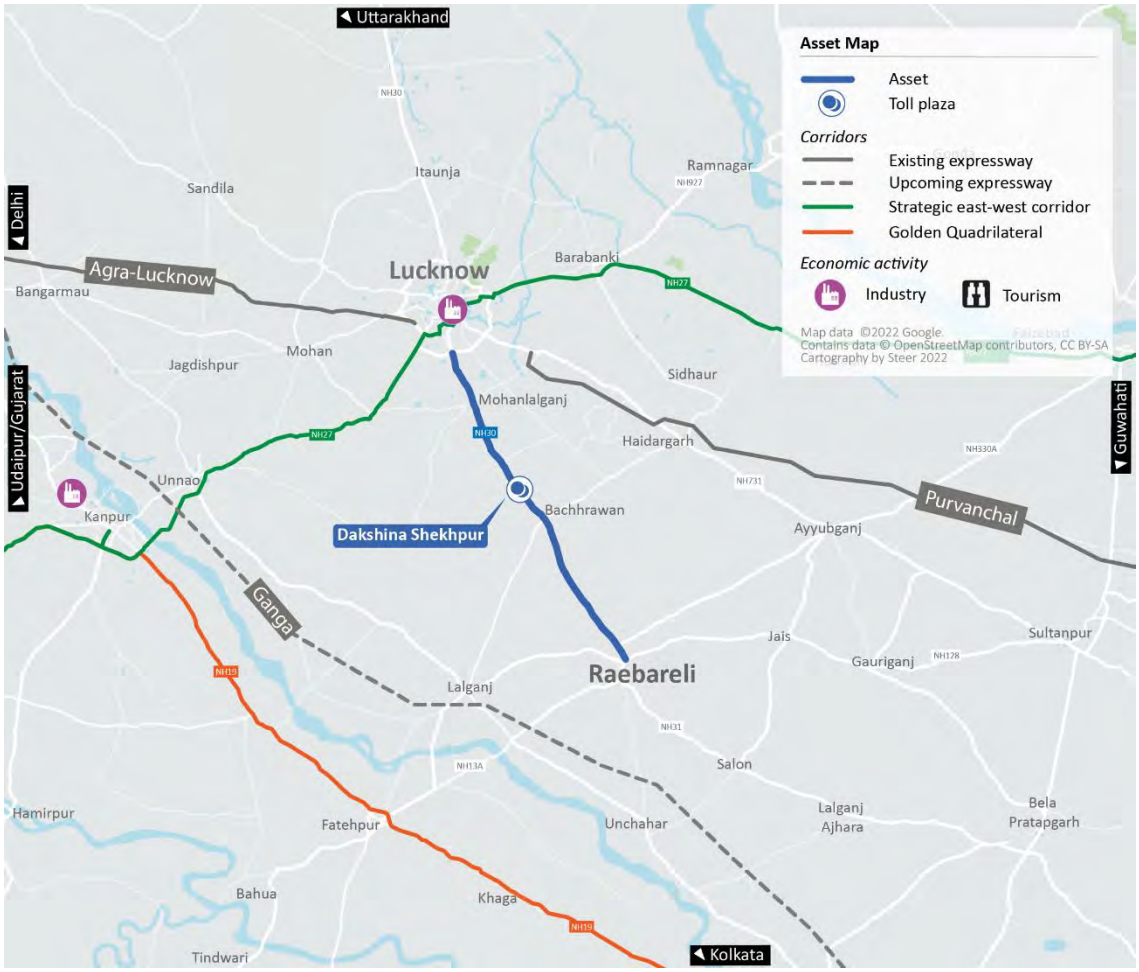
Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to two different types of strategic movements:

- **Short-distance trips** undertaken majorly by passenger vehicles such as cars for work/business and tourism purpose wherein the movement is predominantly local between Lucknow, Raebareli, Prayagraj, Varanasi and Mirzapur. Further, LCVs cater to the local demand generated by two large consumption centres – Lucknow and Raebareli. Short-distance trips made by MAVs feeds into the local consumption demand and carries significant amount of Cement due to the presence of cement factories (Birla Cement, Dalla Cement) in the vicinity.
- **Long-distance trips** undertaken by heavy trucks between Punjab, Haryana, Uttar Pradesh, West Bengal, and Jharkhand carrying a mix of commodities such as agriculture/grocery items, metal, cement, petroleum, and manufacturing items.

2.4 This Asset is a 70 km toll road which forms part of the NH 30 in Uttar Pradesh. It is a four-lane road with one toll plaza, namely, Dakhina Sekhpur (TP1) at Km 42.5 (closer to Lucknow). The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plaza on the Asset has been operational since March 2015 and the client took over the operations in October 2020. There are still 29 years left in the concession period which ends in FY51. The following table presents a summary of the concession.

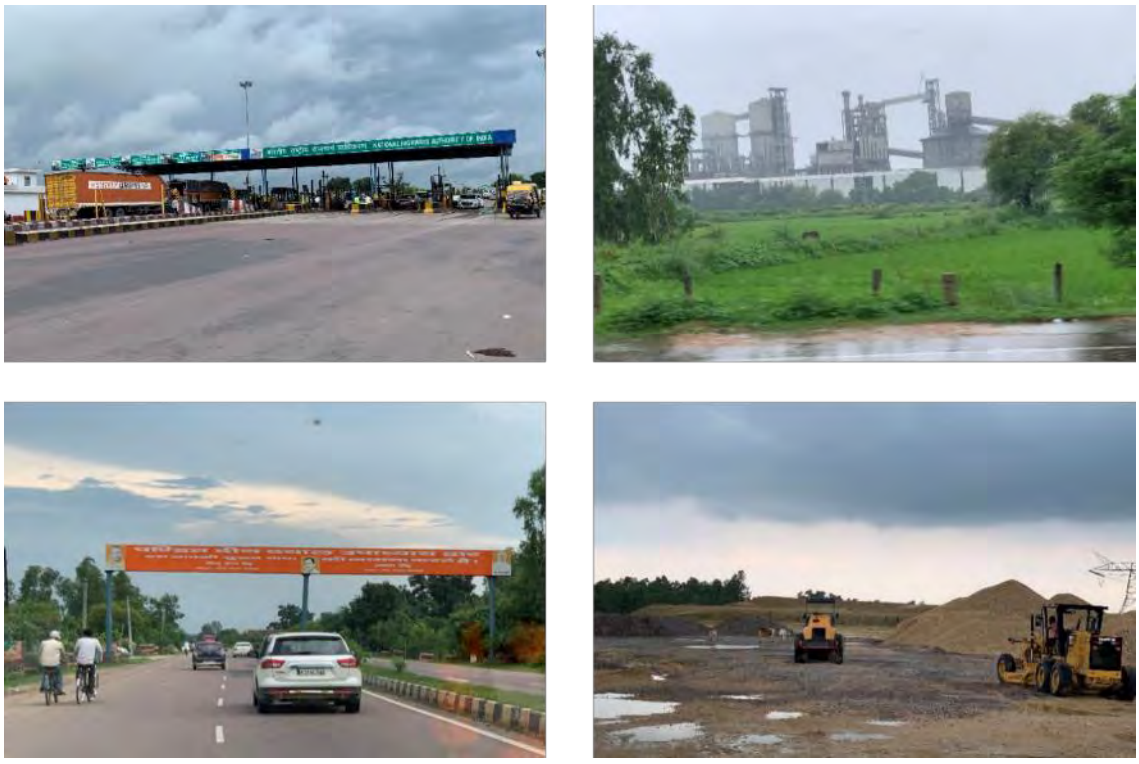
Table 2.1: Summary of concession

	Particulars
State	Uttar Pradesh
Highway and lane configuration	NH 30 four lane
Toll plazas	TP1: Dakhina Sekhpur
Length (km) as per concession agreement, applicable	TP1: 70 km
Commencement of operations	TP1: March 2015
Operated by Client since	October 2020
Concession period	30 years
Last year of concession	FY51

Source: Client data and Concession agreement

2.6 Figure 2.2 shows a typical cross-section of the Asset and its toll plazas. A Cement plant on the road/Asset, and ongoing work on Purvanchal expressway is captured in top right and bottom right image respectively.

Figure 2.3: Typical cross-sections and toll plazas on the Asset



Source: Steer site visit

2.7 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022

Type of Vehicle	Single Journey Fee TP1 Dakhina Sekhpur
CJV	105
LCV	170
Bus/Truck	360
3A	390
HCM/EME/MAV	560
OSV	685

Source: NHAI Revision of User Fee Rate w.e.f 01.04.2021

Key economic activities

2.8 Uttar Pradesh is the third largest economy and the most populous state in the country, accounting for 16% of India's total population which also makes its high consumer base a key factor that contributes to the GDP. Agriculture is the most important and the biggest sector in the state economy followed by the service sector comprising of travel, tourism, real estate, insurance and the finance industry. The state's GSDP grew by a CAGR of 6.29% between 2011-12 and 2018-19, almost in line with the overall GDP growth of India during the same time-period and even after accounting for the economic slowdown caused by the pandemic, UP's GSDP was the second highest in the country reflecting economic revival in the state.

2.9 The capital city of Lucknow, which is on one end of the Asset and a major traffic generator, is the main centre of administration, governance, commerce, technology, culture and tourism in the state with presence of major IT companies, automotive industry, handicrafts sector which accounts for 60% of the total exports from the state, education sector and research and development institutes. In recent times, it has emerged to become a growing IT hub wherein the UP government has awarded the IT Special Economic Zone project to HCL technologies in Lucknow which is expected to provide jobs to 25,000-50,000 people[1]. The city is well-linked to various places in the state as well as to the rest of the country including major cities such as Delhi, Kolkata, Hyderabad, and Bangalore via all modes of transportation.

2.10 Raebareli, situated on the other end of the Asset, is a centrally located city in the state which is well connected to other parts of the state as well as the country, with four national highways passing through the city. It is home to some of the major industries such as the Rail Coach Factory at Lalganj, NTPC power plant at Unchahar where the coal for the plant is supplied from Jharkhand, MP Birla Cement Plant at Raebareli and Kundanganj.

2.11 There is a significant presence of cement plants and a potential growth in this industry in the surrounding areas of the Asset. For example- MP Birla group has a cement in plant in Raebareli with a capacity of 2 million Tonnes Per Annum (MTPA) and has also acquired a plant in

[1] https://www.business-standard.com/article/companies/it-hiring-hcl-technologies-to-increase-lucknow-headcount-by-50-119013100891_1.html, accessed on 24 March 2021

Kundanganj to augment capacity from 1.2 MTPA to 3.6 MTPA[2]. ACC limited has a plant in Tikaria at distance of 50 km from Raebareli with plans to further augment capacity[3].The Asset enables the transport of cement from Varanasi and Prayagraj to the western region of the state and caters to the movement of cement trucks from plants located in Mirzapur, Sonbhadra, Raebareli to Lucknow regional offices or distributors in Lucknow.

2.12 The Asset also plays an integral part in connecting the rest of the country and the state to two of the key cities of great religious importance- Prayagraj known for the confluence of the rivers Ganga, Yamuna and Saraswati (Triveni Sangam), Magh Mela and Kumbh Mela, and Varanasi known for its famous ghats along the banks of river Ganga along with silk weaving. These two destinations also attract people from other parts of the world.

2.13 Evidently, the Asset is a key enabler of movement for both the passenger as well as commercial traffic within the state wherein the local car movement makes up for majority of the trips between places such as Lucknow, Raebareli, Bachhrawan, Fatehpur, Varanasi and Lalganj to name a few.

Alternate Routes

2.14 The key alternate to the corridor is the Lucknow-Sultanpur-Varanasi connection, which is currently under construction between Sultanpur and Varanasi. The Lucknow-Sultanpur section is complete and has started tolling in July 2019 and the tolling for Sultanpur-Jaunpur section is yet to start.

2.15 It is expected that once the full section between Lucknow and Varanasi finishes construction, a proportion of traffic between Lucknow and Varanasi is expected to shift away from the Asset. However, this new connection is expected to be tolled at a much higher rate than the route through the Asset, hence only a small proportion of traffic is expected to shift away. Further, the Raebareli-Prayagraj section of the highway is currently under lane augmentation to a 4 lane configuration, hence, after the completion of this road link, share of traffic moving from Lucknow to Prayagraj OD pairs is likely to shift on this corridor and therefore leading to increase in traffic on the Asset.

[2] **https://economictimes.indiatimes.com/industry/indl-goods/svs/cement/birla-corp-looks-to-scale-up-cement-capacity-by-over-60-per-cent/articleshow/70672908.cms?from=mdr,** accessed on 24 March 2021

[3] **https://realty.economictimes.indiatimes.com/news/allied-industries/acc-plans-to-increase-its-clinker-and-cement-capacities/82002302,** accessed on 24 March 2021

3 Traffic description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

PCU Factor assumption for reporting

3.4 In addition, please see the PCU factors considered in the table below as per IRC64 1990. For MAV, based on the discussion with the Client. For forecasting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5.

Table 3.1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV*	3.4
OSV	4.5

Source: Steer analysis and IRC64,1990, * Rigid-Trailer PCU

Historical Trends

3.5 The following table explains the quarterly recorded MADT by vehicle class, at the Asset's toll plaza over the period of 17 months from October 2020 to March 2022 (as provided by the client).

3.6 As discussed in chapter 2, the Asset is located between two major cities, with Lucknow being a major traffic generator for the Asset. Thus, the Asset observes healthy proportion of traffic from both, passenger vehicles as well as goods vehicles.

Table 3.2: Quarterly Traffic levels at TP1 Dakhina Sekhpur

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22*	FY22 vs FY21
CJV	10,982	10,295	10,873	8,560	10,057	11,215	10,338	10,031	10,761	(1.0%)
LCV	895	659	726	557	598	633	562	587	597	(17.7%)
Bus	633	676	666	476	626	678	637	604	658	(1.2%)
2A	543	676	627	583	683	653	574	623	614	(2.1%)
3A	576	673	637	508	557	488	554	526	520	(18.4%)
MAV	1,318	1,538	1,463	1,155	1,301	1,109	1,017	1,146	1,063	(27.3%)
Total	**14,948**	**14,517**	**14,991**	**11,840**	**13,822**	**14,776**	**13,682**	**13,517**	**14,213**	(5.2%)
PCU	**22,010**	**22,526**	**22,666**	**17,979**	**20,923**	**21,348**	**19,892**	**20,022**	**20,604**	(9.1%)

Source: Steer analysis of Client data. (*Only 12 days of data was available for Oct'20, FY22* is based on Oct-21 to Mar-22)

3.7 CJV have witnessed a flat profile on the Asset registering a negative 1% growth over FY21 in FY22*. However, CJV remain the major contributor to traffic on the Asset.

3.8 As discussed in chapter 2, the presence of cement industry near the Asset maintains a healthy standard of goods vehicle movement on the Asset. Additionally, it also enables movement of cement from Varanasi and Prayagraj to the western regions of Uttar Pradesh. Goods vehicles have witnessed a growth profile between the first three quarters of FY22 with a slight dip in last two quarters of FY22 primarily because of the local and long-distance diversion to alternate roads such as the Sultanpur-Jaunpur-Varanasi Road as well as the commissioning of the Purvanchal expressway (in Nov-2021). Impact of diversions, construction on Asset, and COVID-19 related disruption in the economy led to a decline in the PCU levels.

3.9 LCV's have seen a significant reduction in volumes in FY22 as compared to historical volumes observed on the Asset. This can be explained partly by a reclassification of a number of LCV's into MLCV, which are reported under the CJV category. this reclassification is driven by the mandatory implementation of FASTag starting Feb-21, where several MLCV's which were being tolled as LCV's are now being tolled under the MLCV category.

3.10 The following table shows the revenue by vehicle type at each toll plaza for the months October 2020 to February 2021.

Table 3.3: Revenue (in INR lakhs) at TP1 Dakhina Sekhpur, and AADC (average annual daily collection)

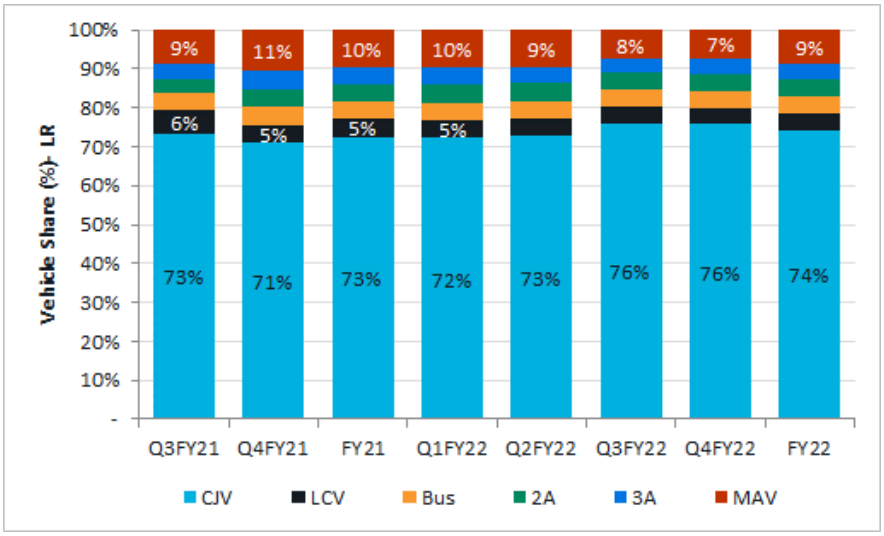
FY	CJV	LCV	Bus	2A	3A	MAV	Total Revenue	AADC (INR lakhs)
FY21 (Oct-21 to Mar-21)	2,893	302	588	673	725	2,398	**7,579**	**20.76**

FY	CJV	LCV	Bus	2A	3A	MAV	Total Revenue	AADC (INR lakhs)
FY22 (Apr-21 to Mar -22)	2,789	252	598	646	577	1,752	**6,613**	**18.12**

Source: Steer analysis of the Client data. * Only 12 days of data was available for Oct'20

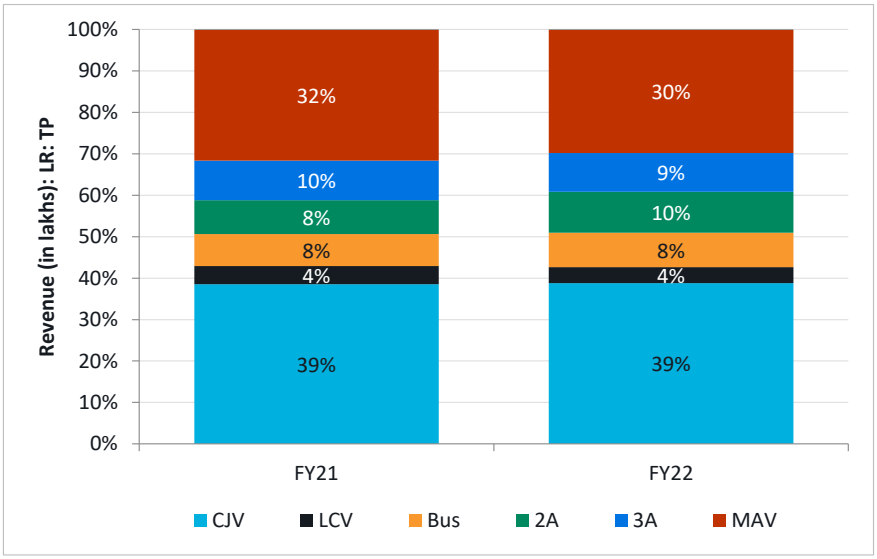
3.11 The figures below show the category-wise share of traffic and revenue at the toll plaza for the months October 2020 to February 2021. Here, CJVs make up the majority of traffic share across all the months followed by MAVs and the contribution to revenue share is the highest by CJVs across all months. However, the combined revenue share of MAV and 3A vehicles across all months on an average is the highest with 40% share compared to the average share of 39% by the CJVs across the same time.

Figure 3.1: Vehicle share at TP1



Source: Steer analysis of the Client data

Figure 3.2: Vehicle wise Revenue share at TP1



Source: Steer analysis of the Client data

Toll Frequencies

3.12 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.13 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this varies from asset to asset or even toll plaza to toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.14 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows the vehicle to cross the plaza twice in a day at discounted rates.
Monthly Pass	Discounted single entry ticket vehicles making multiple trips in a month
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.15 In addition to the above ticket categories, a special category pass of “Local Monthly” is also being sold on the Asset. This pass has been issued by the toll plazas individually and the toll plaza is deciding on the toll for such special passes.

Impact of FASTag implementation

3.16 As mentioned previously, FY22-FY21 has seen an increased penetration of FASTag across all vehicle categories. This trend is expected to continue in the future, given the recent government mandate to 100% tolling via FASTag. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls. The figure below illustrates the FASTag penetration rate at TP1 by March 2022.

Table 3.5: %age of Transactions via Fast Tag, Mar 2022

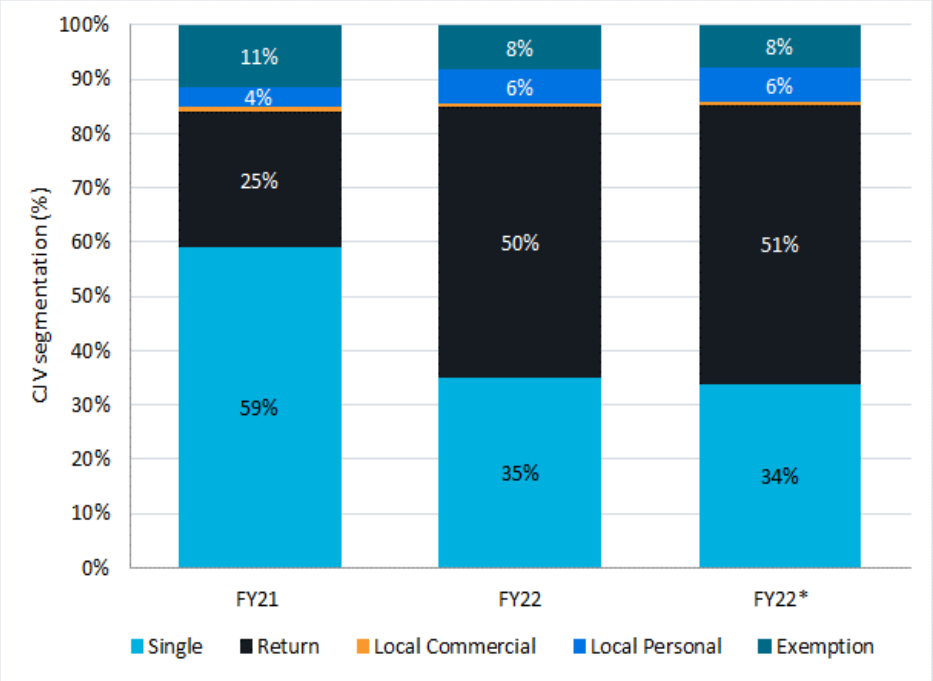
Toll Plaza	CJV	LCV	Bus	2A	3A	MAV
Dakhina Sekhpur toll plaza	88%	86%	99%	98%	96%	99%

Source: Steer Analysis

As we can see from the table above most of the vehicle types across the toll plaza are reporting FASTag penetration close to 90%, with CJV and LCV around 86%-88%, Buses and 2A's are reporting more than 98% proportions at the toll plaza and MAVs have reached 99%. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time. Share of traffic by payment type

3.17 The figures below show the ticket segmentation for CJV and MAV categories. It can be observed that both CJV and MAV tickets are dominated by single journeys.

Figure 3.3:Ticket-segmentation for CJV at TP1 Dakhina Sekhpur



Source: Steer analysis of the Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

3.18 Data for FY21 was available for only Oct-March and thus to do a fair comparison, FY22* has been showcased, which represents traffic segmentation for Oct-21 to Mar-22. Additionally, data for October 2020 is partially available, i.e., for only 12 days as tolling had just begun on the Asset. As a result, Oct-20 data is not the absolute reflection of October traffic.

3.19 Between FY21 and FY22 it is observed that the single ticket shares have substantially decreased across CJV vehicle type. A difference of around 24% has been noticed in single ticket type. As for the return ticket category, there is an increase of 25% and in local personal 2% increase is reported in the overall traffic levels.

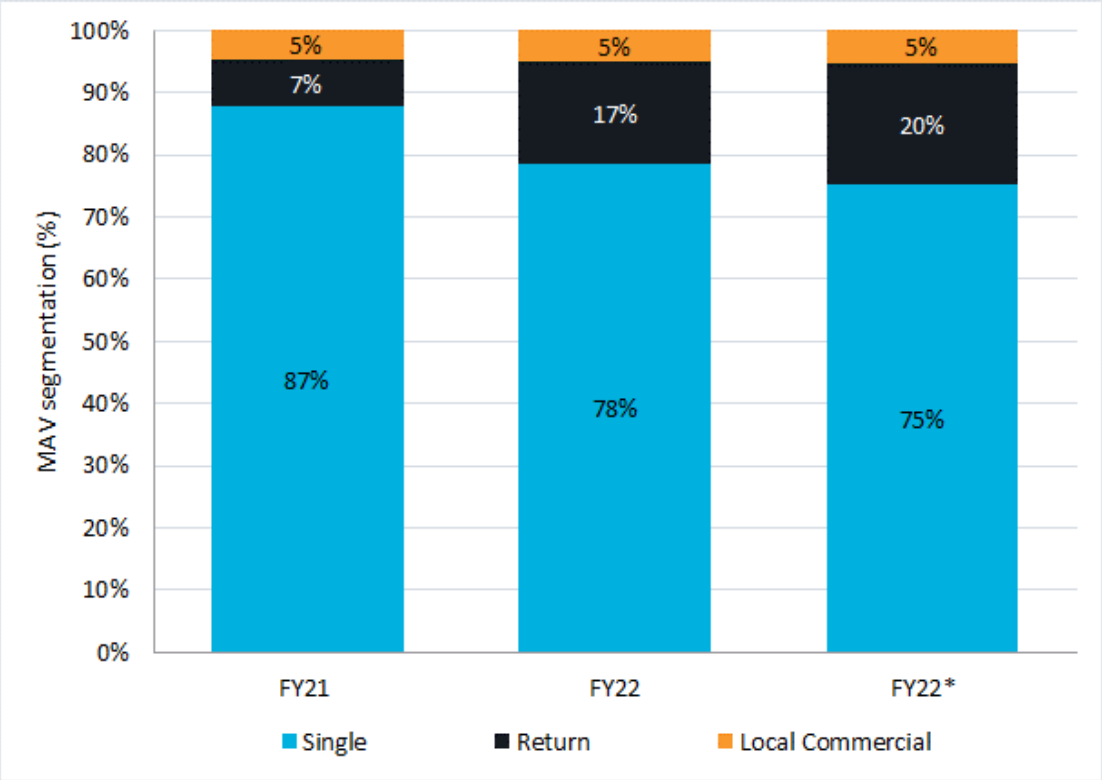
3.20 Active implementation of FASTag enabled users to avail the return journey discount as after January 2020 only single tickets were being sold on cash payments. According to the norms, non-FASTag users can't avail of any discounts and hence, even if the user crosses the toll plaza twice in 24 hours, the user will have to pay 2 times the ticket amount instead of 1.5 times. In FY22, the single ticket share declined substantially due to FASTag mandating scheme of government and further details regarding FASTag are discussed in the sections starting from 3.41.

Table.6: Ticket-segmentation for MAV at TP1 Dakhina Sekhpur

Ticket Category	FY21 (Oct-20 to Mar-21)	FY22	FY22 (Oct-21 to Mar-22)
Single	87%	78%	75%
Return	7%	17%	20%
Local Commercial	5%	5%	5%

Source: Steer analysis of the Client TMS data

Figure 3.4: Ticket-segmentation for MAV at TP1 Dakhina Sekhpur



Source: Steer analysis of the Client data (FY21 has data for Oct-20 to Mar-21, FY22* represents Oct-21 to Mar-22 data)

3.21 Similar to CJVs, between FY21 and FY22 it is observed that the single ticket shares have substantially decreased across MAV vehicle type. A difference of around 9% is observed. As for the return ticket category, there is an increase of 10% and in local commercial no increase is reported. The loss in single tickets sold is made up by the increase in return ticket type.

3.22 FY22 segmentation for LCV, Bus and 2A category for Dakhina Sekhpur toll plaza is given below:

Table 3.7: Ticket segmentation for LCV, Bus AND 2A at TP1 Dakhina Sekhpur

Ticket Category	LCV	Bus	2A
Single	41%	10%	68%
Return	48%	89%	28%
Local commercial	1%	0%	3%
Exemption	8%	0%	1%

Source: Steer analysis of Client data

Data Collection exercise

3.23 As mentioned previously, to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. Both OD surveys and TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Figure 3.5: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	State time
TP1 Dakhina Sekhpur	19 Jan 2021	25 Jan 2021	0000-2359	21 Jan 2021	0900 hours

Source: Steer analysis

3.24 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at the toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.25 Taking an average of the seven-day TVC counts (19th Jan – 25th Jan 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Figure 3.6: WADT from TVC counts

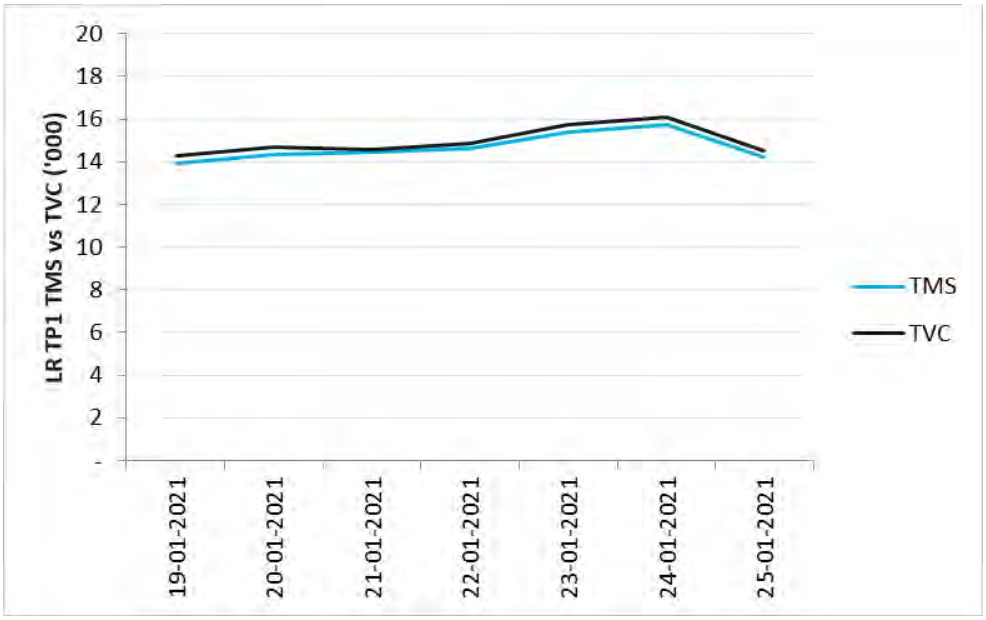
Toll Plaza	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
Dakhina Sekhpur	9,739	952	908	778	430	678	1485	-	14,969

Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.26 As we use the TMS data to estimate the base year MADT, we have used our TVC data to validate the TMS data on those days, as provided by the Client. The following figures show the comparison between the daily traffic observed by TVC and TMS for the toll plaza.

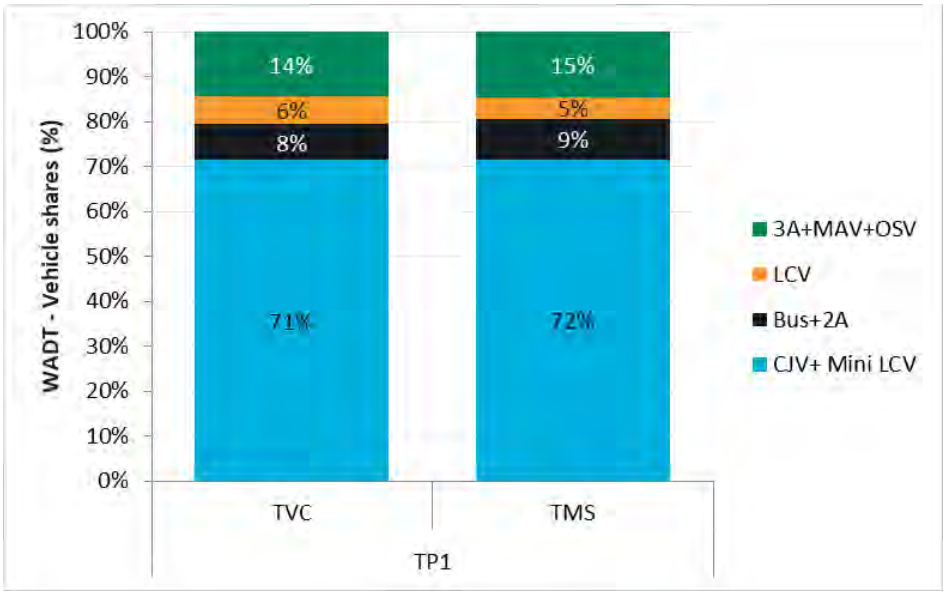
Figure 3.7: Comparison between TVC and TMS daily traffic data on TP1 Dakhina Sekhpur



Source: Steer analysis of TVC and Client TMS data

3.27 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. As can be seen, whilst the share of CJVs and 3A+MAV+OSV is marginally higher for TMS compared to TVC, it is equal for bus/2A and lower for LCV category. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.8: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.28 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.29 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. As mentioned previously, the OD analysis presented here has been based on the data collected on 21st-22nd January 2021.

3.30 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.31 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.32 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TMS data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.8: Sample rates for OD data

Vehicle type	TP1 Dakhina Sekhpur
CJV	17%
Mini Bus + Bus	74%
Mini LCV + LCV+2A	67%
3A	72%
MAV + OSV	61%

Source: Steer analysis of OD data

Zone Categories

3.33 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.9: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.

Aggregate Zone	Description
Rest of Uttar Pradesh	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Delhi NCR	Delhi NCR
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central India	Madhya Pradesh, Chhattisgarh
West India	Gujarat and Maharashtra
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states

Source: Steer analysis

Zonal influence

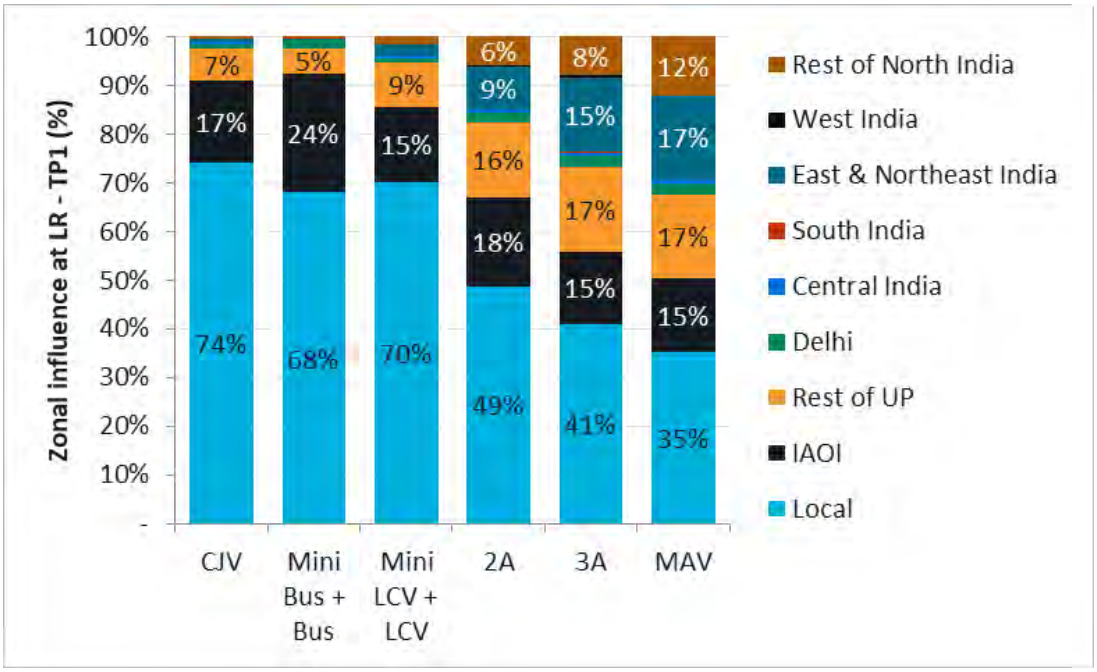
3.34 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[4] at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.35 As can be seen from the figure below, there is a higher share of local trips for both the passenger and commercial vehicles wherein 74% of the influence for CJVs, 35% for MAVs and 41% for 3A vehicles are from areas in close proximity to the Asset. This analysis is in line with our understanding gained from the site visit wherein a heavy influence on the traffic from the surrounding local areas and rest of the state was observed. Also, the results of the top OD pair analysis, as given in the appendices, shows that the majority of the trips originate and end in local and IAOI areas for passenger and 2A traffic whereas for the goods traffic, places such as Kolkata, Punjab and Uttarakhand also feature at the top of the OD pair list.

3.36 Outside the state, places in East & Northeast India such as Bihar, Jharkhand, Assam and West Bengal majorly influence the long-distance heavy goods traffic followed by places in the rest of north India such as Uttarakhand, Himanchal Pradesh, Punjab and Haryana. North to east is one of the key long-distance movements observed on the Asset, with trucks travelling from Punjab-Haryana-Moradabad-Lucknow to East India.

[4] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.9: Zonal influence at TP1 Dakhina Sekhpur



Source: Steer analysis of OD data

Internal External analysis

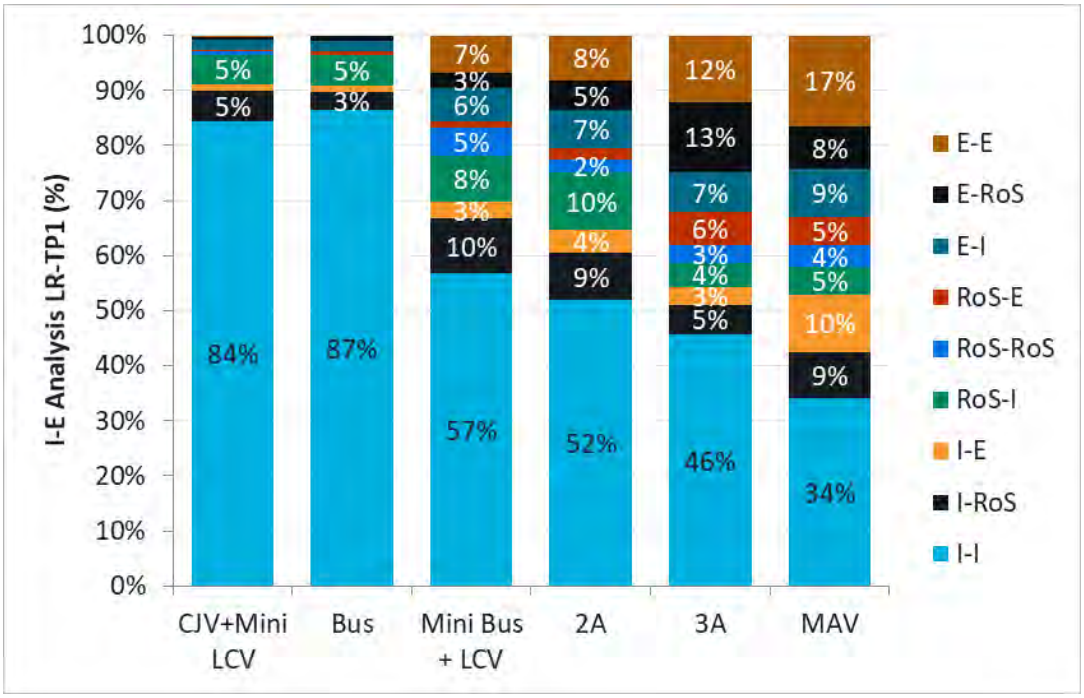
3.37 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e., local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e., through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e., lying on the Asset, while 'External' zones are areas lying outside the state.

3.38 Figure 3.6 below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

3.39 As expected, more than 80% of the passenger traffic originate from and are destined to places within the state of Uttar Pradesh highlighting the short to medium distance nature of these vehicle share on the asset. Similarly, more than 50% of Mini Bus +LCV and 2A vehicles are also starting and ending trips within the state.

3.40 More than half of the 3A and MAV traffic have areas outside the state as either the origin or destination points wherein 12% of the 3A and 17% of the MAV vehicles start and end trips outside the state, highlighting the long-distance nature of these vehicles on the Asset.

Figure 3.10: Internal-external distribution at TP1 Dakhina Sekhpur



Source: Steer analysis of OD data

Commodity distribution

We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	

Commodity Description	Code	Combined codes used for charts
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN
Cement	CMT	CMT

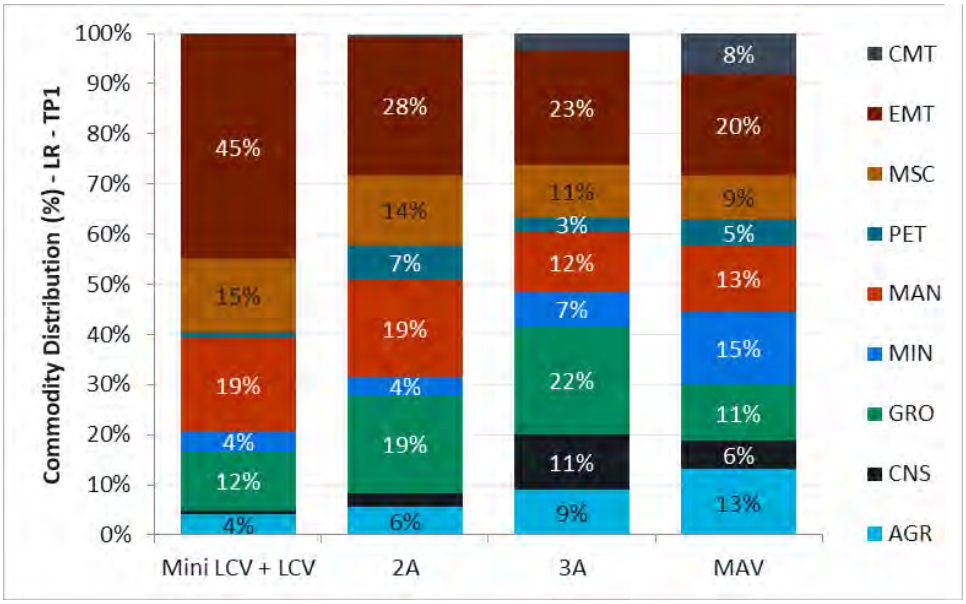
Source: Steer Analysis

3.41 The following figures present the commodity distribution for goods vehicles at the two toll plazas, at the total level and also split by direction, towards Lucknow and towards Raebareli. Grocery items were the key commodity category moved by 3A vehicles accounting for 22% of the share followed by manufacturing items such as paper, plastic and electronic items whereas the dominant commodity moved by MAVs includes minerals, manufacturing and agricultural items, and around 8% of the MAVs used the asset to transport cement. Manufactured goods made up for the key commodity being carried by light-goods vehicles accounting for 19% of both the 2A and LCV vehicle type followed by agricultural and grocery items.

3.42 A high percentage of vehicles moving grocery items are observed as this Asset connects two major cities in Uttar Pradesh and these cities have a large inherent demand of fast-moving consumer goods. The agricultural and grocery items are carried over both short-distances from and to local places such as Lucknow, Raebareli and Kanpur, and over long-distances such as Uttarakhand, Punjab and Delhi. A similar mix of short and long distances trips are observed for vehicles carrying manufactured goods.

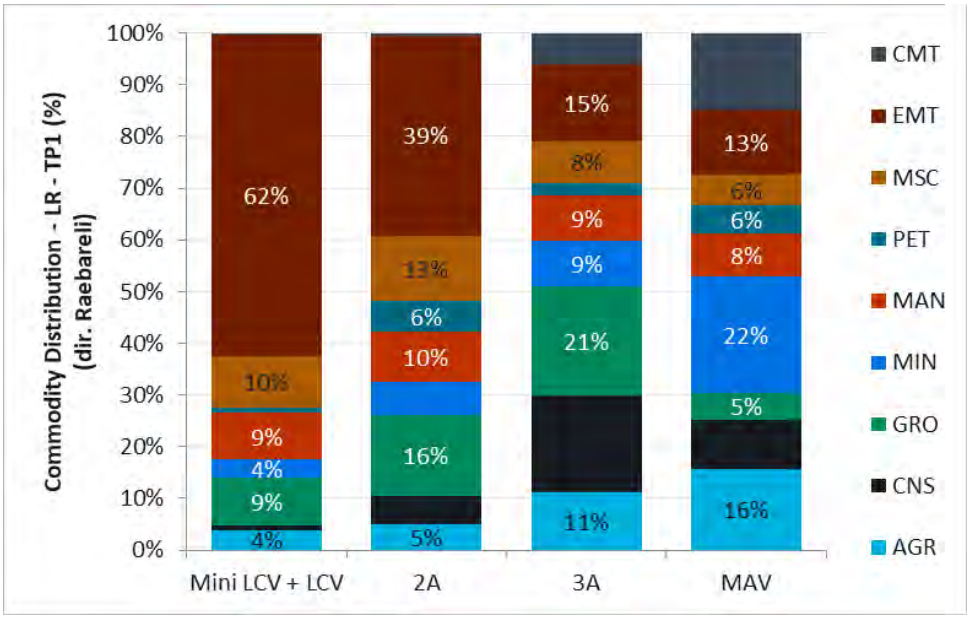
3.43 Looking by direction, a higher share of vehicles across all categories are empty travelling towards Raebareli and vehicles carrying cement make up for a very small share in this direction with grocery and manufacturing items being the top commodities being carried. However, there is a higher share of vehicles carrying cement towards Lucknow probably from plants near Raebareli with 15% MAVs and 6% 3A vehicles contributing to this share. Additionally, a significant share of MAVs (25%) carries minerals such as coal towards Raebareli-Lucknow directions to places such as Uttarakhand, Muzaffarnagar and Kanauj. Overall, vehicles moving towards Lucknow seem to carry a more diverse mix of commodities than those travelling in the direction of Raebareli.

Figure 3.11: Commodity distribution at TP1 Dakhina Sekhpur (Total)



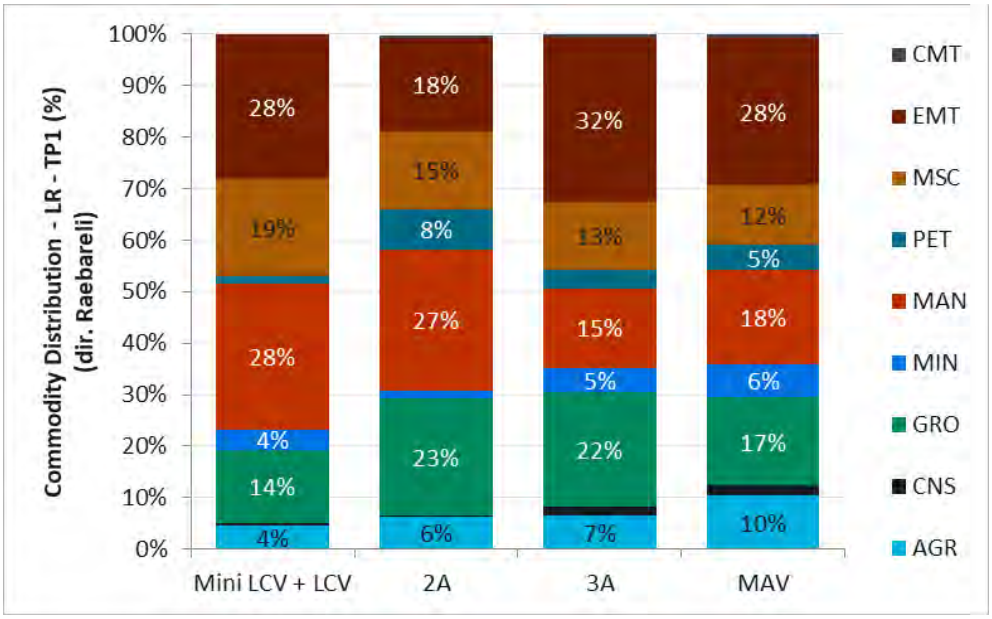
Source: Steer analysis of OD data

Figure 3.12: Commodity distribution at TP1 Dakhina Sekhpur (towards Lucknow)



Source: Steer analysis of OD data

Figure 3.13: Commodity distribution at TP1 Dakhina Sekhpur (towards Raebareli)



Source: Steer analysis of OD data

Trip length analysis

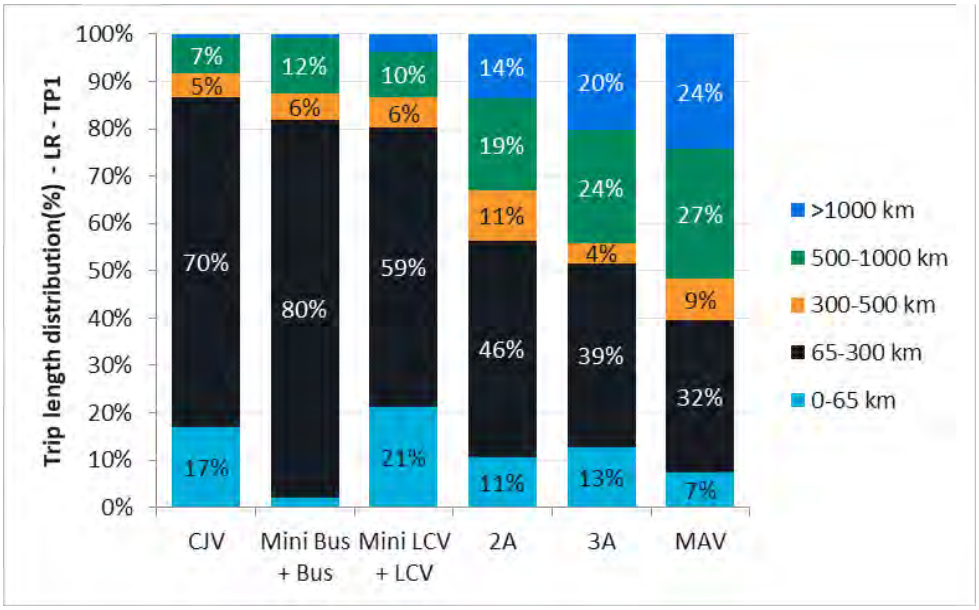
3.44 Trip-length distribution provides the distance-based profile of various vehicle types. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[5]

3.45 Supporting the observations made in zonal & internal-external analysis in the previous sections, the figure below highlights that between 70-80% of passenger vehicles travel shorter distances up to 300 kms, contributing to the local movements on the Assets.

3.46 As expected, the asset caters to the long-distance movement for a significant proportion of commercial traffic as around 40-50% of the 3A and MAVs cover distances ranging from 500 km to more than 1000 km.

[5] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.14: Trip length distribution TP1 Dakhina Sekhpur



Source: Steer analysis of OD data

Conclusions

3.47 In summary, CJVs , and 3A+MAV are the key contributor to the revenue on the Asset. CJV's dominate the traffic volumes on the Asset.

3.48 The analysis on ticket-segmentation shows that for both CJVs and MAVs, single journey tickets accounts for the most dominant ticket category followed by return tickets and exemptions for CJVs and return and local commercial tickets for MAVs. However, it is observed that over time the share of single journeys has reduced and that of return journey tickets increased which is due to a gradual and strict implementation of FASTag since FASTag enables the users to avail the return journey discount. The Asset observes almost negligible violations.

3.49 The Asset has observed significant growth in the proportion of transactions via ETC in the recent months. In the month of March 2022, the ETC penetration for CJVs reached 88%, for MAVs 99%, for LCV 86% of ETC penetration has been achieved.

3.50 The TVC-TMS analysis highlights minor variation between the two datasets wherein at the total level, TVC is approximately 2% higher than the TMS data with the difference being negligible for the larger revenue generating categories (3A, MAV, and OSV combined), 0.2% at a total level.

3.51 The OD analysis found that in terms of zonal influence, the passenger and commercial traffic is heavily influenced by local areas such as Lucknow, Raebareli, Prayagraj and Bachhrawan with the influence ranging from 74% for CJVs, 35% for MAVs and 41% for 3A vehicles, which is also in line with our understanding gained from the site visit. Further, places in East & Northeast India such as Bihar, Jharkhand, Assam, and West Bengal majorly influence the long-distance heavy goods traffic followed by places in the rest of north India such as Uttarakhand, Himanchal Pradesh, Punjab and Haryana.

3.52 The key commodities transported on the Asset includes grocery products, manufactured items, minerals and agricultural commodities by the heavy goods vehicle and grocery/agricultural items by light goods vehicle. It is also observed that a higher share of

vehicles across all categories are empty travelling towards Raebareli with grocery and manufacturing items being the top commodities being carried whereas there is a higher share of vehicles carrying cement towards Lucknow probably from plants near Raebareli with 15% MAVs and 6% 3A vehicles contributing to this share.

3.53 The internal and external distribution highlights the short to medium distance nature of the passenger vehicle share on the asset with more than 80% of traffic originating from and destined towards places within the state of Uttar Pradesh whereas more than 50% of the 3A and MAV traffic start from or are bound towards areas outside the state. Overall, across all categories it is seen that majority of the traffic is internal in nature and therefore it can be inferred that the growth of traffic is directly proportional to the growth of state. This is further supported by the top 10 OD pairs for this Asset as well as the trip length distribution which shows that majority of passenger and light goods traffic cover distances up to 300 kms whereas most of the heavy good traffic travel longer distances up to 1000 kms.

3.54 Therefore, analysing the vehicle share on the Asset and understanding the OD analysis, CJVs make up for the highest share of traffic and significantly contributed to the local traffic share. Heavy goods vehicles, although accounting for around 14% of the traffic on an average over the months, contributes the most to the total revenue share, wherein grocery and agriculture items are the top commodity being transported on the Asset by these vehicles.

4 Socio economic context and traffic growth

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the roads are in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the region where the Asset is located and the country. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Asset.

4.2 In turn, the change in the relative competitive position of the Asset (and thus of the traffic capture they can achieve) derives from how the relative offer for the roads changes, i.e. the service offered, and the tolls charged on the project roads, in comparison to that on competing roads; and whether any competing road facilities are planned.

4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the regions surrounding the Asset.

Population growth

4.4 We have analysed the key socioeconomic drivers of the background traffic demand in Jharkhand state, where the Asset is located.

National level

4.5 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth.

State level

4.6 The following table shows the evolution of population in Utter Pradesh state compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, the state has grown at a higher rate than the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Uttar Pradesh	166	131	34	199	155	44	1.9%	1.7%	2.6%
India	**1,028**	**742**	**286**	**1,210**	**833**	**377**	**1.6%**	**1.2%**	**2.8%**

Source: Ministry of Housing and Urban Affairs – Census Data, http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf

4.7 Due to the complexities of the patterns in which urbanisation takes place, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide a socio-economic context of the trend in the region in which the Asset is located.

Economic growth

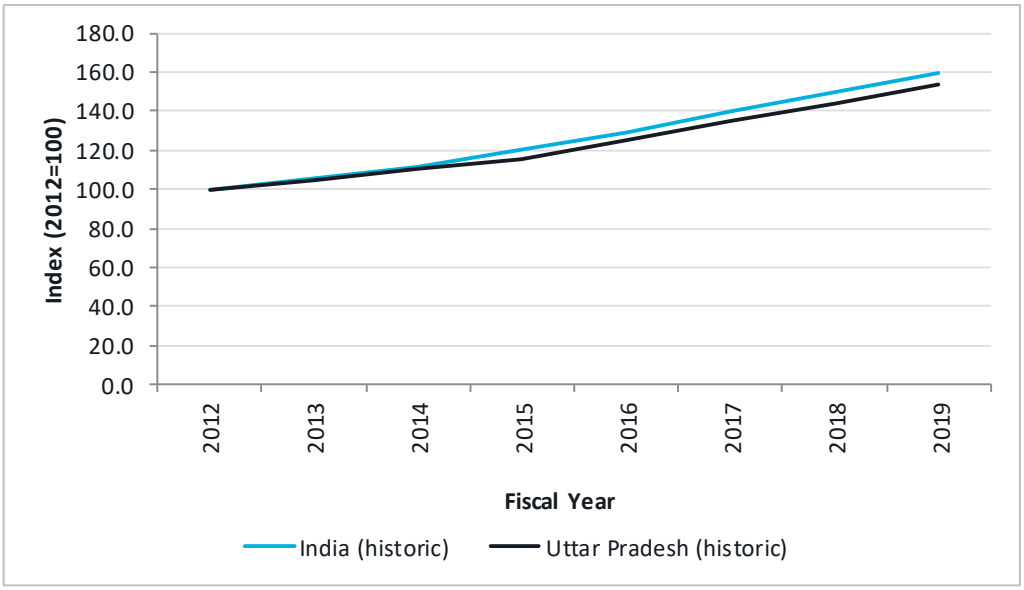
GDP and GSDP Growth

4.8 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.9 The economic performance of Uttar Pradesh has been weaker than the country as a whole. The state contributes approximately 8% to India's GDP. In terms of sectoral contribution to the state GDP, tertiary sector has the highest share (50%) followed by secondary (27%) and primary (24%), with the sectoral shares remaining stable over the last five years

4.10 The following figures illustrates the evolution of Uttar Pradesh's GSDP.

Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

5 Traffic Growth Analysis

Introduction

5.1 In this section, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 In the absence of Historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

Overview

5.5 For brownfield Assets, where sufficient historical traffic evolution is available, it is common practice to use regression model analysis to determine the relationship, expressed as elasticity, between traffic growth and key socioeconomic drivers. This relationship is then applied to assumptions of future socio-economic evolution to estimate future traffic growth.

5.6 As for the Asset under consideration, a consistent historical trend was not available. Therefore, we undertook a benchmark in order to estimate our forecast elasticities, Sources used included our understanding of the Asset, the elasticities used during the bid for TOT3 package by the client and the subsequent lender study that was undertaken by the Client. We have also undertaken a regional benchmarking against Assets having similar traffic profiles, which give us reasonable confidence the relationships proposed.

5.7 In terms of selection of growth drivers for vehicle types, in general we have assumed state GDP as the key driving factor for the passenger traffic given this traffic is generally driven by the local economies of the cities and state containing the Asset. The heavier commercial vehicles generally ply long-distance, and the underlying growth is governed by the general economies of several states or nation as whole.

5.8 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

5.9 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.1: Identified growth drivers to model traffic growth

Vehicle type	GDP India	GSDP Uttar Pradesh
Car	-	100%
LCV	-	100%
Bus	-	100%
2A	-	100%
3A	100%	-
MAV	100%	-

Source: Steer

5.10 The sections below detail out the reasoning for selection of respective growth driver(s) for each vehicle category.

Table 5.2: Elasticity recommendations for the Asset (Lucknow-Raebarelli)

Vehicle Category	Proposed	Growth Driver	Comments
CJV	Uttar Pradesh GSDP	1.2	CJV cater to local movement (98% trips within state) between Lucknow, Raebareli and Allahabad. Strong car growth expected as these populous and big towns grow.
Buses	Uttar Pradesh GSDP	0.5	It seems that buses currently are serving local intercity demand. As these cities grow, the buses are also expected to respond to the increasing demand however only at a 0.5 relationship to GSDP.
LCV	Uttar Pradesh GSDP	0.5	LCV/2A contribute to the local consumption demand of Lucknow-Raebareli. The trip lengths of LCV and 2A category (up to 80%) are predominantly short distance <300Km. Which confirms the understanding that the movements cater to local demand. Considering the above observations, and our experience across other toll roads in the region, we believe that elasticities of 0.5 with respect to state GSDP are considered reasonable.
2A	Uttar Pradesh GSDP	0.5	
3A	GDP India	0.6	Mix of medium and long-distance trips, with trip lengths for more than 80% of the MAV are more than 300km, signifying long distance nature of the movement. Historically on similar Assets, 3A showed a decline but after the Axle load revisions there has been a resurgence the 3A category traffic volumes returning to the roads. We expect this to continue with a small growth in the future.
MAV	GDP India	0.9	

Source: Steer Analysis

Forecasts for growth drivers

5.11 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.12 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing assets, lower manufacturing outputs and lower rural consumption.

5.13 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in Figure 4.2.

5.14 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.15 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

State GSDP

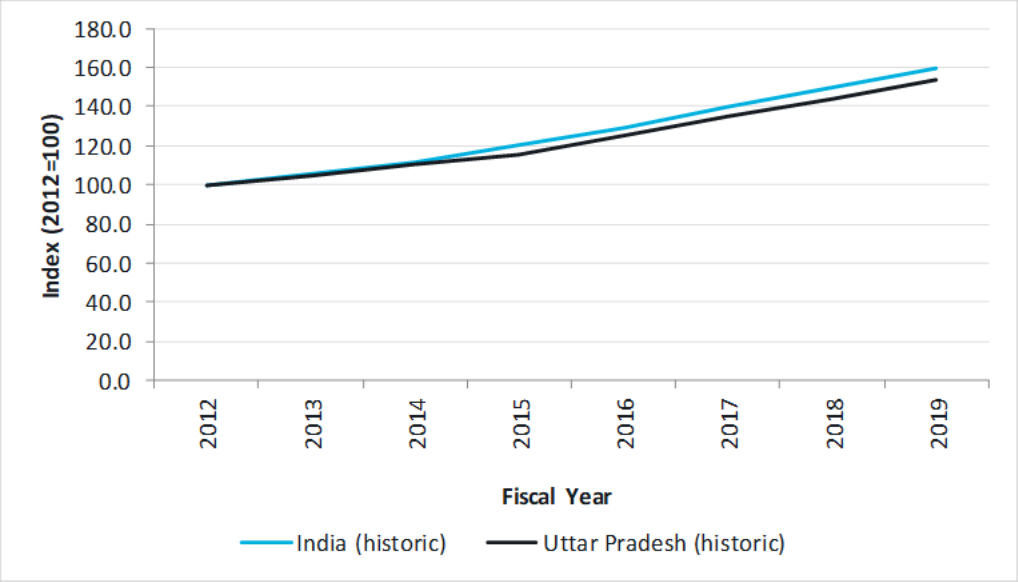
5.16 As per Client projections, Uttar Pradesh's GSDP growth assumes to be in line with the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.17 There are significant investments expected to take place as part of the state's plan and Uttar Pradesh is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher value of GSDP growth rate than expected across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Uttar Pradesh's state economy.

5.18 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.19 The chart below shows the forecast growth lines for GDP and Uttar Pradesh GSDP.

Figure 5.1: GDP-GSDP forecast



Source: GDP and GSDP forecast provided by Client

6 Forecast: Base year AADT and Impacts

Introduction

6.1 In this chapter, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

6.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

6.3 In the absence of Historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

6.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Seasonal Correction Factors

6.5 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.6 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.7 Historical traffic data was available for all toll vehicle categories starting November 2020 up-to March 2022. Therefore, in absence of longer-term historical data to arrive at the SCF, we have benchmarked our SCF from various sources:

- Assets in the vicinity, south or north of the Asset carrying very similar traffic profiles
- SCF assumptions assumed during the Bid by the Client, and
- Site observations and information provided by the toll plaza.

6.8 The below table presents the assumptions in SCF used to estimate the AADT:

Table 6.1: Adopted SCF for the Asset based on benchmarks

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.96	0.96	0.96	1.06	1.06	1.12	1.01	0.98	1.03	1.04	0.93	0.97
LCV	0.95	0.98	0.99	1.07	1.14	1.08	0.99	0.95	0.95	1.02	0.94	1.05
Bus	0.93	0.97	0.97	1.05	1.14	1.08	1.02	0.92	1.00	1.03	1.00	0.98
2A	0.99	0.99	1.00	0.99	1.13	1.02	0.94	1.00	0.99	1.05	0.96	1.04
3A	1.01	1.01	1.10	1.16	1.15	1.08	0.90	0.91	0.92	1.00	0.96	1.04
MAV	1.01	1.03	1.02	1.10	1.14	1.08	1.02	0.98	0.95	0.97	0.89	0.97

Source: Steer analysis of various sources

Base year FY22 AADT estimates

FY22 AADT estimation

6.9 As discussed earlier in chapter 1 and 3, The second wave of COVID-19 infections peaked in the northern half of the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 and again the month of October resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.10 The period starting November 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.11 Further, we believe that the traffic levels observed during the November 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.2: Monthly MADT and Adopted AADT for FY22 (Oct-21 to March-22 FY22N)

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted AADT
CJV	10,379	11,995	11,271	9,595	11,345	10,074	10,692
LCV	677	616	607	532	591	562	585
Bus	662	682	691	627	638	646	651
2A	704	602	652	552	592	578	608
3A	480	442	542	521	623	518	497

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted AADT
MAV	1,210	976	1,141	976	1,063	1,012	1,022
Total AADT	**14,113**	**15,313**	**14,905**	**12,805**	**14,852**	**13,390**	**14,054**
PCU*	**20,998**	**21,375**	**21,671**	**18,775**	**21,359**	**19,542**	**20,270**

Source: Steer Analysis, *Rigid Trailer PCU factor used for MAV

Analysis of potential network/developmental impacts

6.12 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous Chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6 laning LOS improvement

6.13 As per the concession agreement as soon as the Asset his 40,000 PCU's the Asset is eligible for capacity augmentation. The PCU level need to be maintained above the 40,000 levels for 4 consecutive years and 1 year will be earmarked for DPR preparation. After that a three-year period is factored in for construction, during which the Year 1 of construction toll rates will be maintained at 75% and will remain flat at 75%. After the construction is over the toll rates will be calculated as normal, as they should have been in that year.

6.14 A comparison of generalised journey costs (GJC) provides how different elements of cost and time affect traffic. This comparison was done for both light and heavy vehicles. Lower GJCs correspond to higher induced traffic. Based on Steer's studies and research in India, we have found that for every 1% reduction in the GJCs, the traffic increases by a factor of 0.3. We then applied the difference of GJCs to the elasticity of 0.3 to get net influence on the traffic.

6.15 The improvement in travel costs or GJC is translated into the impact on that share of local + IAOI OD movements using a linear inverse relationship. Therefore, the GJC influence is applied on the corresponding shares of traffic, which were extracted from OD data. The table below shows the extent of the LOS impact and the expected timelines of the impact on the Asset.

Table 6.3: Impact of 6 laning LOS improvement

Vehicle category	FY41
CJV	2.7%
Mini LCV	0.6%
Buses	0.6%
LCV	0.6%
2A	1.1%
3A	1.3%
MAV	1.0%

Source: Steer analysis

Improvement of Sultanpur-Jaunpur-Varanasi

6.16 The key alternate to the corridor is the Lucknow-Sultanpur-Varanasi connection, which is currently under construction between Sultanpur and Varanasi. The Lucknow-Sultanpur section is complete and has started tolling in July 2019 and the tolling for Sultanpur-Jaunpur section

has not been started as of now. It is expected that once the full section between Lucknow and Varanasi finishes construction, a proportion of traffic between Lucknow and Varanasi is expected to shift away from the asset. Moreover, this new connection is expected to be tolled at a much higher rate than the route through the asset, hence only a small proportion of traffic is expected to shift away.

Table 6.4: Improvement of Sultanpur-Jaunpur-Varanasi

Vehicle category	FY23	FY24	FY25
Staging of the impact	**50%**	**75%**	**100%**
CJV	(0.01%)	(0.02%)	(0.03%)
2A	(0.8%)	(1.1%)	(1.5%)
3A	(0.6%)	(0.9%)	(1.2%)
MAV	(0.9%)	(1.4%)	(1.8%)

Source: Steer analysis

Development of Purvanchal Expressway

6.17 Purvanchal Expressway is a six-lane access-controlled expressway being constructed in the state of Uttar Pradesh. The expressway will connect Ghazipur town with the state capital, Lucknow via Azamgarh and Ayodhya. This expressway will therefore act as a long-distance alternate for traffic moving from west of Lucknow towards Bihar and further east. The expressway is currently operational since Nov-2021 (FY22) and will start tolling from May 2022 (FY23).

Table 6.5: Development of Purvanchal Expressway

Vehicle category	FY23	FY24
Staging of the impact	**75%**	**100%**
3A	(2.0%)	(2.7%)
MAV	(1.0%)	(1.4%)

Source: Steer analysis

Revenue forecasting assumptions

6.18 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While “trip factors” provide the conversion factor to the former, i.e., traffic (trips) to tickets sold, “toll segmentation” provides the latter i.e., the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.19 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY21 data available and listed in the table below:

Table 6.6: Trip factors at TP1 Dakhina Sekhpur

Forecast	CJV	MLCV	LCV	Bus	2A	3A	MAV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	45	45	45	50	45	45	45
Local Commercial	1	1	1	1	1	1	1
Local Personal	21	20	20	20	20	20	20

Source: Steer analysis of Client TMS data

Toll segmentation

6.20 As discussed in Chapter 3, segmentation trends have largely been stabilising over the last few months, with February 2021 indicating a reduction in the share of exemptions and violations due to FASTag implementation and penetration. This has also resulted in normalisation of travel patterns within Single and Return category across the vehicle categories, therefore we believe that Feb segmentation is a better reflection of the toll segmentation on the Asset. This is presented below.

Table 6.7: Toll segmentation for FY22, TP1 Dakhina Sekhpur

Ticket type	CJV	LCV	Bus	2A	3A	MAV
Single	33.8%	39.7%	9.5%	65.2%	70.0%	74.8%
Return	51.4%	47.6%	90.0%	30.2%	24.0%	19.6%
Local Commercial	0.6%	0.9%	0.0%	2.9%	3.2%	5.2%
Local Personal	6.3%	-	-	-	-	-
Exemptions	7.9%	11.8%	0.6%	1.6%	2.8%	0.4%

Source: Steer analysis of Client TMS data

Toll evolution

6.21 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.22 We have used actual toll rates from the FY21 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.8: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23	14.3%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%

Financial year	WPI growth (%)
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by the Client

Revenue reconciliation

6.23 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset. To reconcile we have used the segmentation Oct-Mar FY22 average, MADT of the month and compared it with the reported revenue for that month. The exercise was undertaken for Feb and Mar 2022.

6.24 The Steer revenue calculations have been built up from monthly raw traffic data files, containing monthly data and ticket type information; and the toll notifications – all shared by the client. The comparison, as shown in the table below, depicts the difference between modelled revenue and the reported revenue is within 0.6%, which gives us confidence in the long term assumptions for trip segmentation and trip factors for revenue estimation.

Table 6.9: FY22 Revenue reconciliation summary

Modelled	Reported	Difference (%)	Modelled	Reported	Difference (%)
Feb-22	Feb-22		Mar-22	Mar-22	
5.23	5.23	(0.0%)	5.36	5.33	0.6%

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.25 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.10: Forecast traffic forecast for TP1 Dakhina Sekhpur

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	9,869	14,865	21,841	45,970	82,859
Mini LCV	965	1,149	1,354	1,847	2,373
Bus	652	776	914	1,248	1,603
LCV	585	696	820	1,120	1,438

Vehicle Type	FY22	FY27	FY32	FY42	FY51
2A	608	713	840	1,153	1,481
3A	497	589	717	1,047	1,412
MAV	1,022	1,349	1,805	3,140	4,902
AADT	**14,198**	**20,138**	**28,292**	**55,525**	**96,067**
PCU's	**20,416**	**27,827**	**37,904**	**70,390**	**1,17,344**

Source: Steer analysis

Table 6.11: Forecast Traffic CAGR (%) for TP1 Dakhina Sekhpur

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	(1.1%)	8.5%	8.0%	7.7%	7.6%
Mini LCV	(1.1%)	3.6%	3.3%	3.2%	3.2%
Bus	(1.9%)	3.6%	3.3%	3.2%	3.2%
LCV	(12.8%)	3.6%	3.3%	3.2%	3.2%
2A	(5.5%)	3.2%	3.3%	3.2%	3.1%
3A	(20.4%)	3.4%	4.0%	3.9%	3.7%
MAV	(27.7%)	5.7%	6.0%	5.7%	5.6%
AADT	**(5.2%)**	**7.2%**	**7.0%**	**7.0%**	**6.8%**
PCU's	**(9.3%)**	**6.4%**	**6.4%**	**6.4%**	**6.2%**

Source: Steer analysis

Table 6.12: Forecast Revenue for TP1 Dakhina Sekhpur (INR crores)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	25.4	51.9	96.5	315.8	854.2
Mini LCV	2.5	4.0	6.0	12.7	24.5
Bus	6.0	9.6	14.3	30.4	58.5
LCV	2.5	4.0	6.1	12.8	24.7
2A	6.5	10.2	15.3	32.7	62.8
3A	5.8	9.3	14.2	32.4	65.6
MAV	17.5	31.5	53.2	143.5	336.1
Total revenue	**66.1**	**120.5**	**205.5**	**580.3**	**1,426.4**

Source: Steer analysis

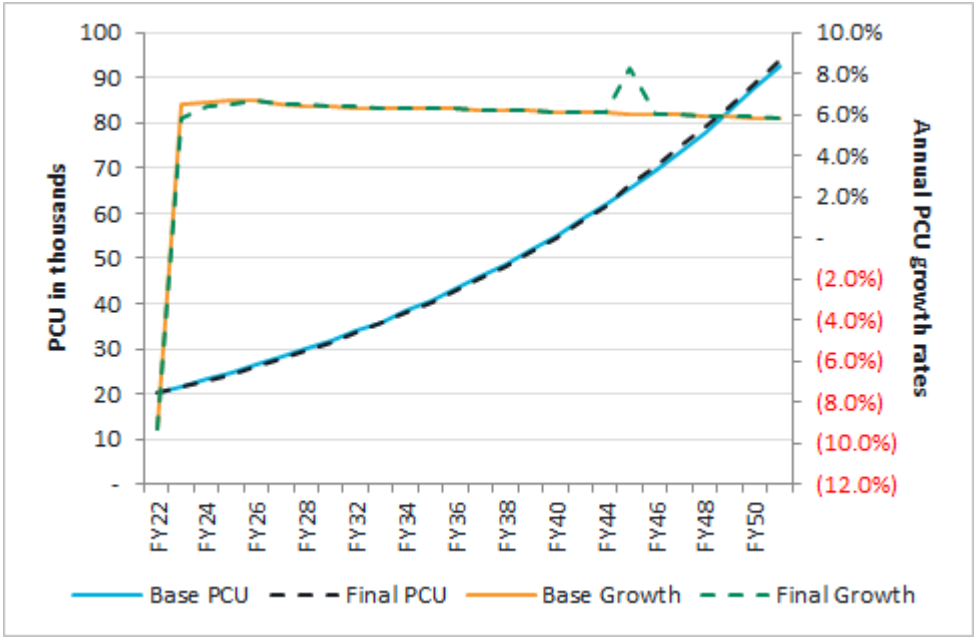
Table 6.13: Forecast Revenue growth CAGR (%) for TP1 Dakhina Sekhpur

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	(3.2%)	15.3%	13.2%	12.6%	12.9%
Mini LCV	(7.4%)	10.1%	8.3%	7.8%	8.2%
Bus	1.7%	9.9%	8.4%	7.8%	8.2%
LCV	(16.6%)	9.9%	8.4%	7.8%	8.2%

Vehicle Type	FY21-FY22	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
2A	(4.1%)	9.7%	8.3%	7.9%	8.2%
3A	(20.5%)	9.9%	9.0%	8.6%	8.7%
MAV	(26.9%)	12.4%	11.1%	10.4%	10.7%
Total revenue	**(12.7%)**	**12.8%**	**11.3%**	**10.9%**	**11.2%**

Source: Steer analysis

Figure 6.1: Forecast PCUs and growth rates at TP1 Dakhina Sekhpur



Source: Steer analysis

Upside and Downside Cases

6.26 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.27 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.28 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.14: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
LRTL	GDP/GSDP	+1% every year	-1% every year
LRTL	WPI	+1% every year	-1% every year
LRTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.29 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.30 The upside case impacts included in forecasts are summarised in below:

Table 6.15: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning of the Asset)	Sultanpur Jaunpur Varanasi Link			Purvanchal Expressway	
Year	**FY39**	**FY23**	**FY24**	**FY25 onwards**	**FY23**	**FY24 onwards**
TP-1	CJV: 3.4% LCV/Bus: 0.7% 2A: 1.4% 3A: 1.3% MAV: 1.3%	2A: -0.6% 3A: -0.5% MAV: -0.7%	2A: -0.9% 3A: -0.7% MAV: -1.0%	2A: -1.1% 3A: -0.9% MAV: -1.4%	3A: -1.5% MAV: -0.8%	3A: -2.0% MAV: -1.0%

Source: Steer analysis of OD data, and publicly available information

Impacts-Downside Case

6.31 The downside case impacts included in forecasts are summarised in below:

Table 6.16: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning of the Asset)	Sultanpur Jaunpur Varanasi Link			Purvanchal Expressway	
Year	**FY45**	**FY23**	**FY24**	**FY25 onwards**	**FY23**	**FY24 onwards**
TP-1	CJV: 2.0% LCV/Bus: 0.4% 2A: 1.0% 3A: 0.8% MAV: 0.8%	2A: -1.0% 3A: -0.8% MAV: -1.1%	2A: -1.4% 3A: -1.1% MAV: -1.7%	2A: -1.9% 3A: -1.5% MAV: -2.3%	3A: -2.5% MAV: -1.3%	3A: -3.3% MAV: -1.7%

Source: Steer analysis of OD data, and publicly available information

The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.32 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.33 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.17: Traffic forecast (With Upside Impacts) for TP1

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	9,869	10,920	16,416	26,582	68,118	145,059
Mini LCV	965	1,007	1,200	1,475	2,191	3,026
Bus	652	681	811	997	1,480	2,044
LCV	585	611	727	894	1,328	1,834
2A	608	632	748	920	1,375	1,899
3A	497	514	627	802	1,298	1,909
MAV	1,022	1,087	1,468	2,115	4,267	7,566
AADT	**14,198**	**15,451**	**21,997**	**33,785**	**80,058**	**163,336**
PCU's	**20,416**	**21,973**	**30,194**	**44,660**	**99,097**	**193,810**

Source: Steer analysis

Table 6.18: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	10.6%	10.7%	10.1%	9.9%	9.7%
Mini LCV	4.4%	4.5%	4.2%	4.0%	4.0%
Bus	4.4%	4.5%	4.2%	4.0%	4.0%
LCV	4.4%	4.5%	4.2%	4.0%	4.0%
2A	3.8%	4.3%	4.2%	4.1%	4.0%
3A	3.3%	5.1%	5.1%	4.9%	4.8%
MAV	6.4%	7.8%	7.6%	7.3%	7.2%
AADT	**8.8%**	**9.2%**	**9.0%**	**9.0%**	**8.8%**
PCU's	**7.6%**	**8.3%**	**8.1%**	**8.3%**	**8.1%**

Source: Steer analysis

Table 6.19: Revenue forecast (With Upside Impacts) for TP1 (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	25.4	31.0	59.1	125.8	541.0	1,884.8
Mini LCV	2.5	2.9	4.3	7.0	17.4	39.3
Bus	6.0	6.9	10.3	16.7	41.8	94.0

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
LCV	2.5	2.9	4.3	7.1	17.6	39.7
2A	6.5	7.4	11.1	17.9	45.1	101.5
3A	5.8	6.6	10.2	17.1	46.5	111.5
MAV	17.5	20.6	35.3	66.3	226.0	653.7
Total Revenue	**66.1**	**78.4**	**134.6**	**257.8**	**935.5**	**2,924.4**

Source: Steer analysis

Table 6.20: Revenue growth (With Upside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	22.2%	17.5%	16.3%	15.7%	15.8%
Mini LCV	15.3%	10.8%	10.1%	9.6%	9.8%
Bus	15.2%	10.7%	10.0%	9.6%	9.8%
LCV	15.0%	10.6%	10.2%	9.6%	9.8%
2A	14.8%	10.6%	10.0%	9.7%	9.8%
3A	14.9%	11.3%	11.0%	10.5%	10.6%
MAV	17.8%	14.3%	13.5%	13.0%	13.1%
Total	**18.5%**	**14.5%**	**13.9%**	**13.8%**	**13.8%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.34 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.35 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.21: Traffic forecast (With Dowside Impacts) for TP1

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	9,869	10,515	13,586	18,284	31,577	50,012
Mini LCV	965	991	1,105	1,253	1,579	1,910
Bus	652	669	746	847	1,067	1,290
LCV	585	601	670	759	957	1,158
2A	608	619	683	775	977	1,186
3A	497	497	557	647	854	1,078
MAV	1,022	1,046	1,249	1,563	2,361	3,317
AADT	**14,198**	**14,937**	**18,596**	**24,128**	**39,371**	**59,951**
PCU's	**20,416**	**21,276**	**25,851**	**32,733**	**51,215**	**75,465**

Source: Steer analysis

Table 6.22: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	6.5%	6.6%	6.1%	5.6%	5.7%
Mini LCV	2.7%	2.8%	2.5%	2.3%	2.4%
Bus	2.7%	2.8%	2.5%	2.3%	2.4%
LCV	2.7%	2.8%	2.5%	2.3%	2.4%
2A	1.7%	2.5%	2.5%	2.3%	2.4%
3A	(0.1%)	2.9%	3.1%	2.8%	2.8%
MAV	2.4%	4.5%	4.6%	4.2%	4.2%
AADT	**5.2%**	**5.6%**	**5.3%**	**5.0%**	**5.1%**
PCU's	**4.2%**	**5.0%**	**4.8%**	**4.6%**	**4.6%**

Source: Steer analysis

Table 6.23: Revenue forecast (With Downside Impacts) for TP1 (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	25.4	29.9	45.9	75.8	140.6	413.7
Mini LCV	2.5	2.8	3.7	5.2	7.0	15.8
Bus	6.0	6.7	9.0	12.5	17.0	37.7
LCV	2.5	2.8	3.8	5.3	7.2	15.9
2A	6.5	7.2	9.6	13.2	18.0	40.2
3A	5.8	6.3	8.5	12.1	17.2	40.0
MAV	17.5	19.7	28.2	43.2	70.3	182.3
Total Revenue	**66.1**	**75.4**	**108.7**	**167.3**	**277.2**	**745.6**

Source: Steer analysis

Table 6.24: Revenue growth (With Downside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	17.6%	11.3%	10.6%	6.4%	9.8%
Mini LCV	13.4%	7.3%	6.8%	3.1%	6.4%
Bus	12.2%	7.7%	6.7%	3.1%	6.4%
LCV	12.1%	7.6%	6.8%	3.1%	6.4%
2A	11.1%	7.5%	6.6%	3.2%	6.4%
3A	9.9%	7.8%	7.2%	3.6%	6.8%
MAV	12.4%	9.4%	8.9%	5.0%	8.3%
Total	**14.1%**	**9.6%**	**9.0%**	**5.2%**	**8.5%**

Source: Steer analysis

Target revenues and modification of concession period

6.36 As per the concession agreement, the target revenue for TP1 should be 9.1 Cr for the month of March 2030 first calculation of target revenue and 21.6 Cr for the month of March 2040 for the second calculation of target revenue. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual revenue.' If the target revenue for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6.25: Target Revenues for Extension 1

Asset	Target Month	Target Revenue	Estimated Revenue			Average Revenue	Variation (%)
		Cr	2029	2030	2031		
LR TP1	Mar-30	9.05	12.97	14.38	15.90	14.42	59.3%

Source: Steer analysis

Table 6.26: Target Revenues for Extension 2

Asset	Target Month	Target Revenue	Estimated Revenue			Average Revenue	Variation (%)
		Cr	2039	2040	2041		
LR TP1	Mar-40	21.64	26.07	27.61	45.57	33.09	52.9%

Source: Steer analysis

6.37 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have forecast seasonality of March month to adjust for seasonal trends and arrive at March traffic from AADT traffic, which is then segmented according to the forecast toll segmentation and trip factors and multiplied with respective estimated toll rates to get to a monthly revenue collection.

6.38 As seen from the table above, the target revenue forecast for the Asset is higher than the concession agreement target revenue by a rounded 59% for target date 1 and 52% for target date 2 respectively. As the difference lies above the permitted threshold of 20% and 30% for target date 1 and 2 respectively, a renegotiation of the length of the concession agreement is expected. As per the concession agreement, for every 1% excess target revenue, the concession period shall be decreased by 1.5%, with a capping at 20%. Therefore, for the excess traffic on these toll plazas, the concession period, originally 30 years, is expected to be decreased by 5 years from FY51, potentially reducing the last date of concession to FY46.

Summary outlook

6.39 Passenger movement on the asset is the largest share of traffic on this asset. On one side is the state capital of Lucknow and on the other side is the state judicial capital and a major tourism centre of Prayagraj. Cars are expected to see a healthy growth on the asset following the overall behavioural shift of users away from public transport.

6.40 The asset benefits from its strategic location connecting the east-west movement of goods from Uttarakhand and Northern Uttar Pradesh towards south-eastern Uttar Pradesh,

Jharkhand, and West Bengal. The 3A/MAV traffic on the asset is a mix of regional and long-distance traffic carrying a variety of commodities ranging from agricultural products, manufacturing items and minerals. This portion of traffic is assumed to see a strong growth relationship with the national GDP and state GSDP.

6.41 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.42 With regards to the short-term background growth, we see the following risk:

- The nascent recovery from the pandemic could be subdued due stronger lockdowns being implemented and traffic growth not sustaining the coming months. However as it was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure could see a major comeback in the second part of FY23 resulting in increased activity in the corridor.

6.43 Overall, we see a positive outlook for the region and the Asset, given that it serves major urban centres of Lucknow and Prayagraj and eastern Uttar Pradesh as a whole. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Top 10 OD Pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. For both CJVs and MAVs and OSVs the top OD Pairs are combined below:

TP1 Dakhina Sekhpur

Table A.1: CJV, Bus and Mini Bus top 10 OD pair shares at TP1 Dakhina Sekhpur

	OD Pair	Share
1.	Raebareli-Lucknow	37%
2.	Lucknow-Prayagraj	16%
3.	Bachhrawan-Lucknow	7%
4.	Lucknow-Fatehpur	5%
5.	Lalganj-Lucknow	5%
6.	Lucknow-Pratapgarh	4%
7.	Lucknow-Varanasi	4%
8.	Bachhrawan-Nigoha	2%
9.	Lucknow-Banda	1%
10.	kundanganj-Lucknow	1%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Dakhina Sekhpur

	OD Pair	Share
1.	Raebareli-Lucknow	11%
2.	Lucknow-Prayagraj	6%
3.	Lucknow-Kolkata	4%
4.	Unchahar-Lucknow	4%
5.	Bachhrawan-Lucknow	3%
6.	Kolkata-Punjab	3%
7.	Lucknow-Varanasi	2%
8.	kundanganj-Lucknow	2%
9.	Kolkata-Uttarakhand	2%
10.	Lucknow-Fatehpur	1%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

This section presents the detailed traffic forecasts for the forecast period until FY50, year of expected close of the concession. The following two tables show the AADT and traffic growth, respectively.

Table B.1: Forecasts for (background + impacts) AADT at TP1 Dakhina Sekhpur

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	10,705	999	675	605	625	505	1,066	**15,180**	**21,606**
FY24	11,630	1,035	699	627	645	521	1,125	**16,283**	**22,983**
FY25	12,635	1,072	724	650	666	542	1,193	**17,481**	**24,485**
FY26	13,725	1,111	750	673	690	566	1,270	**18,783**	**26,127**
FY27	14,865	1,149	776	696	713	589	1,349	**20,138**	**27,827**
FY28	16,083	1,188	803	720	738	613	1,432	**21,577**	**29,623**
FY29	17,384	1,228	830	744	763	638	1,519	**23,105**	**31,521**
FY30	18,770	1,269	857	769	788	663	1,609	**24,726**	**33,525**
FY31	20,254	1,311	886	794	814	690	1,705	**26,453**	**35,651**
FY32	21,841	1,354	914	820	840	717	1,805	**28,292**	**37,904**
FY33	23,537	1,397	944	847	868	744	1,910	**30,247**	**40,290**
FY34	25,347	1,442	974	874	895	773	2,020	**32,326**	**42,816**
FY35	27,278	1,488	1,005	902	924	803	2,136	**34,535**	**45,489**
FY36	29,337	1,535	1,037	930	953	833	2,256	**36,881**	**48,316**
FY37	31,531	1,583	1,069	959	983	864	2,383	**39,371**	**51,305**
FY38	33,865	1,631	1,102	989	1,013	896	2,515	**42,012**	**54,463**
FY39	36,349	1,681	1,136	1,019	1,044	929	2,654	**44,811**	**57,799**
FY40	38,988	1,732	1,170	1,050	1,076	962	2,798	**47,776**	**61,319**
FY41	42,916	1,794	1,212	1,087	1,120	1,011	2,981	**52,121**	**66,385**
FY42	45,970	1,847	1,248	1,120	1,153	1,047	3,140	**55,525**	**70,390**
FY43	49,209	1,902	1,285	1,152	1,187	1,084	3,306	**59,124**	**74,612**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY44	52,640	1,957	1,322	1,186	1,222	1,122	3,478	**62,927**	**79,058**
FY45	56,273	2,013	1,360	1,220	1,257	1,160	3,658	**66,942**	**83,739**
FY46	60,116	2,070	1,399	1,255	1,293	1,200	3,846	**71,178**	**88,663**
FY47	64,178	2,129	1,438	1,290	1,329	1,240	4,041	**75,645**	**93,840**
FY48	68,469	2,188	1,478	1,326	1,366	1,282	4,243	**80,352**	**99,280**
FY49	72,997	2,248	1,519	1,363	1,404	1,324	4,454	**85,308**	**1,04,992**
FY50	77,772	2,310	1,560	1,400	1,442	1,368	4,672	**90,523**	**1,10,987**
FY51	82,859	2,373	1,603	1,438	1,481	1,412	4,902	**96,067**	**1,17,344**

Source: Steer analysis

Table B.2: Forecasts for (background +impacts) AADT growth rates (%) at TP1 Dakhina Sekhpur

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY23	8.5%	3.5%	3.5%	3.5%	2.7%	1.5%	4.3%	**6.9%**	**5.8%**
FY24	8.6%	3.6%	3.6%	3.6%	3.2%	3.3%	5.6%	**7.3%**	**6.4%**
FY25	8.6%	3.6%	3.6%	3.6%	3.2%	4.0%	6.0%	**7.4%**	**6.5%**
FY26	8.6%	3.6%	3.6%	3.6%	3.6%	4.3%	6.5%	**7.4%**	**6.7%**
FY27	8.3%	3.5%	3.5%	3.5%	3.5%	4.2%	6.2%	**7.2%**	**6.5%**
FY28	8.2%	3.4%	3.4%	3.4%	3.4%	4.1%	6.1%	**7.1%**	**6.5%**
FY29	8.1%	3.4%	3.4%	3.4%	3.4%	4.0%	6.1%	**7.1%**	**6.4%**
FY30	8.0%	3.3%	3.3%	3.3%	3.3%	4.0%	6.0%	**7.0%**	**6.4%**
FY31	7.9%	3.3%	3.3%	3.3%	3.3%	4.0%	5.9%	**7.0%**	**6.3%**
FY32	7.8%	3.3%	3.3%	3.3%	3.3%	3.9%	5.9%	**6.9%**	**6.3%**
FY33	7.8%	3.2%	3.2%	3.2%	3.2%	3.9%	5.8%	**6.9%**	**6.3%**
FY34	7.7%	3.2%	3.2%	3.2%	3.2%	3.8%	5.8%	**6.9%**	**6.3%**
FY35	7.6%	3.2%	3.2%	3.2%	3.2%	3.8%	5.7%	**6.8%**	**6.2%**
FY36	7.5%	3.1%	3.1%	3.1%	3.1%	3.8%	5.7%	**6.8%**	**6.2%**
FY37	7.5%	3.1%	3.1%	3.1%	3.1%	3.7%	5.6%	**6.8%**	**6.2%**
FY38	7.4%	3.1%	3.1%	3.1%	3.1%	3.7%	5.6%	**6.7%**	**6.2%**
FY39	7.3%	3.1%	3.1%	3.1%	3.1%	3.7%	5.5%	**6.7%**	**6.1%**
FY40	7.3%	3.0%	3.0%	3.0%	3.0%	3.6%	5.4%	**6.6%**	**6.1%**
FY41	10.1%	3.6%	3.6%	3.6%	4.2%	5.0%	6.5%	**9.1%**	**8.3%**
FY42	7.1%	3.0%	3.0%	3.0%	3.0%	3.6%	5.3%	**6.5%**	**6.0%**
FY43	7.0%	2.9%	2.9%	2.9%	2.9%	3.5%	5.3%	**6.5%**	**6.0%**
FY44	7.0%	2.9%	2.9%	2.9%	2.9%	3.5%	5.2%	**6.4%**	**6.0%**
FY45	6.9%	2.9%	2.9%	2.9%	2.9%	3.5%	5.2%	**6.4%**	**5.9%**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total	PCU
FY46	6.8%	2.8%	2.8%	2.8%	2.8%	3.4%	5.1%	**6.3%**	**5.9%**
FY47	6.8%	2.8%	2.8%	2.8%	2.8%	3.4%	5.1%	**6.3%**	**5.8%**
FY48	6.7%	2.8%	2.8%	2.8%	2.8%	3.3%	5.0%	**6.2%**	**5.8%**
FY49	6.6%	2.8%	2.8%	2.8%	2.8%	3.3%	5.0%	**6.2%**	**5.8%**
FY50	6.5%	2.7%	2.7%	2.7%	2.7%	3.3%	4.9%	**6.1%**	**5.7%**
FY51	6.5%	2.7%	2.7%	2.7%	2.7%	3.3%	4.9%	**6.1%**	**5.7%**

Source: Steer analysis

Revenue forecasts

Table B.3: Forecasts for final (background +impacts) Revenue (INR Crores) at TP1 Dakhina Sekhpur

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY23	3,043	284	682	285	733	644	2,008	**7,680**
FY24	3,444	307	742	313	799	702	2,256	**8,563**
FY25	4,010	340	808	342	866	771	2,504	**9,640**
FY26	4,572	370	885	373	944	850	2,815	**10,808**
FY27	5,187	401	959	405	1,023	926	3,150	**12,051**
FY28	5,883	435	1,048	440	1,120	1,016	3,521	**13,463**
FY29	6,723	475	1,134	477	1,207	1,106	3,903	**15,025**
FY30	7,557	511	1,228	520	1,310	1,205	4,325	**16,657**
FY31	8,476	549	1,325	559	1,409	1,308	4,783	**18,409**
FY32	9,647	598	1,433	605	1,526	1,423	5,321	**20,554**
FY33	10,852	645	1,546	653	1,643	1,545	5,872	**22,755**
FY34	12,246	697	1,661	701	1,778	1,680	6,483	**25,248**
FY35	13,781	752	1,797	759	1,914	1,823	7,146	**27,973**
FY36	15,470	810	1,938	815	2,070	1,981	7,945	**31,029**
FY37	17,426	875	2,083	880	2,225	2,146	8,731	**34,366**
FY38	14,544	701	1,692	711	1,802	1,744	7,233	**28,426**
FY39	15,610	722	1,743	733	1,857	1,808	7,630	**30,104**
FY40	16,790	746	1,801	757	1,918	1,879	8,068	**31,959**
FY41	28,326	1,185	2,826	1,191	3,031	2,994	13,031	**52,584**
FY42	31,576	1,270	3,039	1,283	3,268	3,237	14,354	**58,028**
FY43	35,428	1,370	3,273	1,385	3,519	3,509	15,830	**64,314**
FY44	39,670	1,476	3,537	1,495	3,794	3,809	17,470	**71,251**
FY45	44,420	1,590	3,795	1,601	4,075	4,116	19,129	**78,726**
FY46	49,362	1,701	4,074	1,722	4,379	4,453	21,066	**86,757**

Vehicle Type	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY47	55,124	1,829	4,388	1,857	4,704	4,806	23,154	**95,862**
FY48	61,899	1,979	4,731	1,993	5,071	5,213	25,460	**1,06,347**
FY49	68,577	2,113	5,064	2,134	5,442	5,611	27,916	**1,16,858**
FY50	76,385	2,270	5,449	2,302	5,851	6,063	30,627	**1,28,947**
FY51	85,425	2,447	5,852	2,467	6,278	6,559	33,613	**1,42,642**

Source: Steer analysis

C Data collection exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1 Dakhina Sekhpur

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
19-01-2021	TP1	TVC	8,998	1,003	929	772	392	670	1,505	-	14,269
20-01-2021	TP1	TVC	9,349	973	931	779	466	658	1,505	-	14,661
21-01-2021	TP1	TVC	9,077	995	966	780	447	694	1,612	-	14,571
22-01-2021	TP1	TVC	9,600	990	919	863	434	686	1,379	-	14,871
23-01-2021	TP1	TVC	10,465	991	893	760	489	654	1,512	-	15,764
24-01-2021	TP1	TVC	11,182	837	883	767	372	661	1,411	-	16,113
25-01-2021	TP1	TVC	9,499	874	835	725	411	721	1,472	-	14,537

Source: Steer analysis

Table C.2: WADT TVC vs TMS

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	10,690	908	778	430	2,163	-	14,969
	TMS	10,488	670	665	678	2,157	0	14,659

Source: Steer analysis and Client data

Zone list

Table C.3: Zone list used for OD analysis

Zone No	Zone Name	State
1	Kalli Paschim	Uttar Pradesh
2	Mohanlalganj	Uttar Pradesh
3	Mastipur	Uttar Pradesh
4	Churwa	Uttar Pradesh

Zone No	Zone Name	State
5	Dehwa	Uttar Pradesh
6	malhipur	Uttar Pradesh
7	Bachhrawan	Uttar Pradesh
8	kundanganj	Uttar Pradesh
9	Kandawan	Uttar Pradesh
10	peerun	Uttar Pradesh
11	Harchandpur	Uttar Pradesh
12	Kathwara	Uttar Pradesh
13	Gangaganj	Uttar Pradesh
14	Thulendi	Uttar Pradesh
15	isiya	Uttar Pradesh
16	Dostpur	Uttar Pradesh
17	nigoha	Uttar Pradesh
18	uday pur	Uttar Pradesh
19	badan khera	Uttar Pradesh
20	purseni	Uttar Pradesh
21	Kankaha	Uttar Pradesh
22	Hilauli	Uttar Pradesh
23	Neewa	Uttar Pradesh
24	Asrenda	Uttar Pradesh
25	Nagram	Uttar Pradesh
26	Pariwan	Uttar Pradesh
27	Karora	Uttar Pradesh
28	Devi Khera	Uttar Pradesh
29	Tamanpur	Uttar Pradesh
30	Beraru	Uttar Pradesh
31	Sivli	Uttar Pradesh
32	Pahnasa	Uttar Pradesh
33	Barvaliya	Uttar Pradesh
34	Utranva	Uttar Pradesh
35	Raebareli	Uttar Pradesh
36	Maharajganj	Uttar Pradesh
37	Ayyubganj	Uttar Pradesh
38	Musafirkhana	Uttar Pradesh
39	Jais	Uttar Pradesh
40	Gauriganj	Uttar Pradesh
41	Lalganj	Uttar Pradesh

Zone No	Zone Name	State
42	purwa	Uttar Pradesh
43	Haidargarh	Uttar Pradesh
44	Unchahar	Uttar Pradesh
45	Salon	Uttar Pradesh
46	Nidhasan	Uttar Pradesh
47	Ajgain	Uttar Pradesh
48	Kanpur	Uttar Pradesh
49	Lucknow	Uttar Pradesh
50	Prayagraj	Uttar Pradesh
51	Agra	Uttar Pradesh
52	Aligarh	Uttar Pradesh
53	Ambedkar Nagar	Uttar Pradesh
54	Amethi	Uttar Pradesh
55	Amroha	Uttar Pradesh
56	Auraiya	Uttar Pradesh
57	Azamgarh	Uttar Pradesh
58	Badaun	Uttar Pradesh
59	Baghpat	Uttar Pradesh
60	Bahraich	Uttar Pradesh
61	Ballia	Uttar Pradesh
62	Balrampur	Uttar Pradesh
63	Banda	Uttar Pradesh
64	Barabanki	Uttar Pradesh
65	Bareilly	Uttar Pradesh
66	Basti	Uttar Pradesh
67	Bijnor	Uttar Pradesh
68	Bulandshahr	Uttar Pradesh
69	Chandauli	Uttar Pradesh
70	Chitrakoot	Uttar Pradesh
71	Deoria	Uttar Pradesh
72	Etah	Uttar Pradesh
73	Etawah	Uttar Pradesh
74	Faizabad	Uttar Pradesh
75	Farrukhabad	Uttar Pradesh
76	Fatehpur	Uttar Pradesh
77	Firozabad	Uttar Pradesh
78	Gautam Buddha Nagar	Uttar Pradesh

Zone No	Zone Name	State
79	Ghaziabad	Uttar Pradesh
80	Ghazipur	Uttar Pradesh
81	Gonda	Uttar Pradesh
82	Gorakhpur	Uttar Pradesh
83	Hamirpur	Uttar Pradesh
84	Hapur	Uttar Pradesh
85	Hardoi	Uttar Pradesh
86	Hathras	Uttar Pradesh
87	Jalaun	Uttar Pradesh
88	Jaunpur	Uttar Pradesh
89	Jhansi	Uttar Pradesh
90	Kannauj	Uttar Pradesh
91	Kanpur Dehat	Uttar Pradesh
92	Kanpur nagar	Uttar Pradesh
93	kasganj	Uttar Pradesh
94	Kaushambi	Uttar Pradesh
95	Kushinagar	Uttar Pradesh
96	Lakhimpur Kheri	Uttar Pradesh
97	Lalitpur	Uttar Pradesh
98	Mahamaya Nagar	Uttar Pradesh
99	Mahoba	Uttar Pradesh
100	Mainpuri	Uttar Pradesh
101	Mathura	Uttar Pradesh
102	Mau	Uttar Pradesh
103	Meerut	Uttar Pradesh
104	Mirzapur	Uttar Pradesh
105	Moradabad	Uttar Pradesh
106	Muzaffarnagar	Uttar Pradesh
107	Pilibhit	Uttar Pradesh
108	Pratapgarh	Uttar Pradesh
109	Rampur	Uttar Pradesh
110	Saharanpur	Uttar Pradesh
111	Sambhal	Uttar Pradesh
112	Sant Kabir Nagar	Uttar Pradesh
113	Sant Ravi Das Nagar(bhadohi)	Uttar Pradesh
114	Shahjahanpur	Uttar Pradesh
115	Shamli	Uttar Pradesh

Zone No	Zone Name	State
116	Shrawasti	Uttar Pradesh
117	Siddharth Nagar	Uttar Pradesh
118	Sitapur	Uttar Pradesh
119	Sonbhadra	Uttar Pradesh
120	Sultanpur	Uttar Pradesh
121	Unnao	Uttar Pradesh
122	Varanasi	Uttar Pradesh
123	Kolkata	West Bengal
124	Durgapur	West Bengal
125	Jamshedpur	Jharkhand
126	Kharagpur	West Bengal
127	Ranchi	Jharkhand
128	Aurangabad	Bihar
129	Patna	Bihar
130	Andhra Pradesh	Andhra Pradesh
131	Arunanchal Pradesh	Arunanchal Pradesh
132	Assam	Assam
133	Bihar	Bihar
134	Chandigarh	Chandigarh
135	Chhattisgarh	Chhattisgarh
136	Dadara & Nagar Havelli	Dadara & Nagar Havelli
137	Daman & Diu	Daman & Diu
138	Goa	Goa
139	Gujarat	Gujarat
140	Haryana	Haryana
141	Himachal Pradesh	Himachal Pradesh
142	Jammu & Kashmir	Jammu & Kashmir
143	Jharkhand	Jharkhand
144	Karnataka	Karnataka
145	Kerala	Kerala
146	Madhya Pradesh	Madhya Pradesh
147	Maharashtra	Maharashtra
148	Manipur	Manipur
149	Meghalaya	Meghalaya
150	Mizoram	Mizoram
151	Nagaland	Nagaland
152	NCT of Delhi	NCT of Delhi

Zone No	Zone Name	State
153	Puducherry	Puducherry
154	Punjab	Punjab
155	Rajasthan	Rajasthan
156	Sikkim	Sikkim
157	Tamil Nadu	Tamil Nadu
158	Telangana	Telangana
159	Tripura	Tripura
160	Uttarakhand	Uttarakhand
161	West Bengal	West Bengal
163	Nepal	North India
164	Dhaka	East & North East of India
162	Odisha	Odisha

Source: Steer analysis of OD data

Direction-wise commodity distribution

Table C.4: Commodity distribution towards Raebareli for TP1 Dakhina Sekhpur

Commodities	Mini LCV + LCV	2A	3A	MAV
Agriculture	4%	6%	7%	10%
Construction	1%	0%	2%	2%
Groceries	14%	23%	22%	17%
Minerals	4%	2%	5%	6%
Manufacturing	28%	27%	15%	18%
Petroleum	1%	8%	4%	5%
Miscellaneous	19%	15%	13%	12%
Empty	28%	18%	32%	28%
Cement	-	0%	0%	1%

Source: Steer analysis of OD data

Table C.5: Commodity distribution towards Lucknow for TP1 Dakhina Sekhpur

Commodities	Mini LCV + LCV	2A	3A	MAV
Agriculture	4%	5%	11%	16%
Construction	1%	5%	19%	9%
Groceries	9%	16%	21%	5%
Minerals	4%	6%	9%	22%
Manufacturing	9%	10%	9%	8%
Petroleum	1%	6%	2%	6%
Miscellaneous	10%	13%	8%	6%
Empty	62%	39%	15%	13%

Commodities	Mini LCV + LCV	2A	3A	MAV
Cement	0%	0%	6%	15%

Source: Steer analysis of OD data

Trip length distribution

Table 6.27: Trip length frequency for TP1 Dakhina Sekhpur

Distance range	CJV	Bus	Mini LCV	LCV	2A	3A	MAV
0-65 km	17%	2%	26%	10%	11%	13%	7%
65-300 km	70%	80%	62%	53%	46%	39%	32%
300-500 km	5%	6%	5%	10%	11%	4%	9%
500-1000 km	7%	12%	6%	17%	19%	24%	27%
>1000 km	1%	1%	1%	10%	14%	20%	24%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

D Impact analysis

Table D.1: GJC comparison for level of service improvement

	Asset		
	CJV	2A	MAV
Existing Toll rates	95	315	495
Length	70	70	70
Existing GJC	610	1,915	4,040
GJC post improvement	571	1,780	3,623

Source: Steer analysis of OD data

6.44 The table below compares the GJC of the Asset and the alternate after the planned upgrades.

Table D.2: GJC comparison between the Asset and the Sultanpur-Varanasi alternate

	Via Asset			Via Sultanpur Varanasi		
	CJV	2A	MAV	CJV	2A	MAV
Existing Toll rates	230	740	1,185	175	565	925
Length	305	305	305	287	287	287
Existing GJC	2,626	8,057	16,313	2,614	8,735	17,779
GJC post improvement	-	-	-	2,570	8,114	16,228

Source: Steer analysis of OD data

6.45 The table below compares the GJC of the Asset and the Purvanchal expressway.

Table D.3: GJC comparison of the Asset and the Purvanchal expressway.

	via Asset			Via Purvanchal expressway		
	2A	3A	MAV	2A	3A	MAV
Existing Toll rates	230	825	1,185	823	4,022	4,022
Length	601	601	601	505	505	505
GJC	5,100	21,865	32,263	4,257	19,862	27,902

Source: Steer analysis of OD data

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Anshika Saxena

Reviewer/approver

Samhita Indurkar

Other contributors

Vaibhav Gupta, Wasey Khan, Aditya Karan, Chanda Malhotra

Distribution

Client:

Steer:

Version control/issue number

V1.0

Date

April 2022

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence
Mahua-Bharatpur Expressway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence
Mahua-Bharatpur Expressway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Content

Disclaimer **9**

Glossary Items **11**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Concession and tolling details 7

Key Economic activities 9

Alternate Routes 10

3 Traffic Description **11**

Introduction 11

Historical trends 11

Data Collection exercise 25

Overview 25

Key findings of the TVC data analysis 26

Key findings of origin-destination analysis 28

Conclusions 35

4 Socio Economic Context **37**

Introduction 37

Population growth 37

Economic growth 38

5 Traffic growth analysis **40**

Introduction 40

Estimation of background elasticities 40

Forecasts for background elasticities 46

Forecasts for growth drivers 47

6 Forecasts: Base year AADT and Impacts 49

Introduction 49

Seasonality Correction factors 50

Base year FY22 AADT estimates 51

Analysis of potential network/developmental impacts 52

Revenue forecasting assumptions 57

Traffic and Revenue forecasts 60

Upside and Downside Cases 64

Traffic and Revenue Forecasts-Upside case 66

Traffic and Revenue Forecasts-Downside case 69

Summary outlook 72

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4

Figure 2.1: Asset location in the regional network context 6

Figure 2.2: Asset context 7

Figure 2.3: Typical cross section of the Asset road and toll plazas 8

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- Amoli 14

Figure 3.2 Historical evolution in vehicle shares and reported AADT for TP2- Ludhawai 15

Figure 3.3 Month on Month traffic recovery vs FY20 16

Figure 3.4 FASTag penetration: Amoli toll plaza 19

Figure 3.5 FASTag penetration: Ludhawai toll plaza 19

Figure 3.6 Ticket-segmentation for CJV at TP1 Amoli 20

Figure 3.7 Ticket-segmentation for MAV at TP1 Amoli 20

Figure 3.8 Ticket-segmentation for CJV at TP2 Ludhawai 21

Figure 3.9 Ticket Segmentation for MAV at TP2 Ludhawai 21

Figure 3.10 A2 TVC WADT 26

Figure 3.11: Comparison between TVC and TMS daily traffic data on TP1 Amoli 27

Figure 3.12: Comparison between TVC and TMS daily traffic data on TP2 Ludhawai 27

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs 28

Figure 3.14: Zonal influence at TP1 Amoli 30

Figure 3.15 Internal-external distribution at TP1 Amoli 31
Figure 3.16: Commodity distribution at TP1 (Both directions) 33
Figure 3.17: Commodity distribution at TP1 (towards Jaipur) 33
Figure 3.18: Commodity distribution at TP1 (towards Agra) 34
Figure 3.19: Trip length distribution, TP1 Amoli 35
Figure 4.1: Evolution of Rajasthan's state GDP and national GDP 38
Figure 4.2: Sectoral contribution to Rajasthan's GSDP 39
Figure 5.1: Relationship between CJV traffic and Rajasthan GSDP 43
Figure 5.2: Relationship between LCV+2A combined traffic and Rajasthan GSDP 44
Figure 5.3: Relationship between Bus traffic and Rajasthan GSDP 45
Figure 5.4: Relationship between 3A+MAV combined traffic and India's GDP 46
Figure 5.5: GDP-GSDP forecast 48
Figure 6.1: Alternate routes and Asset route shown against the regional network context 52
Figure 6.2: Asset location on long-distance route option between Udaipur/Chittorgarh and Kanpur 56
Figure 6.3: Traffic and growth rates for forecast PCUs – Base and With Impacts, TP1 Amoli ... 63
Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP2 Ludhawai . 64

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Summary of concession 8
Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022 8
Table 2.3: PCU factors 10
Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Amoli 11
Table 3.2: Historical evolution in AADT by vehicle class at TP2 – Ludhawai 12
Table 3.3 Historical YoY growth rates and CAGR by vehicle class at TP1- Amoli 12
Table 3.4 Historical YoY growth rates and CAGR by vehicle class at TP2 - Luadhawai 13
Table 3.5: Historical revenue evolution by class (in INR crores): 15
Table 3.6: Typical ticket types sold at NHAI plazas 17
Table 3.7: Timeline of national ETC implementation 17
Table 3.8: %age of Transactions via Fast Tag, Mar, 2022 18
Table 3.9: Historical ticket segmentation at TP1 Amoli 23

Table 3.10: Historical ticket segmentation at TP2 Ludhawai 24
Table 3.11: Overloading shares for FY19, FY20 and FY22..... 25
Table 3.12: Data collection schedule..... 25
Table 3.13: Sample rates for OD data..... 29
Table 3.14: Zone aggregations for zonal influence analysis 29
Table 3.15: Aggregate commodity categories..... 32
Table 4.1: CAGR of population in India..... 37
Table 4.2: Population Growth in India (2001 – 2011)..... 38
Table 5.1 Vehicle wise growth and CAGR (%) at Amoli toll plaza..... 40
Table 5.2 Vehicle wise growth and CAGR (%) at Ludhawai toll plaza..... 41
Table 5.3: Split between individual vehicle types at each toll plaza 41
Table 5.4: Identified growth drivers to model traffic growth..... 42
Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 47
Table 6.1: Key intermediate and final outputs in the forecast..... 49
Table 6.2: Seasonality correction factors for TP1 Amoli..... 50
Table 6.3: Seasonality correction factors for TP2 Ludhawai 50
Table 6.4 Monthly AADT and Adopted AADT for FY22 - TP1 Amoli 51
Table 6.5 Monthly AADT and Adopted AADT for FY22 - TP1 Ludhawai 51
Table 6.6: List of network/other developments..... 52
Table 6.7: Impact of government efforts to revive sand industry..... 54
Table 6.8: Impact of completion of Jaipur Ring Road..... 54
Table 6.9: Impact due to completion of missing section on Agra Ring Road 55
Table 6.10: Impacts due to construction-related movement for specific upcoming infrastructure projects..... 56
Table 6.11: Forecast toll segmentation, FY22 onwards at TP1 Amoli 58
Table 6.12: Forecast toll segmentation, FY22 onwards at TP2 Ludhawai 58
Table 6.13: Overloading assumptions for forecast years FY22 onwards under various ticket categories 59
Table 6.14: WPI growth forecast assumptions..... 59
Table 6.15: Revenue reconciliation summary for Feb 2022..... 60
Table 6.16: Traffic forecasts (with impacts) AADT forecast for TP1 Amoli..... 60
Table 6.17: Traffic forecasts (with impacts) CAGR (%) for TP1 Amoli 60

Table 6.18: Revenue forecasts (INR crores) for TP1 Amoli 61
Table 6.19: Revenue forecasts CAGR (%) for TP1 Amoli 61
Table 6.20: Traffic forecasts (with impacts) AADT forecast for TP2 Ludhawai 62
Table 6.21: Traffic forecasts (with impacts) CAGR(%) for TP2 Ludhawai 62
Table 6.22: Revenue forecasts (INR crores) forecast for TP2 Ludhawai 62
Table 6.23: Revenue forecasts CAGR (%) for TP2 Ludhawai 63
Table 6.24: Summary of Macro Assumptions for upside and downside cases 64
Table 6.25: Summary of impacts on the Assets 65
Table 6.26: Summary of impacts on the Assets 66
Table 6.27: Traffic forecast (With Upside Impacts) for TP1: Amoli 66
Table 6.28: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Amoli 67
Table 6.29: Revenue forecast (With Upside Impacts) for TP1: Amoli (In Cr) 67
Table 6.30: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Amoli 68
Table 6.31: Traffic forecast (With Upside Impacts) for TP2: Ludhawai 68
Table 6.32: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Ludhawai 68
Table 6.33: Revenue forecast (With Upside Impacts) for TP2: Ludhawai (In Cr) 69
Table 6.34: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Ludhawai 69
Table 6.35: Traffic forecast (With Downside Impacts) for TP1: Amoli 69
Table 6.36: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Amoli 70
Table 6.37: Revenue forecast (With Downside Impacts) for TP1: Amoli (In Cr) 70
Table 6.38: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Amoli 70
Table 6.39: Traffic forecast (With Downside Impacts) for TP2: Ludhawai 71
Table 6.40: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Ludhawai 71
Table 6.41: Revenue forecast (With Downside Impacts) for TP2: Ludhawai (In Cr) 72
Table 6.42: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Ludhawai 72

Appendices

A Developments in sand-mining

B Top 10 OD Pairs

C Detailed forecasts

D Data Collection Exercise

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an Asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September

Acronym	Meaning
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (referred to as 'Client' hereafter) has commissioned Steer Davies Gleave India Private Limited (hereafter called 'Steer') for a traffic due diligence to be carried out on Mahua-Bharatpur Road (hereafter called 'Asset').

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data , Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI and WPI line based on forecasts provided by client

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on existing/brownfield Assets.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from FY10 to FY22.
  - Concession agreement and toll notifications
  - Previous studies
- Steer-commissioned TVC counts from 27th January to 2nd February 2021
- Steer conducted OD surveys on behalf of the Client in July 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY21 to the end of each concession period.

- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset against our Steer knowledge base (e.g., similar Asset types in the same state), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes major network and other impacts including change in toll rates and more. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until May 3rd 2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March and 20th April. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

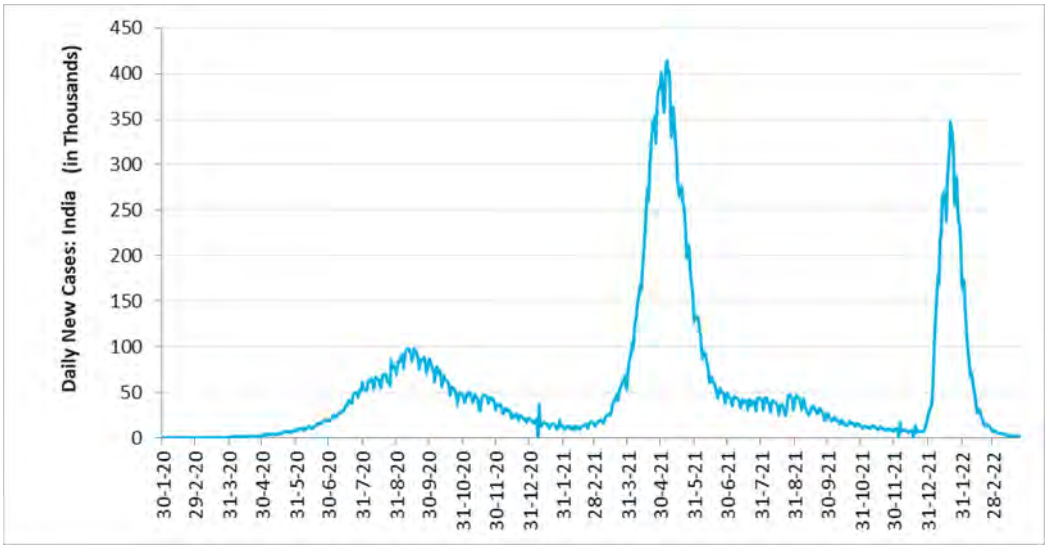
1.11 Data from various roads across the country indicates that the largest impact on MAV traffic was experienced between the months of March 2020 to May 2020, with rest of the FY21 showing MAV volumes par FY20 levels. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic

recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., are more stable and are driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 28th February 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during first wave when the whole country went under strict lockdown for first quarter. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe in comparison to fatality rate, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave

1.16 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus service. For example, once a family starts using a personal CJV for

inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis;
- Chapter 4 discusses the socio-economic context of the corridor and region containing the Asset;
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

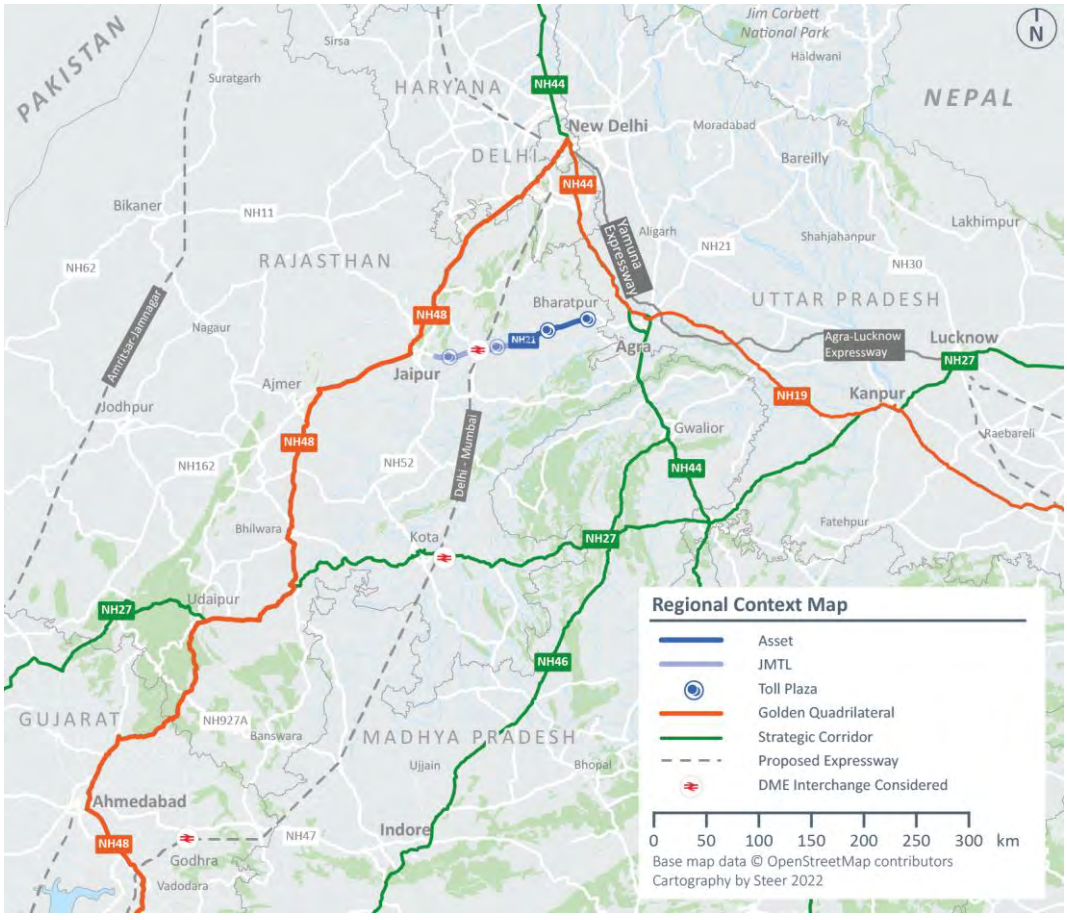
Introduction

2.1 This chapter provides a description of the Asset, primarily based on primary (site visits) data, our understanding of the region and network surrounding the Asset. Starting with the strategic network context, the chapter discusses the Asset-level context, followed by economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Rajasthan, connecting Mahua to Bharatpur, near the edge of the south-western Uttar Pradesh. The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to three different types of strategic movements:

- **Short-distance trips** including tourism and leisure trips between some of the most attractive tourist destinations in India. Such trips are mostly comprising of CJVs which are either local or run between key tourist locations of Agra and Bharatpur at one end and Jaipur on the other.
- **Medium-distance trips** between Rajasthan and Uttar Pradesh connect marble-processing sites of Rajasthan to its consumption sites in Uttar Pradesh. The Asset also transports significant number of manufactured products across the states of UP and Rajasthan.
- **Long-distance trips** between Gujarat and southern Rajasthan, and UP/East India connects ports and industries of western India to major consumption and production centres in North India.

2.4 The Asset is a 57.3 km toll road which forms a part of the NH 21 in Rajasthan. This is a four-lane road with two toll plazas, namely, Amoli (TP1) at Km 98.5 (closer to Mahua) and Ludhawai (TP2) at Km 64.5 (closer to Bharatpur). The following figure provides a closer view of the Asset in the context of its immediate surroundings and location of toll plazas.

Figure 2.2: Asset context

Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plaza on the Asset have been operational since April 2009 and the Client took over the operations in May 2015. There are 11 years left in the concession period with FY32 being the last year of concession period. The following table presents a summary of the Asset.

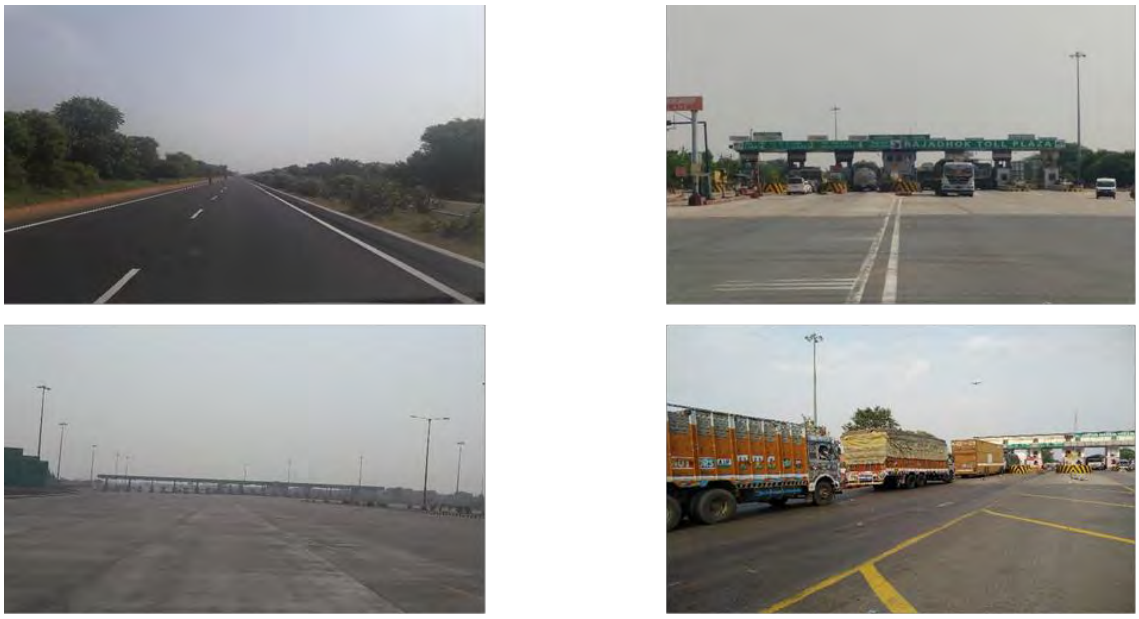
Table 2.1: Summary of concession

Particulars	Details
State	Rajasthan
Highway and lane configuration	NH 21 four lane
Toll plazas	TP1: Amoli TP2: Ludhawai
Length (km) as per concession agreement, applicable	TP1: 38.65 Km TP2: 18.65 Km
Commencement of operations*	May 2009
Operated by Client since	May 2015
Concession period	25 years
Last year of concession	FY32

Source: Client data

2.6 Figure 2.3 shows a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross section of the Asset road and toll plazas



Source: Steer site visit

2.7 The tolls on the Asset are collected for the following vehicle category with rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022

Type of Vehicle	Single Journey Fee	
	TP1 Amoli	TP2 Ludhawai
CJV	45	20
LCV	80	40
Bus/Truck	165	80
3A/MAV	265	130

HCM/EME/OSV	265	130

Source: NHAI Revision of User fee Rate w.e.f 01.07.2021

2.8 The Asset currently issues tickets including single, local commercial, local personal and through ticket under NHAI concession. There are no return and monthly tickets issued on the Asset. The local commercial and local personal ticket categories are discounted single entry tickets for trips within 20kms and 10kms respectively. The Asset issues special category of "through ticket" where a user can buy a ticket for both plazas, a common ticket to cross the entire length, this ticket cane be bought at either plaza which can be redeemed at another.

2.9 Further, detailed information on this have been provided in Chapter 3 of the report.

Key Economic activities

2.10 Rajasthan is the largest state in India by area, sharing borders with five major states- Uttar Pradesh, Haryana, Punjab, Madhya Pradesh and Gujarat. It is rich in natural resources particularly minerals and produces about 57 different minerals.[1] Predominantly an agrarian economy and a major producer of grains, oilseeds and edible oil, the recent times has seen a high rise in the service sector growth wherein the sector contributed to 47% to state's GSDP in 2019-20 followed by agriculture at 32% and industries at 21%.[2]

Urban centres, business and tourism

2.11 The state of Rajasthan and its bordering cities in UP (e.g. Agra and Mathura) are known for their tourist destinations. This contributes significantly to high passenger traffic volumes both within cities and on highways. The capital city of Jaipur, located on one end of the Asset, is a thriving urban city which is the main centre of administration, governance, culture, education, business and service sector in the state. It is a prominent tourism destination contributing majorly to the flourishing hospitality industry in the state. This reflects in considerable passenger volumes between the three nodes of India's Golden Triangle - Delhi, Jaipur and Agra – observed on the Asset. In recent times, the city has also emerged as a promising hub for global outsourcing and IT industry. Jaipur's strategic location on the golden quadrilateral connects it with major industrial, agricultural, and cultural centres of Chennai, Kolkata, Delhi, and Mumbai.

Marble, cement and sand

2.12 The State is also a leading producer of cement grade limestone with around 67.23 million tonnes of production in FY20.[3] Places like Kishangarh, Kota and Dausa produce stone and sand, apart from being a hub of major marble processing centres, with a history of supplying marble to the rest of India.

2.13 Sandmining in India has long faced issues of corruption involving local mafias and a lack of proper implementation of mining policies by the government. Since November FY18, when Supreme Court order ruled the requirement of environmental clearances for all sand mines,

---

[1] http://www.mines.rajasthan.gov.in/dmgcms/page?menuName=YzCjPSj/AU7RGgRfpUoY5A==#:~:text=Rajasthan%20is%20the%20richest%20state,zinc%20ores%2C%20selenite%20and%20wollastonite.

[2] Please refer to Chapter 4 for more detail.

[3] https://www.ibef.org/states/rajasthan.aspx#:~:text=The%20state%20is%20the%20leading,million%20foreign%20tourists%20visited%20Rajasthan., accessed on 13 April 2021

including those less than five hectares of size, there has been a reported drop in traffic carrying construction-related commodities on the Asset, particularly sand. State government requests to allow earlier licence holders to mine sand were also rejected by the court.

2.14 However, on 25 January 2021, Rajasthan released a policy on Manufactured Sand (M-Sand) which provides an industry status to the units producing it for construction work and reduces dependency on riverbed sand. M-Sand is an artificially created sand which is produced by grinding hard rocks like basalt, granite, silica and sandstone among others. It is different from naturally occurring sand which is extracted through riverbed sand mining and is potentially less harmful for the environment. The new policy is expected to revive the sand mining activities, give rise to new sand production units and likely increase the traffic carrying construction-related commodities on the Asset.

Alternate Routes

2.15 For long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states, there is an alternative route along NH 27 that joins Udaipur to Kanpur via Chittorgarh-Kota-Jhansi. In Chapter 6, we have discussed how the completion of the Agra Ring Road, Jaipur Ring Road and Dausa-Lalsot section which improves the relative level of service on the Asset corridor and has a positive impact.

2.16 During our site visit to the Asset, no major micro-diversions through local roads were observed close to the toll plazas. Chapter 6 provides a discussion and estimation of potential impacts on the Asset.

PCU factors considered for reporting

2.17 Please refer the PCU factors considered in the below table as per IRC64 1990. Based on the discussion with client, for reporting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5 as defined in IRC64 1990.

Table 2.3: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.99
OSV	4.5

Source: Steer analysis and IRC64,1990

3 Traffic Description

Introduction

3.1 This chapter outlines the historical and current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic volume count (TVC) data. This includes data collected as a part of this study and previous studies of this Asset, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of commodity movements, travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicle. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand, on the Asset.

3.3 Actual toll plaza data is used as the primary basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trends

3.4 The tables below indicate the historical variation in traffic volume at the toll plazas, in terms of vehicle shares and total AADT.

3.5 In terms of vehicle composition, CJVs are the biggest contributor on the Asset with a share of over 40% since FY16, except for a slight dip in FY21 due to COVID-19. The high CJV volumes observed on the Asset is primarily due to the Asset lying on a tourism driven corridor which fetches high daily passenger trips between the three nodes of India's Golden Triangle - Delhi, Jaipur and Agra. 2A and LCV's on the Asset have shown declining trend since FY16 while bus traffic volumes have grown during the same period. This is due to high buses reported under exemptions in the provided vendor data. There has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag.

3.6 As shown in the table below the CAGR at PCU level for TP1 total traffic was of 3.8% between FY12 and FY20 and 3.7% at TP2. Even the highest CAGRs for the entire FY18 to FY22 period have been in the Bus and CJV categories with a positive growth.

Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Amoli

Class	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	2,957	3,106	3,095	3,403	4,085	4,012	4,125	4,313	4,449	4,951	5,660
LCV	708	809	955	990	1,069	1,086	1,085	966	863	451	303

Class	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
Bus	464	449	437	407	568	717	721	811	879	902	1,273
2A	587	597	619	619	531	276	314	345	349	206	100
3A/MAV	2,553	2,753	2,768	2,907	3,594	3,788	4,229	3,506	3,508	3,631	3,540
Total	**7,269**	**7,713**	**7,874**	**8,326**	**9,847**	**9,879**	**10,474**	**9,941**	**10,048**	**10,141**	**10,875**
PCU	**16,956**	**18,008**	**18,305**	**19,108**	**22,761**	**23,139**	**25,068**	**22,667**	**22,874**	**22,868**	**23,801**

Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

Table 3.2: Historical evolution in AADT by vehicle class at TP2 – Ludhawai

Class	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	3,447	3,554	3,563	3,753	4,266	4,366	4,588	4,876	5,202	5,821	6,916
LCV	817	939	1,128	1,145	1,250	1,249	1,253	1,134	1,045	463	330
Bus	457	448	456	425	525	735	759	837	903	926	1,241
2A	632	640	665	640	551	274	314	327	340	213	161
3A/MAV	2,598	2,785	2,832	2,875	3,442	3,837	4,335	3,493	3,501	3,615	3,526
Total	**7,951**	**8,366**	**8,646**	**8,838**	**10,034**	**10,461**	**11,249**	**10,667**	**10,991**	**11,038**	**12,174**
PCU	**17,897**	**18,901**	**19,477**	**19,686**	**22,562**	**23,974**	**26,300**	**23,457**	**23,916**	**23,790**	**25,131**

Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

3.7 The traffic profile at both the plazas is similar. However, Ludhawai plaza caters to higher CJV volumes than Amoli, as it is closer to Bharatpur city and Agra. Also, TP2 provides direct connectivity to Morena and Gwalior via NH21.

3.8 MAVs are the second largest traffic contributor on the Asset with share of over 30% historically of the total traffic. The high shares are likely to be due to the large-scale marble and sand mining activities in the Asset state which fetches high goods demand.

3.9 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Table 3.3 Historical YoY growth rates and CAGR by vehicle class at TP1- Amoli

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR (16-18)	CAGR (16-22)	CAGR (18-22)
CJV	20.0%	(1.8%)	2.8%	4.6%	3.2%	11.3%	14.3%	**0.5%**	**5.6%**	**8.2%**
LCV	7.9%	1.6%	(0.1%)	(11.0%)	(10.7%)	(47.7%)	(32.9%)	**0.8%**	**(19.0%)**	**(27.3%)**
Bus	39.7%	26.2%	0.6%	12.5%	8.4%	2.6%	41.1%	**12.7%**	**14.4%**	**15.3%**
2A	(14.2%)	(48.0%)	13.7%	9.8%	1.4%	(41.1%)	(51.5%)	**(23.1%)**	**(24.3%)**	**(24.9%)**
3A/MAV	23.6%	5.4%	11.6%	(17.1%)	0.1%	3.5%	(2.5%)	**8.5%**	**(0.3%)**	**(4.4%)**
Total	18.3%	0.3%	6.0%	(5.1%)	1.1%	0.9%	7.2%	**3.1%**	**1.7%**	**0.9%**
PCUs	19.1%	1.7%	8.3%	(9.6%)	0.9%	(0.0%)	4.1%	**4.9%**	**0.7%**	**(1.3%)**

Source: Steer analysis of TMS data provided by client

Table 3.4 Historical YoY growth rates and CAGR by vehicle class at TP2 - Luadhawai

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR (16-18)	CAGR (16-22)	CAGR (18-22)
CJV	13.7%	2.3%	5.1%	6.3%	6.7%	11.9%	18.8%	**3.7%**	**8.4%**	**10.8%**
LCV	9.2%	(0.0%)	0.3%	(9.5%)	(7.9%)	(55.7%)	(28.7%)	**0.1%**	**(19.9%)**	**(28.3%)**
Bus	23.4%	39.9%	3.3%	10.3%	7.8%	2.6%	34.0%	**20.3%**	**15.4%**	**13.1%**
2A	(14.0%)	(50.2%)	14.4%	4.2%	3.9%	(37.3%)	(24.3%)	**(24.5%)**	**(18.5%)**	**(15.3%)**
3A/MAV	19.7%	11.5%	13.0%	(19.4%)	0.3%	3.3%	(2.5%)	**12.2%**	**0.4%**	**(5.0%)**
Total	13.5%	4.3%	7.5%	(5.2%)	3.0%	0.4%	10.3%	**5.9%**	**3.3%**	**2.0%**
PCU	14.6%	6.3%	9.7%	(10.8%)	2.0%	(0.5%)	5.6%	**8.0%**	**1.8%**	**(1.1%)**

Source: Steer analysis of TMS data provided by client

3.10 The slowdown between FY19 and FY20 was due to a combination of factors associated with-:

- *Completion of large construction activities in the vicinity (Agra-Lucknow expressway)* – negative traffic impact due to construction
- *Construction activity on a key feeder route (Dausa-Lalsot)* - traffic loss due to construction
- *Construction of Jaipur ring road* - negative traffic impact due to construction
- *Increase in axle load norms and economic slowdown* - observed over seven quarters starting FY19 up to Q3 FY20 resulting a negative impact on Asset's traffic

3.11 The CAGR for this Asset was comprised of a positive 3.8% PCU level during the FY12-20 period and 0.8% during the FY16-20 period whereas between FY20-22 the Asset has recorded positive 2.3% PCU CAGR primarily driven by growth in CJV, Bus and MAV category, key reasons for the traffic growth profile is presented below.

- Starting in 2021, Dausa- Lalsot section was operational which led to increase in CJV and MAV traffic at all plazas of the Asset. Additionally, the Jaipur Ring Road completion has also led overall increase in traffic on the Asset. Furthermore, with the preference for personal mobility post COVID-19 and the non-resumption of train network across the country has led to healthy growth of CJV traffic on the Asset. Additionally
- Goods vehicles at the Asset has witnessed a 0.1% degrowth between FY16-20 primarily because of the mining ban. Whereas, the growth recorded was positive between FY12-20 upto 3.9%. Overall, MAV volume on the Asset has increased by 0.4% between FY20 -22. MAV's on the Asset have witnessed a slight degrowth in FY22 due to the 3rd wave of COVID-19.

3.12 Historically, buses on the Asset have seen a healthy growth with positive CAGR of over 18% between FY20-22 and 13% between FY16-20. However, the growth is higher at Amoli plaza of the Asset being closer to urban city. Additionally, in the last five years the volume of buses on the Asset is higher than LCV and 2A. This can be because of high reporting of buses in comparison to ongoing trend under "ETC punch" ticket category which applies the toll rates of single ticket. Further, in FY22 share of buses has significantly increased compared historically because in September month of FY22 Rajasthan government issued a letter regarding REET

exam allowing toll operators on the Asset to exempt bus traffic on some dates of the month thereby reducing the monthly average.

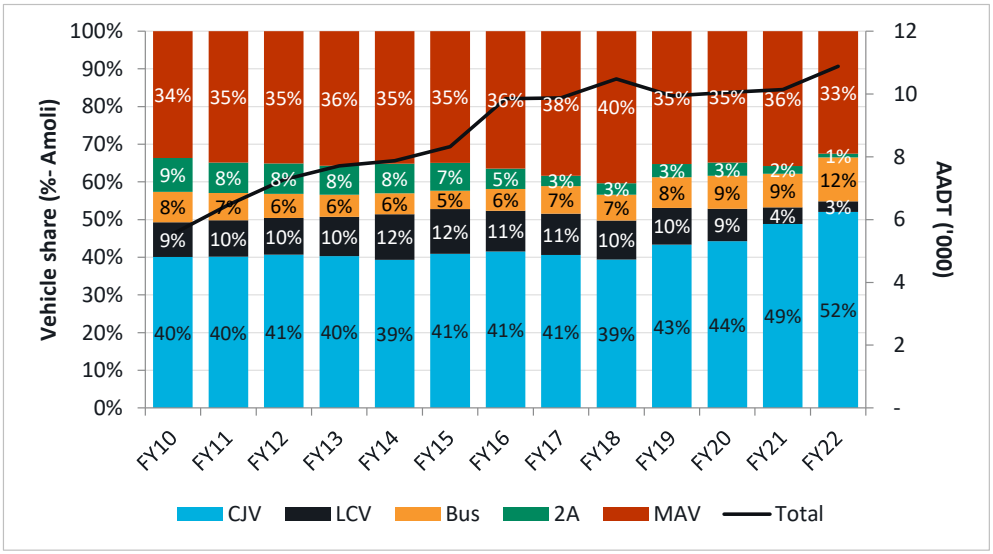
3.13 The LCV- 2A category has historically been affected by classification issues probably due of similar size and look of the vehicle. Additionally, there has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag.

3.14 2A's on this Asset have witnessed a drastic declining trend where the overall drop in 2A category is of the order of 38%. This could be attributed to the following factors — reclassification of traffic between bus and 2A and due to the preference of 3A and MAV post axle load norms after 2018.

3.15 Overall, the Asset saw steady and healthy growth from FY10 to FY18 but decline in growth in FY19 and FY20. The underlying growth trends between FY12 and FY18 combined with the strong recovery observed in FY21, which was a pandemic influenced year, shows the underlying strength of traffic growth drivers that influence this Asset. The impact of these past trends on the future outlook of traffic growth have been discussed in further detail in Chapter 5.

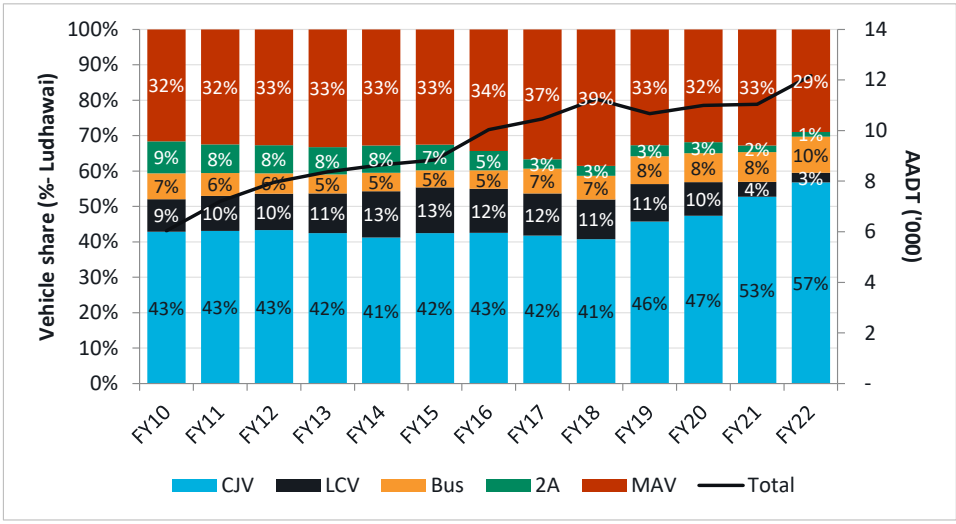
3.16 The figure below presents the vehicle shares as they have evolved from FY10 upto FY22.

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- Amoli



Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

Figure 3.2 Historical evolution in vehicle shares and reported AADT for TP2- Ludhawai



Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 is full year data till Mar'22)

3.17 The table below presents the reported historical revenue on the Asset.

Table 3.5: Historical revenue evolution by class (in INR crores):

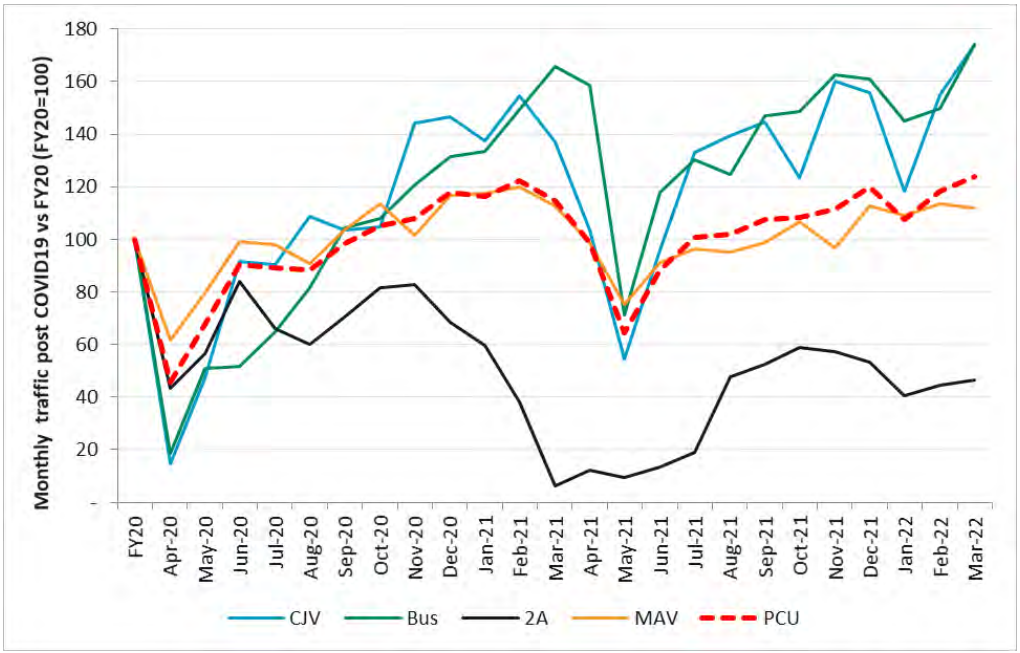
	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22	CAGR (17-20)	CAGR (20-22)
Annual Revenue (INR Crore)	58.09	72.12	67.86	72.38	69.33	81.12	7.6%	5.9%

Source: Steer analysis of the Client data

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.18 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. 2nd wave of COVID-19 resulted in regional lockdowns in Q1 and Q2 FY22, while the 3rd wave of COVID-19 impacted traffic volumes in Q4 of FY22. The evolution of traffic FY20 onwards is presented in the figure below.

Figure 3.3 Month on Month traffic recovery vs FY20



Source: Steer analysis of the Client data

3.19 As we can see from the figure above, by Q4FY21 the Asset reached the FY20 PCU levels, with FY21 being impacted by COVID-19 related restrictions in Q1FY21. The impact of 2nd wave of COVID-19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to other vehicle categories. From the above graph we can see 2A and MAV traffic have witnessed lower degrowth as compared to other modes due to COVID-19 impact. However, post second wave of COVID-19, MAVs have seen a growth due to ease of sand mining ban on the Asset. Compared to FY20 levels, buses reported on the Asset are higher than 2A and LCV. This is specially in the September month of FY22 where Rajasthan government issued letter regarding REET (a state level student's engineering exam) asking toll operators to exempt bus traffic on some dates of the month affecting the overall monthly average. Additionally, there are high buses reported than ongoing trend under "ETC tag ticket" category in FY22 which is another reason for bus volume trend as shown in Figure 3.2.

Toll Frequencies

3.20 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.21 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the Asset catering to strategic long-distance traffic

generally observes high share of single ticket traffic. The same can be verified through OD data where the vehicle category with high single ticket shares would have longer trip length with one of their trip end outside the Asset state. Other reasons for high single shares include the absence of return, local passes, through in and through-out tickets issued on the Asset. This is especially post- FASTag implementation where the user is allowed to pay at each toll plaza.

3.22 However, on this Asset since return and monthly passes are not available, 90% of the tickets issued are single. Primarily, the traffic which is not eligible for local personal and commercial passes have single ticket as the only option, which explains high share of single traffic on the Asset, as discussed in the next section.

3.23 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.6: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Local Personal	Discounted monthly pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.
Through traffic	Allows vehicle to buy ticket one plaza of the Asset and get redeemed at another and vice versa

3.24 In addition to the above ticket categories, a special category of “Through ticket” is also being sold on the Asset. This pass is actually a full one ticket which can be redeemed at either plaza of the Asset and vice versa.

3.25 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

FASTag implementation

3.26 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via “FASTag”. The timeline of ETC implementation is presented in the following table.

Table 3.7: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash lane, cash users entering ETC lanes were charged double the toll.

Date	ETC Development
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.27 FY21 had multiple disruptions in traffic patterns related to the pandemic. There was also significant change in ticket segmentation observed across several toll roads around the country due to the imposition of mandatory use of FASTag, the electronic toll payment mechanism mandated by NHAI. This resulted in shares of users paying by FASTag jump significantly across all vehicle categories. To encourage that nearly all toll plaza users shift to FASTag, there was also a penalty for cash payers introduced. The final deadline for mandatory use of FASTag was set for February 2021 which has had the desired impact of over 95% of toll revenue collection now being collected through FASTag across the NHAI toll plazas. This has also increased the operational efficiency of toll plazas significantly as well as improved the traffic and revenue reporting standards due to limited use of cash through manual means at toll plazas.

3.28 The increased use of FASTag in FY20-21 ensured efficient tolling operations as well as increased compliance. Moreover, with better management due to FASTag the combined share of exemption and violations reported under CJV category as shown in section below have decreased by 4-5% in FY22 in comparison to FY19. By March 2022, FASTag penetration increased significantly across various vehicle types. The table below presents the reported percentage of traffic via FASTag.

Table 3.8: %age of Transactions via Fast Tag, Mar, 2022

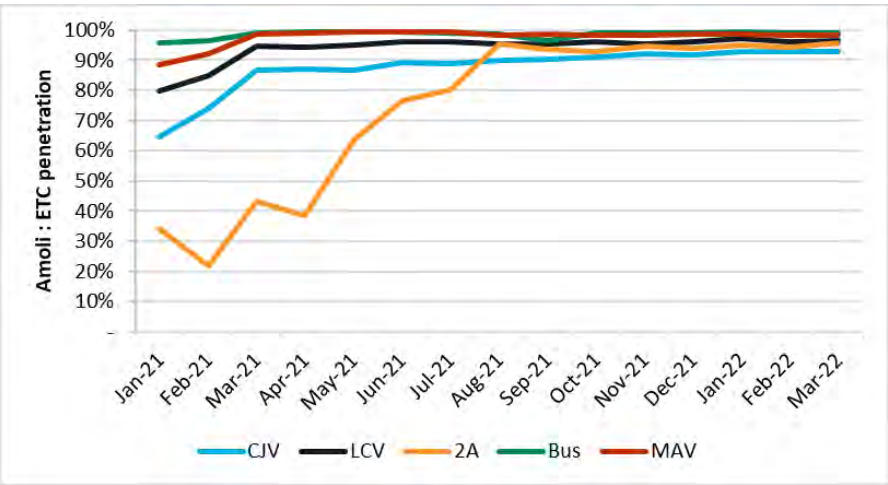
Toll Plaza	CJV	LCV	2A	Bus	MAV
Amoli toll plaza	93%	96%	96%	99%	98%
Ludhawai toll plaza	92%	96%	95%	99%	99%

Source: Steer Analysis

3.29 As we can see from the table above most of the categories of vehicles types across the toll plaza are reporting more than 95% FASTag penetration, with CJV's also reporting more than 90% proportions. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time.

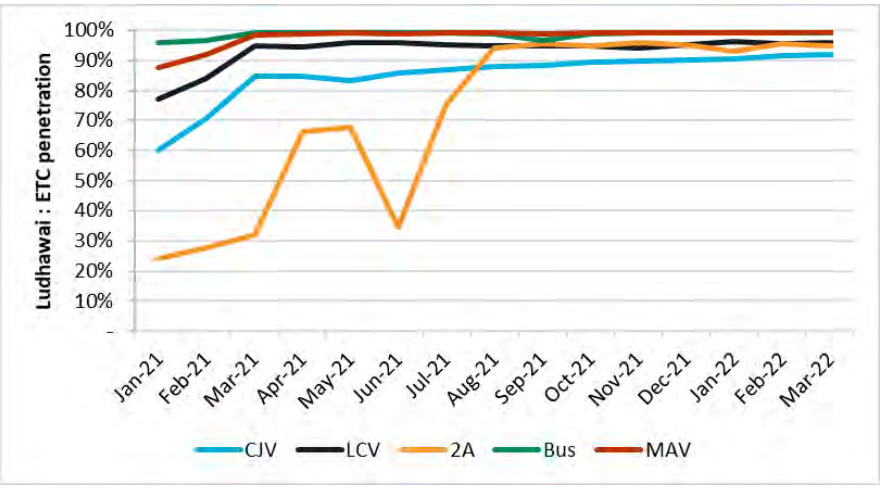
3.30 The figure below illustrates the evolution of the percentage of traffic via FASTag at all the plazas.

Figure 3.4 FASTag penetration: Amoli toll plaza



Source: Steer analysis of the Client data

Figure 3.5 FASTag penetration: Ludhawai toll plaza

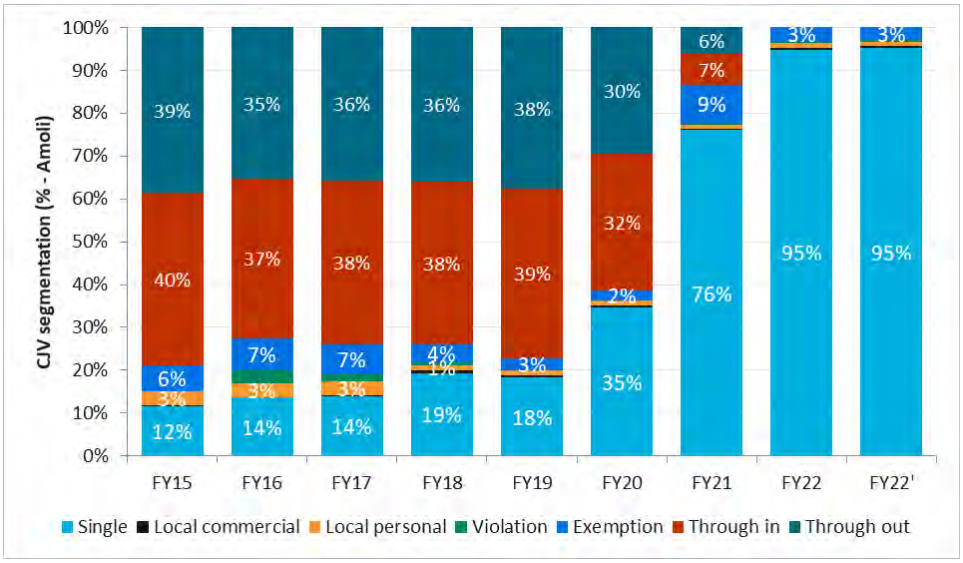


Source: Steer analysis of the Client data

3.31 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in ETC penetration, it was observed that traffic patterns have begun to return to their initial segmentation.

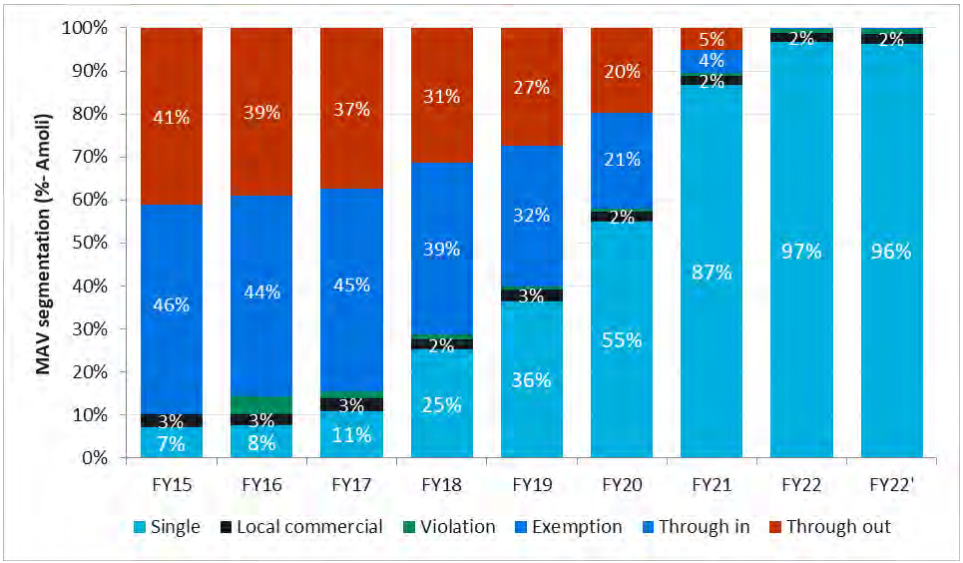
3.32 The following figures provide the toll segmentation for the historical years at TP1 Amoli and TP2 Ludhawai for CJV and MAV while the table provides the same for the remaining vehicle types.

Figure 3.6 Ticket-segmentation for CJV at TP1 Amoli



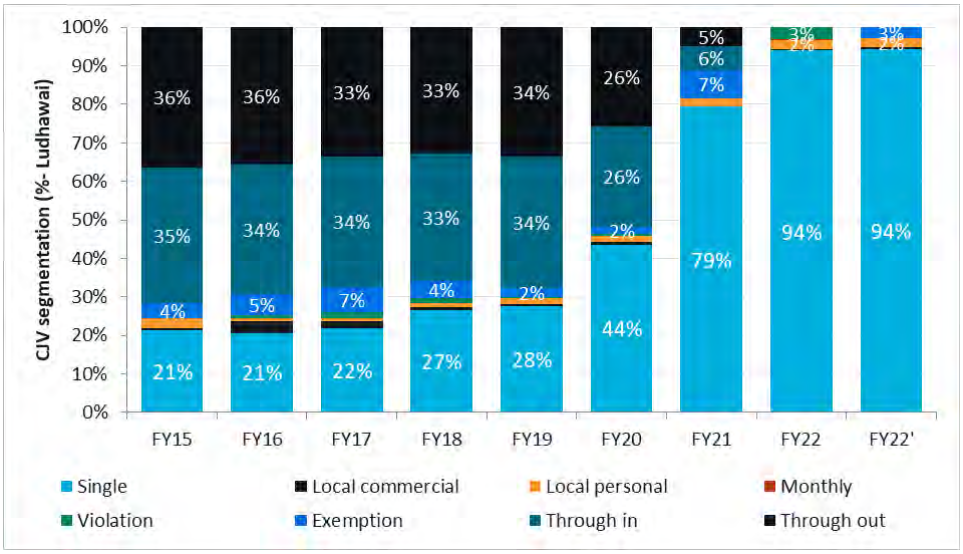
Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

Figure 3.7 Ticket-segmentation for MAV at TP1 Amoli



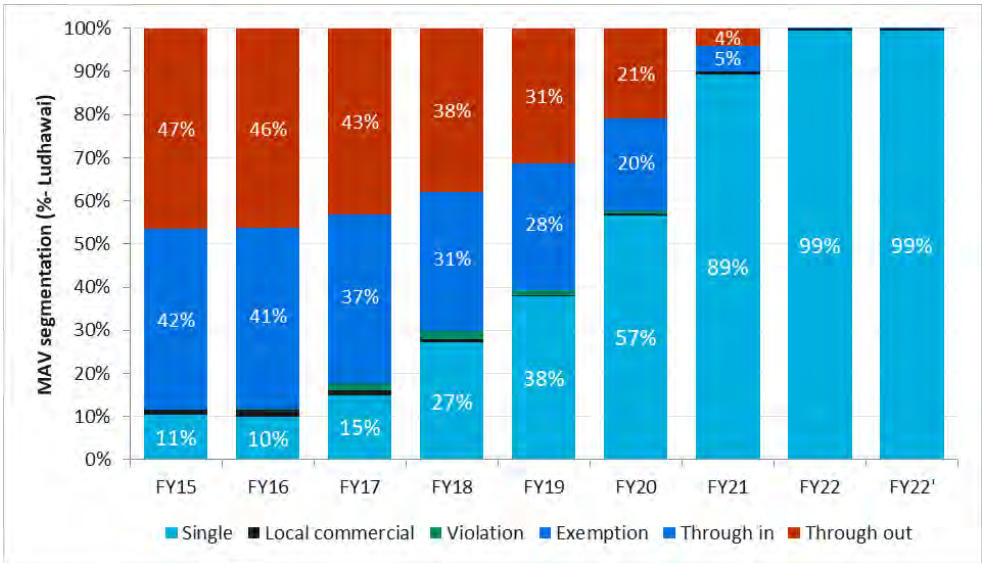
Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

Figure 3.8 Ticket-segmentation for CJV at TP2 Ludhawai



Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

Figure 3.9 Ticket Segmentation for MAV at TP2 Ludhawai



Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

3.33 As can be seen in the figures below, both plazas had a significant volume of traffic classified as 'Through Traffic Out' and 'Through Traffic In' between FY15 and FY21. This is likely as there are no significant traffic generators between the two toll plazas on the Asset. The CA provides for these 'through traffic' categories which allow buying at one TP Single tickets for both the TPs. The 'through traffic' categories until FY20 show a significant share of 70-80% of CJV and 60-70% of MAV on both TPs. However, since FY21 there is a significant shift in the ticket share from through to single where the share of single tickets issued for CJV has increased by 30% and through tickets dipped over 25%.

3.34 In FY19 and FY20, both toll plazas experience a significant decline in 'Through Traffic Out' and 'Through Traffic In', for CJVs and MAVs. This coincides with a significant increase in the share

of ‘Single’ tickets. Following this trend, in FY22 the small share of through trips appearing on the Asset becomes zero where there are no through tickets issued on the Asset plaza. Compared to FY20, the share of ‘Single’ tickets in FY22 increased by 60% for CJVs at TP1 and 50% at TP2 during this period, for MAVs this share increase stands at 42% at both TP1 and TP2. High share of CJV trips under single category on the Asset is also verified from OD data presented below where the averaged trip length of CJV is 300kms making medium distanced trips. Also, the high share of single ticket type is due to other tickets such as return and monthly being not available as per the toll notification. Same is for MAV where according to the internal-external analysis 54% of MAVs plying on the Asset have one of their trip end outside the Asset state making medium to long distance movement under single ticket category. Additionally, Gujarat, North-East and Delhi NCR are few major external zones for MAVs on the Asset.

3.35 The figure below presents the ticket segmentation of CJV and MAV at TP1 and TP2 where for CJVs there has been a steady decline in the number of exemptions reported on the Asset starting FY16, however the exemptions have stabilised FY20 onwards to 2-3%. As expected, there is a negligible share of violations for MAVs. The ticket segmentation of other vehicle types is presented in the table below. The declining exemption and violation shares since FY20 is a result of FASTag implementation which has resulted with better management of traffic system and operations. Discontinuation of through traffic tickets in FY22 is also the result of FASTag implementation where the operators discontinued the discounted tickets which are not in accordance with NHAI concession.

Table 3.9: Historical ticket segmentation at TP1 Amoli

LCVs	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
Single	26%	29%	22%	25%	27%	31%	66%	96%	97%
Local commercial	3%	3%	3%	2%	2%	2%	2%	1%	1%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	1%	0%	0%	0%	0%	0%	0%	1%
Exemption	2%	1%	1%	1%	1%	1%	3%	2%	2%
Through traffic in	34%	33%	37%	36%	35%	33%	15%	0%	0%
Through traffic out	35%	33%	36%	36%	35%	33%	14%	0%	0%
Bus									
Single	8%	7%	4%	13%	24%	44%	92%	99%	99%
Local commercial	3%	2%	2%	1%	1%	1%	1%	0%	0%
Violation	-	9%	1%	1%	0%	0%	0%	0%	0%
Exemption	1%	0%	1%	0%	0%	0%	1%	1%	0%
Through traffic in	41%	48%	48%	44%	39%	29%	3%	0%	0%
Through traffic out	47%	34%	44%	41%	36%	26%	3%	0%	0%

Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

Table 3.10: Historical ticket segmentation at TP2 Ludhawai

LCVs	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
Single	36%	39%	32%	33%	36%	42%	68%	94%	93%
Local commercial	3%	4%	3%	3%	3%	3%	3%	5%	6%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Monthly	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	1%	1%	0%	0%	0%	0%	0%
Exemption	1%	1%	1%	1%	1%	1%	2%	2%	1%
Through traffic in	31%	28%	32%	31%	30%	28%	14%	0%	0%
Through traffic out	30%	28%	32%	31%	29%	27%	13%	0%	0%
Bus									
Single	11%	8%	6%	16%	25%	45%	93%	99%	99%
Local commercial	4%	2%	3%	2%	1%	1%	0%	0%	0%
Violation	-	0%	1%	1%	0%	-	0%	0%	0%
Exemption	0%	1%	0%	0%	0%	0%	1%	1%	0%
Through traffic in	45%	37%	43%	39%	35%	26%	3%	0%	0%
Through traffic out	39%	52%	47%	42%	38%	28%	3%	0%	0%

Source: Steer analysis of the Client data *FY22 is the annual level segmentation *FY22' is the averaged Oct- Mar Segmentation

Overloading

3.36 Overloaded vehicles on the Asset are charged twice the toll fee they would otherwise pay for their ticket type at the toll plaza. The table shows the share of overloaded vehicles paying twice the toll fee for each vehicle category for certain toll segmentation types on each toll plaza for FY19, FY20 and FY22. Currently as in FY22, the Asset charges overloading under "Single" and "Local Commercial" category where the user gets charged in the next category. Also, it shows the averaged October- March overloading share for FY22. The significant increased levels of overloading shares in FY22 relative to FY20-19 is because of two reasons, firstly of the bidirectional overloading charge on the Asset which until FY21 was unidirectional. Secondly, lifting up of the sand-mining ban in FY22 in accordance with the Supreme court law which has increased the share of overloading carrying vehicles on the Asset. Additionally, in the below table overloading shares under "Through traffic in" appears zero which is verified with no traffic reported under Through traffic in FY22.

Table 3.11: Overloading shares for FY19, FY20 and FY22

Vehicle type	Single			Local Commercial			Through traffic in		
	FY19	FY20	FY22*	FY19	FY20	FY22*	FY19	FY20	FY22*
TP1 Amoli									
LCV	1.4%	8.0%	7.0%	1.2%	3.2%	27.9%	0.8%	1.5%	-
2A	5.3%	12.2%	31.4%	15.2%	31.4%	9.3%	2.0%	5.7%	-
MAV	6.1%	11.0%	10.3%	15.2%	38.3%	83.9%	2.6%	10.0%	-
TP2 Ludhawai									
LCV	0.1%	1.6%	4.5%	0.1%	0.3%	-	0.0%	0.6%	-
Bus	0.0%	0.4%	0.6%	-	0.2%	-	0.0%	0.0%	-
2A	0.5%	5.3%	9.9%	-	3.2%	-	0.2%	1.1%	-
MAV	0.7%	9.0%	10.5%	0.1%	4.1%	32.4%	0.1%	0.6%	-

Source: Steer review of Client TMS data FY22* includes the averaged Oct-Mar overloading shares

Data Collection exercise

Overview

3.37 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.12: Data collection schedule

TP	7-day videography-based TVC			1-day OD survey	
	Start date	**End date**	**Time (hrs)**	**Start date**	**Start time**
TP1	27 Jan2021	02 Feb 2021	0000-2359	09 July 2019	0900 hours
TP2	27 Jan2021	02 Feb 2021	0000-2359	N/A	N/A

Source: Steer analysis

3.38 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

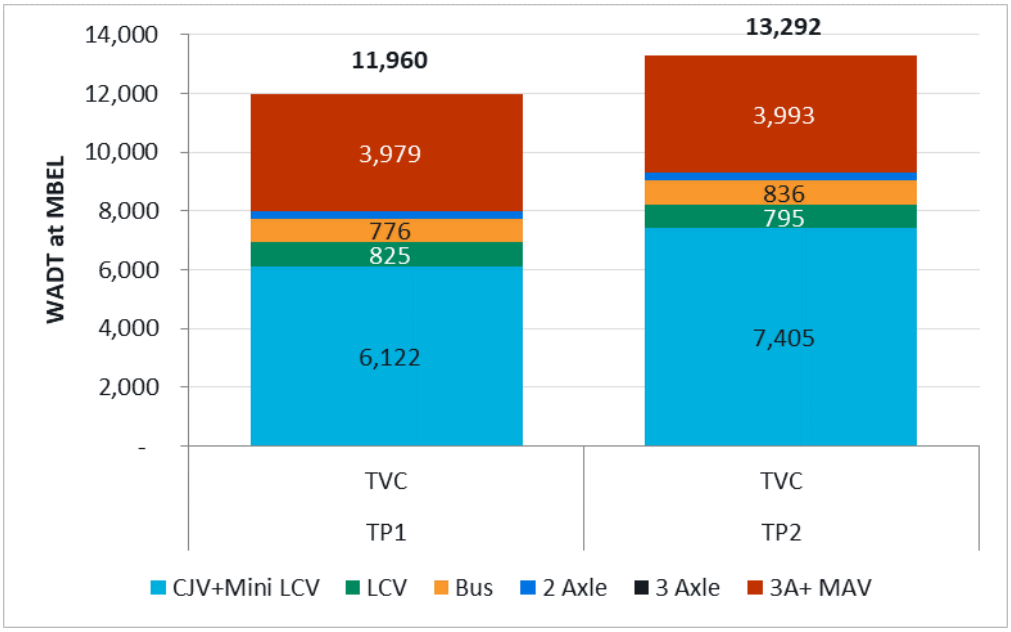
3.39 Please also note that OD survey data was available only at Amoli toll plaza and not Ludhawai . Since Amoli and Ludhawai toll plazas show similar traffic profiles, as observed both from the historical data and our site visits, the OD findings seen at Amoli can be applied to Ludhawai as well.

Key findings of the TVC data analysis

WADT estimates

3.40 Taking an average of the seven-day TVC counts (27th Jan – 2nd Feb 2021, 0000-2359 hours), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-toll able vehicle such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicle, government vehicle and other vehicle types officially allowed as 'exempted' under the concession agreement.

Figure 3.10 A2 TVC WADT



Source: Steer analysis of TVC data

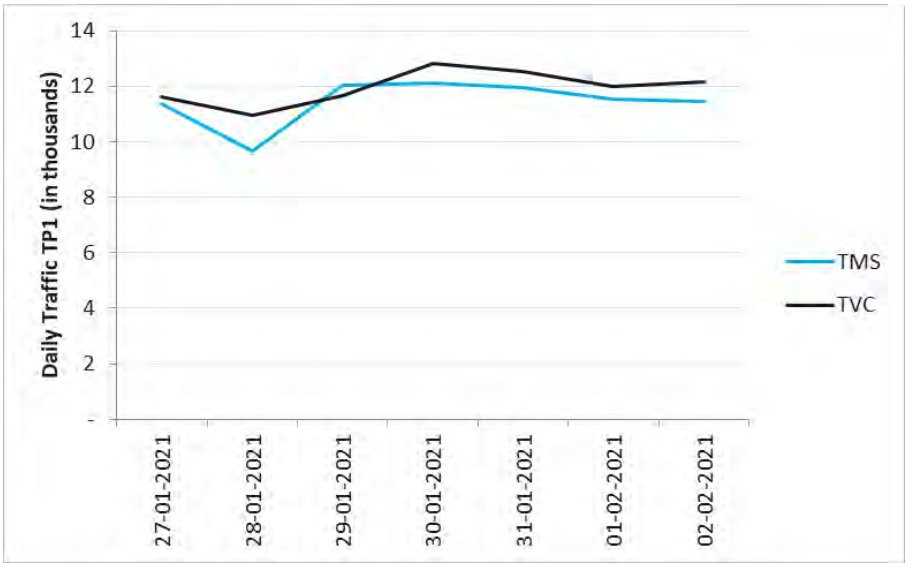
TVC v/s TMS analysis

3.41 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those particular days, as provided by the Client.

3.42 The following figures show the comparison between the daily traffic observed by TVC and TMS for the two toll plazas. As shown in the figures below, the TVC and TMS overall are within the acceptable range of variation.[4]

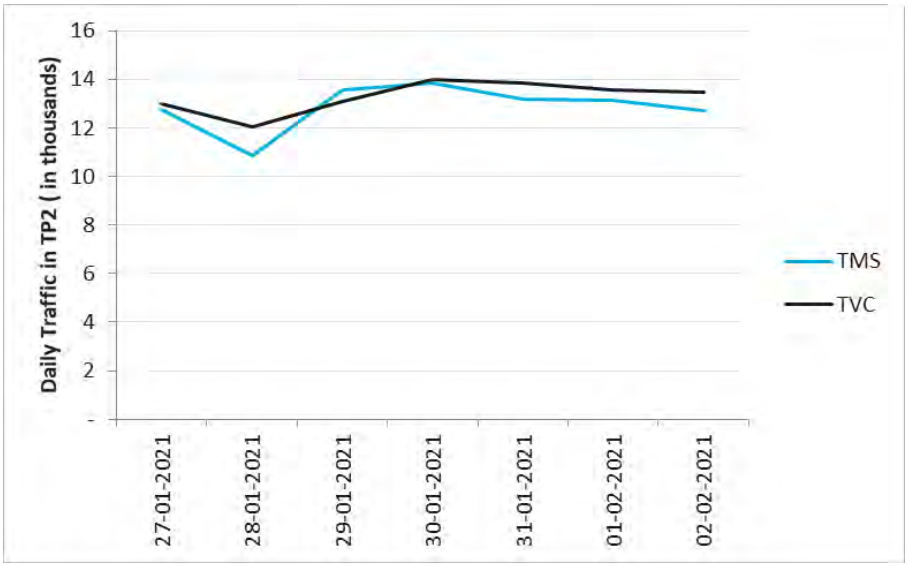
[4] One of the reasons for the difference between TVC and TMS is the different time slots being considered. TMS data provided ranges from 0600 hrs to 0559 hrs whereas TVC data ranges from 0000 hrs to 1159 hrs.

Figure 3.11: Comparison between TVC and TMS daily traffic data on TP1 Amoli



Source: Steer analysis of TVC and Client TMS data

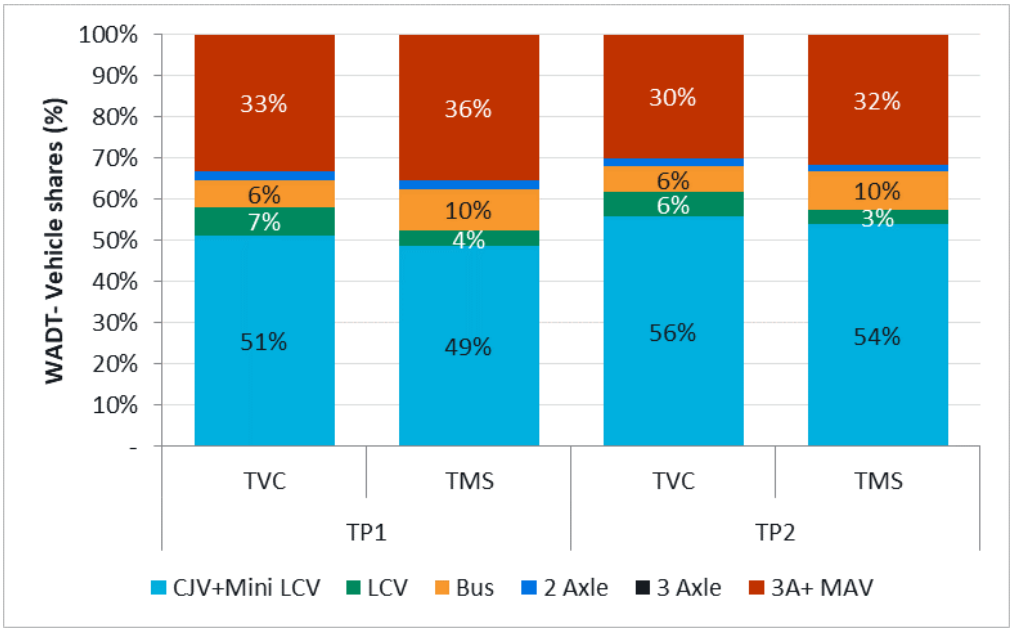
Figure 3.12: Comparison between TVC and TMS daily traffic data on TP2 Ludhawai



Source: Steer analysis of TVC and Client TMS data

3.43 The figure below compares the shares of vehicle types at both plazas, between TVC and TMS data. It can be observed from the figure below, while shares of CJVs are higher for TVC compared to TMS, it is vice-versa for other vehicle categories. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.13 Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.44 Considering the above findings, the TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.45 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in July 2019. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred in this period.

3.46 We have analysed the regional drivers of demand based on the following analysis:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.47 While zonal analysis and the list of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported on this Asset. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analysis is generally used to estimate key drivers of traffic and aid making informed forecasting assumptions related to traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.48 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TVC data) during the same time period.

The table below presents the sample rates for key vehicle type aggregations at TP1 Amoli. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.13: Sample rates for OD data

Vehicle type	TP1 Amoli
CJV	55%
Bus	68%
LCV	39%
2A Truck	74%
MAV	54%
Total	55%

Source: Steer analysis of OD data

Zone categories

3.49 To facilitate better understanding of key regional traffic drivers as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.14: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Rajasthan	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Uttar Pradesh	Uttar Pradesh (including Agra, Mathura)
Rest of North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central NCR	Delhi State, including New Delhi
Gujarat & Maharashtra	Gujarat and Maharashtra (including Mumbai)
Central India	Madhya Pradesh, Chhattisgarh
South India	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states
Outside India	Nepal, Bhutan, Bangladesh

Source: Steer analysis

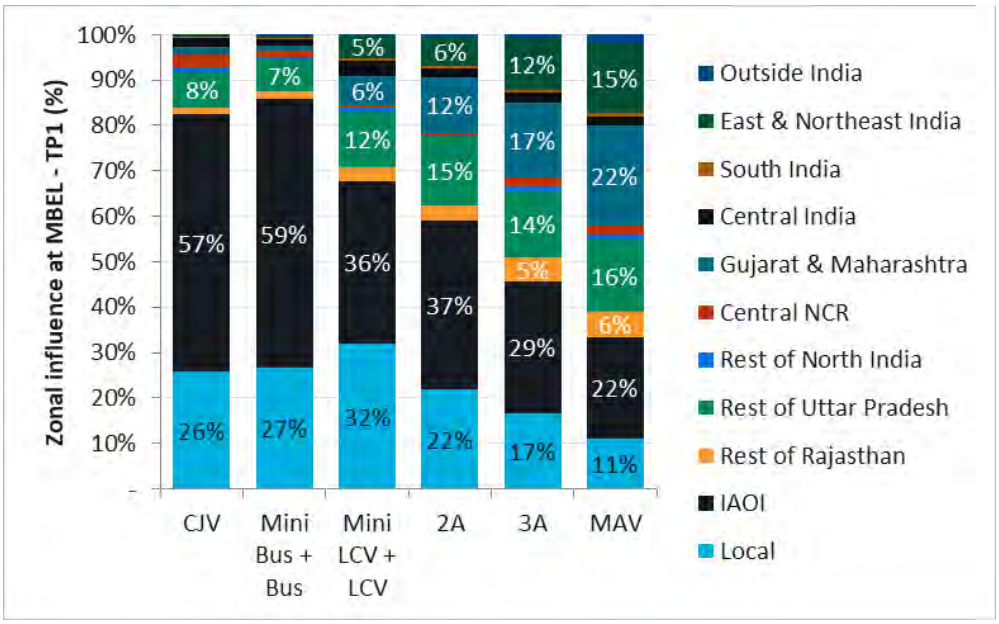
Zonal influence

3.50 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[5] at TP1 Amoli, aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed based on trip ends and not trips.

3.51 As can be seen from the figure below, IAOI zones, followed by local zones, have the largest influence. IAOI trips range from 22% for MAV to 57% for CJV, with major zonal influence from Jaipur.

3.52 Besides IAOI and local zones, we see an equally high share of 'Rest of Uttar Pradesh' (14-16%), 'Gujarat & Maharashtra' (12-22%) and 'East & Northeast India' (6-15%) in the zonal influence of 2A, 3A and MAV categories. We assume a similar OD zonal influence at Ludhawai as well.

Figure 3.14: Zonal influence at TP1 Amoli



Source: Steer analysis of OD data

Internal External analysis

3.53 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local or IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

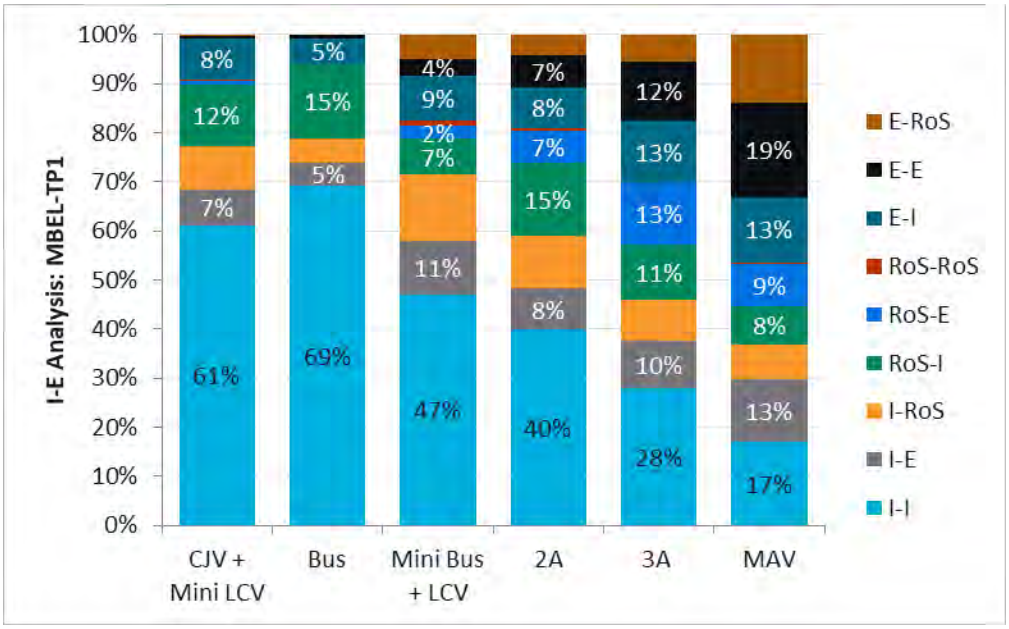
[5] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

3.54 The figure below shows the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation but at a trip level.

3.55 We see that TP1 Amoli has about 19% of E-E trips for MAVs even though there is limited economic activity in the vicinity of the Asset, since the traffic on this Asset is largely non divertible due to absence of any other viable alternate roads.. As expected, CJVs, Bus, LCV and 2A show much lower E-E trips and more trips in the I-E, E-I and I-I mix as they travel shorter distances.

3.56 Since data is not available for TP2 Ludhawai, keeping in view the short length of the Asset and the fact that there are no major attractors or generators present along the Asset, it is assumed that TP2 Ludhawai have similar Internal-External distribution to TP1 Amoli.

Figure 3.15 Internal-external distribution at TP1 Amoli



Source: Steer analysis of OD data

Commodity distribution

3.57 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.15: Aggregate commodity categories

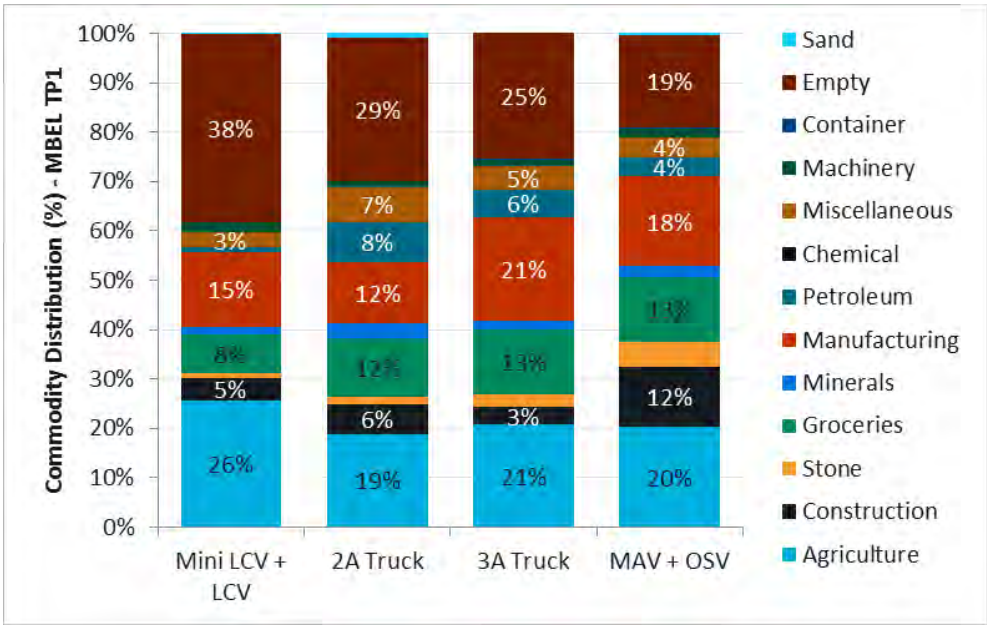
Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

3.58 Figure 3.16 figure below presents the commodity distribution for goods vehicles at TP1 Amoli, at the total level as well as by direction, towards Jaipur and towards Agra. As observed during our site visit, we see that at the total level (Figure 3.16) agricultural products make up the highest shares in the distribution at 19-26%, mostly comprising trips within Rajasthan. The second largest contributor is manufactured products, which have a share of 12-21% across the vehicle categories. It majorly comprises of marble being transported from Kota, Kishangarh in Rajasthan towards Uttar Pradesh, Bihar, Odisha etc.

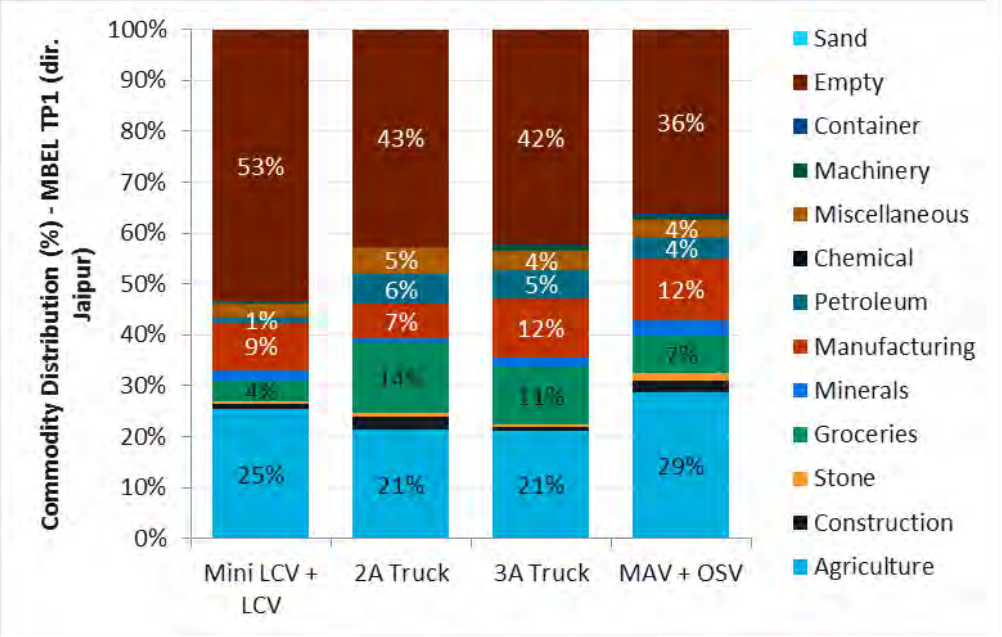
3.59 Looking by direction, a greater share of vehicles also travels empty towards Jaipur (36%-53%), than those travelling in the opposite direction towards Agra (2-20%). Another key difference is the share of manufactured products, which is much greater travelling towards Agra (20-33%), than travelling towards Jaipur (7-12%). A similar trend is applicable to the share of construction materials contributes to a negligible share of vehicles travelling towards Jaipur, but up to 22% in case of MAVs in the direction towards Agra.

Figure 3.16: Commodity distribution at TP1 (Both directions)



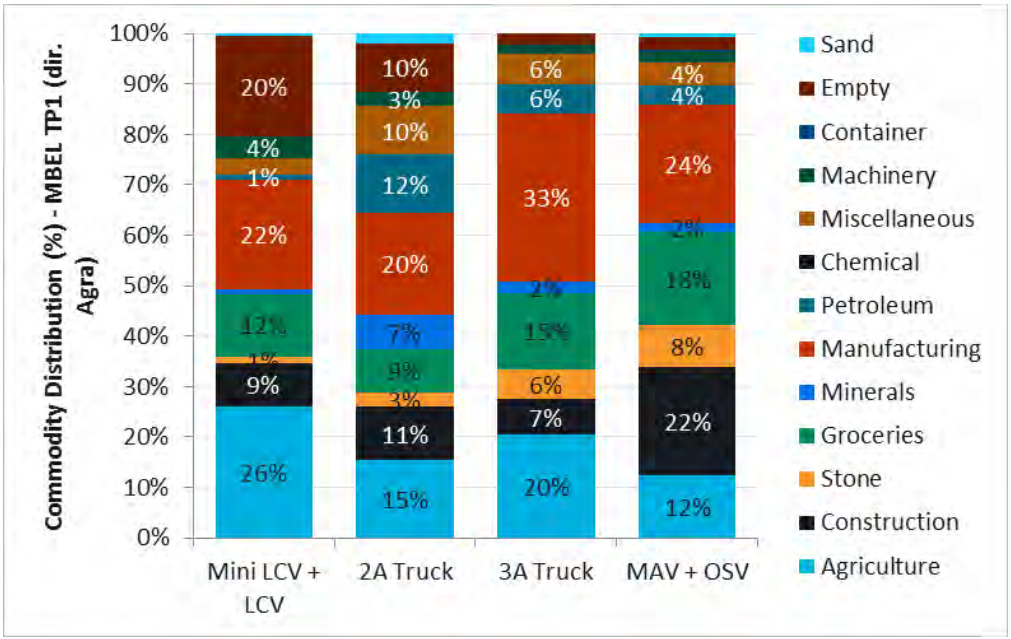
Source: Steer analysis of OD data

Figure 3.17: Commodity distribution at TP1 (towards Jaipur)



Source: Steer analysis of OD data

Figure 3.18: Commodity distribution at TP1 (towards Agra)



Source: Steer analysis of OD data

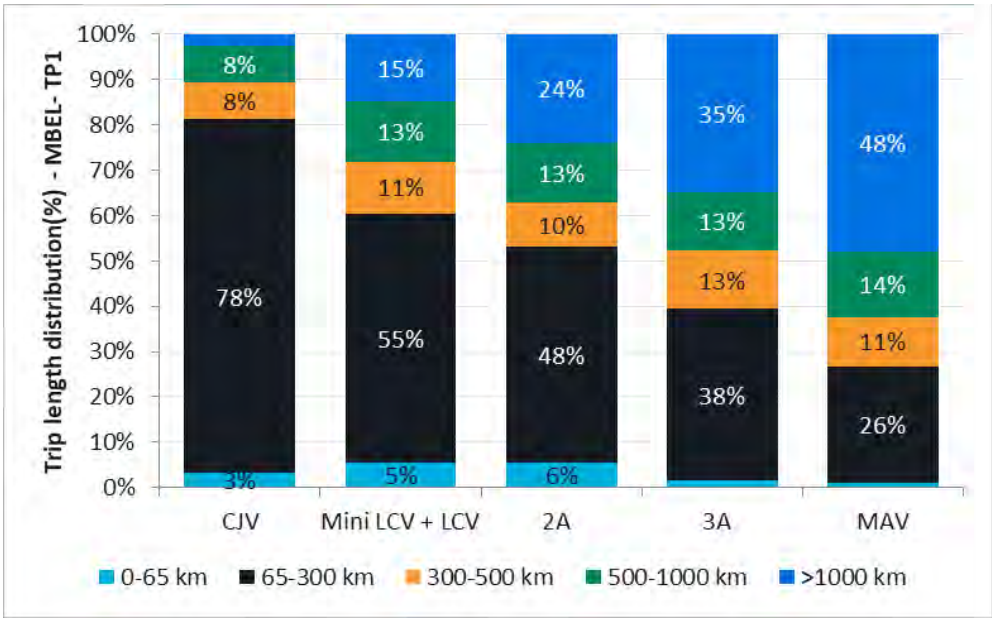
3.60 Since data is not available for TP2, keeping in view the short length of the Asset and no major attractors or generators are present along the Asset, it is assumed that TP2 Ludhawai has similar commodity distribution to TP1.

Trip length analysis

3.61 Trip-length distribution provides the distance-based profile of various vehicle categories. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[6]

[6] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.19: Trip length distribution, TP1 Amoli



Source: Steer analysis of OD data

3.62 As can be seen in Figure 3.19 above, a significant share of trips (especially for CJVs) are shorter than 300 km long as CJVs nature of movement is primarily short-distance. On the other hand, close to half of MAV trips do trips longer than 1000 km due to long distance movements between Gujarat at one end and Uttar Pradesh, east and north-eastern India at the other end. This has also been observed across other Assets in the country. These findings are in line with the zonal influence and top OD pairs observed on the Asset as well.

Conclusions

3.63 In summary, in FY22 the Asset had an AADT of 10,875 at TP1 Amoli and 12,174 at TP2 Ludhawai. Looking at the vehicle shares of the Asset, the dominant vehicle class is CJVs, holding 50% of the vehicle class share followed by MAV holding approx. 30% of traffic share. Traffic has shown significant recovery starting FY22 when the Dausa-Lalsot section and Jaipur Ring Road was commissioned resulting in improved connectivity to Delhi and South. Also, with the re-opening of tourist sites in Rajasthan and Delhi, the CJV traffic has increased. MAV's have also grown in the recent years driven by increase in sand mining traffic as one of the key reasons.

3.64 The TVC counts does show some variation on the TMS, at the total level TMS is 4% lower than TVC at TP1, and 3% lower than TVC at TP2. However, the differences are small for larger revenue generating categories (3A, MAV and OSV combined), 1.4% and 0.5% at TP1 and TP2 respectively. Considering these findings and only slight variations, we are confident in the accuracy of using the Client TMS data.

3.65 Key takeaways from the OD analysis include a dominant influence of IAOI and local trips, particularly for CJVs which is largely influenced by Jaipur. Agricultural products and manufacturing products hold the greatest commodity shares. Following these, groceries and stone also hold considerable shares (13% and 5% respectively). Majority of the traffic is sticky to the Asset with only 12% being external-external in PCU terms which is using the Asset as it offers excellent connectivity to the regions in the immediate vicinity of the corridor.

3.66 The overall characteristic of the Asset is strategic is nature connecting several key urban and economic activity centres of Jaipur, Agra, Bharatpur in immediate vicinity with wider generators and attractors of south Rajasthan, Gujrat, Maharashtra to Uttar Pradesh and Delhi NCR also being connected by the Asset. Urban population and tourism linked growth is seen as an added advantage for CJV and Bus traffic.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Rajasthan (containing the Asset), compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, Rajasthan has grown at a rate which is slightly higher than the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Rajasthan	56.5	43.3	13.2	68.5	51.5	17.0	2.0%	1.8%	2.6%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of patterns of urbanisation, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

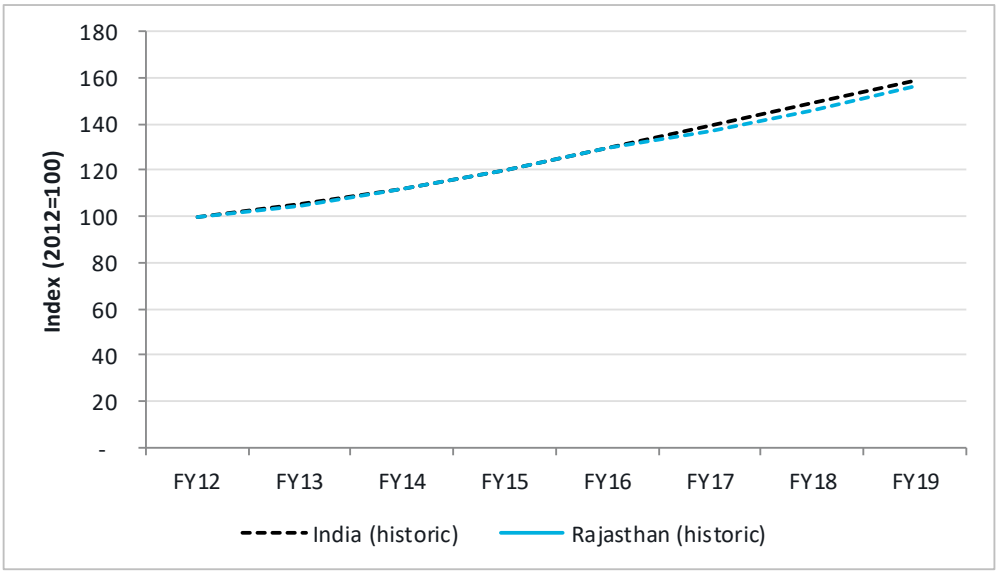
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Rajasthan has been very similar to the country. The state contributes approximately 5% to India's GDP. The following figures illustrates the evolution of India and Rajasthan's GDP.

Figure 4.1: Evolution of Rajasthan's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

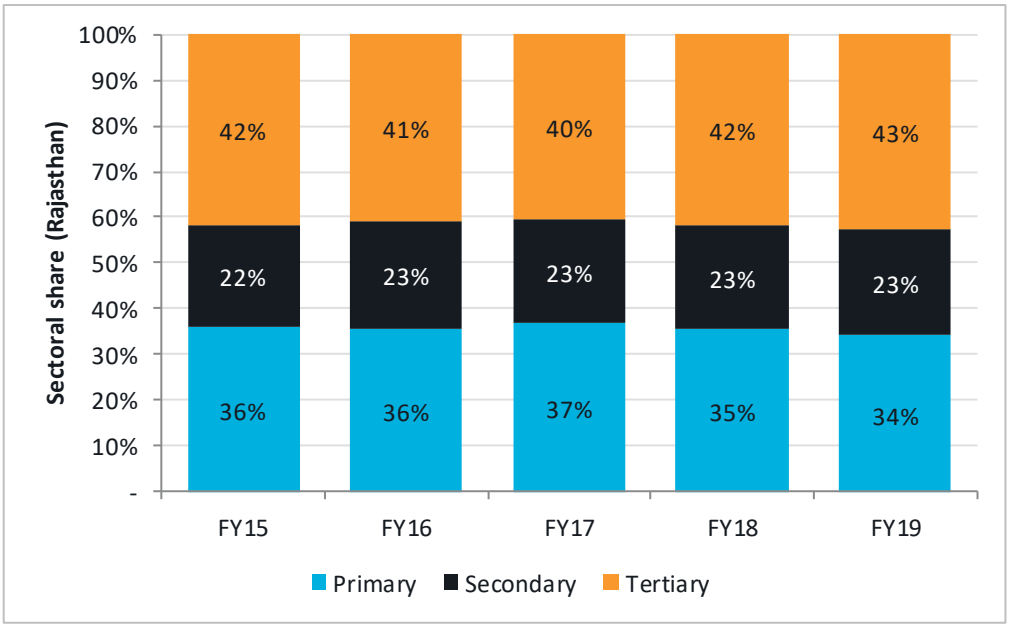
4.9 Rajasthan, the largest (area-wise) state in India, is in the north-western part of the country. In terms of sectoral contribution to the state GDP, tertiary sector has the highest share followed by primary and secondary, with the shares remaining stable during the last five years.

4.10 The tourism and transport sector constitutes a major share of the state's tertiary sector. Rajasthan is considered a favoured tourist destination in India, with key tourist attractions being Jaipur, Jodhpur, Jaisalmer, Bharatpur and Udaipur. In 2018, the state attracted over 50 million domestic tourist arrivals in the country whereas, in terms of foreign tourist arrivals it holds fifth position with over 1.7 million7 tourist visiting state every year.

4.11 In terms of secondary sector, the state has key industrial areas in Kishangarh (marble); Manesar (automobile), Pali and Jodhpur (textiles), Chittorgah -Neemuch (cement), Kota (stone). Rajasthan is one of the largest mineral producing states in India and the sole producer of lead and zinc ores in the country. The state has one of the largest limestone reserves, making it a hub for cement industries. In terms of agricultural produce, the state is largely known for its production of wheat, cotton, cereals and pulses.

4.12 The state is mainly known for production of wheat, cotton, cereals and pulses.

Figure 4.2: Sectoral contribution to Rajasthan's GSDP



Source: Central Statistics Organisation

[7] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 To understand the historical traffic trends in relation to these growth drivers, we carry out regression analysis to determine the historical relationship between each traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This could be because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.5 Elasticities, in the case of traffic growth, are the relationships between traffic and growth drivers. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.6 The table below shows the historical CAGRs on the Asset by each vehicle category. The growth rates have been bucketed to analyse the historical growth under different time periods to arrive at an elasticity assumption.

Table 5.1 Vehicle wise growth and CAGR (%) at Amoli toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
CJV	20.0%	(1.8%)	2.8%	4.6%	3.2%	11.3%	14.3%	**5.2%**	**2.2%**	**12.8%**
LCV	7.9%	1.6%	(0.1%)	(11.0%)	(10.7%)	(47.7%)	(32.9%)	**2.5%**	**(5.2%)**	**(40.7%)**
Bus	39.7%	26.2%	0.6%	12.5%	8.4%	2.6%	41.1%	**8.3%**	**11.5%**	**20.3%**
2A	(14.2%)	(48.0%)	13.7%	9.8%	1.4%	(41.1%)	(51.5%)	**(6.3%)**	**(9.9%)**	**(46.5%)**
3A/MAV	23.6%	5.4%	11.6%	(17.1%)	0.1%	3.5%	(2.5%)	**4.1%**	**(0.6%)**	**0.5%**

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
Total	18.3%	0.3%	6.0%	(5.1%)	1.1%	0.9%	7.2%	**4.1%**	**0.5%**	**4.0%**
PCU	19.1%	1.7%	8.3%	(9.6%)	0.9%	(0.0%)	4.1%	**3.8%**	**0.1%**	**2.0%**

Source: Steer analysis of TMS data provided by client

Table 5.2 Vehicle wise growth and CAGR (%) at Ludhawai toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
CJV	13.7%	2.3%	5.1%	6.3%	6.7%	11.9%	18.8%	**5.3%**	**5.1%**	**15.3%**
LCV	9.2%	(0.0%)	0.3%	(9.5%)	(7.9%)	(55.7%)	(28.7%)	**3.1%**	**(4.4%)**	**(43.8%)**
Bus	23.4%	39.9%	3.3%	10.3%	7.8%	2.6%	34.0%	**8.9%**	**14.5%**	**17.3%**
2A	(14.0%)	(50.2%)	14.4%	4.2%	3.9%	(37.3%)	(24.3%)	**(7.5%)**	**(11.4%)**	**(31.1%)**
3A/MAV	19.7%	11.5%	13.0%	(19.4%)	0.3%	3.3%	(2.5%)	**3.8%**	**0.4%**	**0.3%**
Total	13.5%	4.3%	7.5%	(5.2%)	3.0%	0.4%	10.3%	**4.1%**	**2.3%**	**5.2%**
PCU	14.6%	6.3%	9.7%	(10.8%)	2.0%	(0.5%)	5.6%	**3.7%**	**1.5%**	**2.5%**

Source: Steer analysis of TMS data provided by client

5.7 As the TMS data did not provide a breakup between the individual vehicle categories for the toll categories 3A/MAV, we have used FY21 TVC counts, as discussed in Chapter 3, to estimate the splits in FY22. Similarly, TVC splits of FY21 have been used for Bus and 2A estimation due to abnormal reporting issue than ongoing trend. The following table presents the splits which have further helped in the elasticity estimation. However, in our regression analysis, we have used the combined traffic as data for historical years which were available only in combined form.

Table 5.3: Split between individual vehicle types at each toll plaza

Toll plaza	Vehicle type (for toll)	Vehicle type (for growth)	Share (%)
Amoli toll plaza	Bus/2A	Bus	76%
		2A	24%
	3A/MAV	3A	15%
		MAV	85%
Ludhawai toll plaza	Bus/2A	Bus	76%
		2A	24%
	3A/MAV	3A	15%
		MAV	85%

Source: Steer analysis of independent TVC data

5.8 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.4: Identified growth drivers to model traffic growth

Vehicle type	Growth Driver
Car	GSDP Rajasthan
LCV	GSDP Rajasthan
Bus	GSDP Rajasthan
2A	GSDP Rajasthan
3A	GDP India
MAV	GDP India

Source: Steer analysis of Client data

5.9 The recent historical period of tolling is chequered with variations in traffic growth between years for certain vehicle types, due to construction of Dausa-Lalsot road and the Supreme Court ban on sandmining, impacting movement of commercial vehicles. Therefore, certain impacted years were not available for the regression analysis. This is one of the reasons for differences between the derived and assumed elasticities as we typically forecast elasticities to reflect the more recently observed relationship between traffic growth and macroeconomic growth either based on recent elasticities or benchmarks.

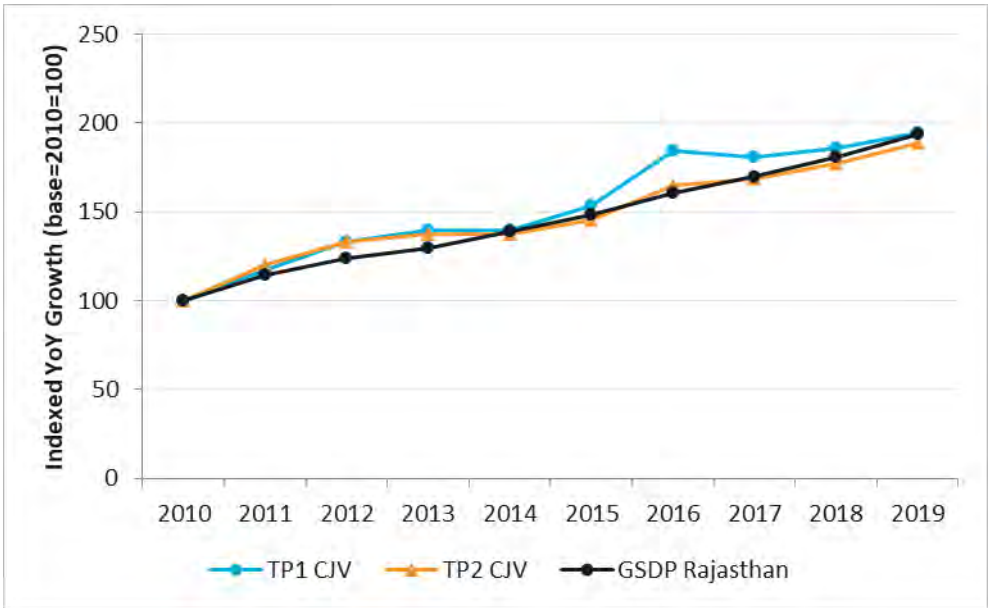
5.10 It should be noted that in our regression analysis, we have used the combined traffic for toll categories as data for historical years was available only in combined form. Given the high uncertainties driven by the on-going pandemic, we believe that the regressions and elasticities based on data up to FY20 are more reliable for the forecasts.

5.11 Further, FY21 and FY22 have been impacted by COVID-19 related restrictions and the traffic volumes on the Asset were significantly impacted during the travel restrictions imposed during the first, second and third wave of COVID-19. Hence, FY21 and FY22 have not been considered while undertaking the regression analysis.

CJV

5.12 It was observed from the OD data that CJVs primarily cater to regional movements between Jaipur, Bharatpur, Agra and other towns in the vicinity of the Asset. We have therefore assumed Rajasthan GSDP to be the growth driver for modelling growth of CJV traffic. The following figure shows the relationship between indexed values of CJV traffic and Rajasthan GSDP at TP1 Amoli and TP2 Ludhawai.

Figure 5.1: Relationship between CJV traffic and Rajasthan GSDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.13 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or are slightly higher than growth in GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. However, in FY20 there was brief drop in car sales primarily owing to scheduled roll out of BS VI norms from April 2021.

5.14 Historically, the CJV traffic on the Asset has shown strong growth in the FY12-16 period, with the FY16-19 period showing slower growth rates. The slower growth in recent years is attributed to lowering reported violations over the years as observed from the TMS data discussed in Chapter 3. Moreover, the shift to passenger choices has seen strong recovery in this vehicle category from FY20 onwards due to people avoiding public transport. This trend is expected to sustain as users' perceptions of preferring personal vehicles in the medium term will continue driving CJV growth.

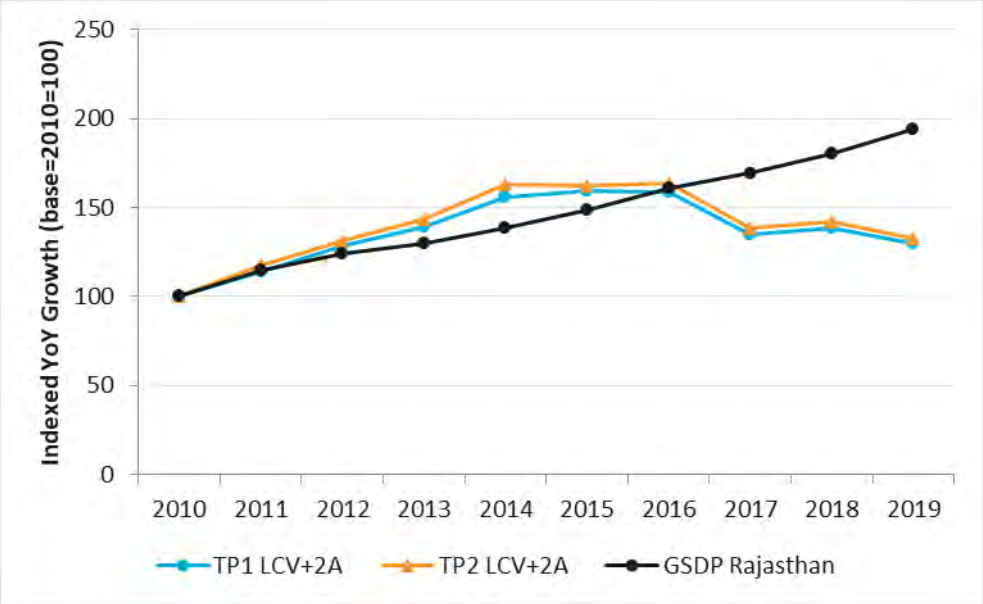
5.15 Nevertheless, the regression analysis suggests that between FY17 and FY19 traffic has grown with a background traffic growth elasticity of 1.0 and 1.1 at TP1 and TP2 respectively, with respect to GSDP. Taking note of the positive outlook for passenger traffic on the tourism-driven Asset and the regression results, we have assumed a forecast background elasticity of 1.0 with respect to Rajasthan GSDP for CJVs on both toll plazas.

LCV, 2A

5.16 Compared to heavy vehicles such as 3A and MAV, LCV and 2As are used for more regional movements within the state – Rajasthan in this case as seen in the OD data analysis. More than 80% of LCVs and 70% of 2As have one trip end in Rajasthan. We have therefore taken GSDP of Rajasthan would be a more appropriate growth driver to model growth of LCV+2A traffic. The following figure shows the relationship between indexed values of LCV+2A combined traffic and Rajasthan's GSDP.

5.17 Though growing steadily during FY11-14 period, LCV+2A combined growth on the Asset has been flatlining in FY15 and FY16 and negative since. The FY17-20 period has shown an overall negative growth. However, looking at the disaggregate data for 2A traffic, we observe that 2As were growing faster than LCV until FY18. We believe this could be due to shift in growth from LCV to 2As, and/or classification issues. We have observed that that 2As are growing faster than LCVs along other roads Assets across the country due to the revised axle load norms implemented in July FY19.

Figure 5.2: Relationship between LCV+2A combined traffic and Rajasthan GSDP



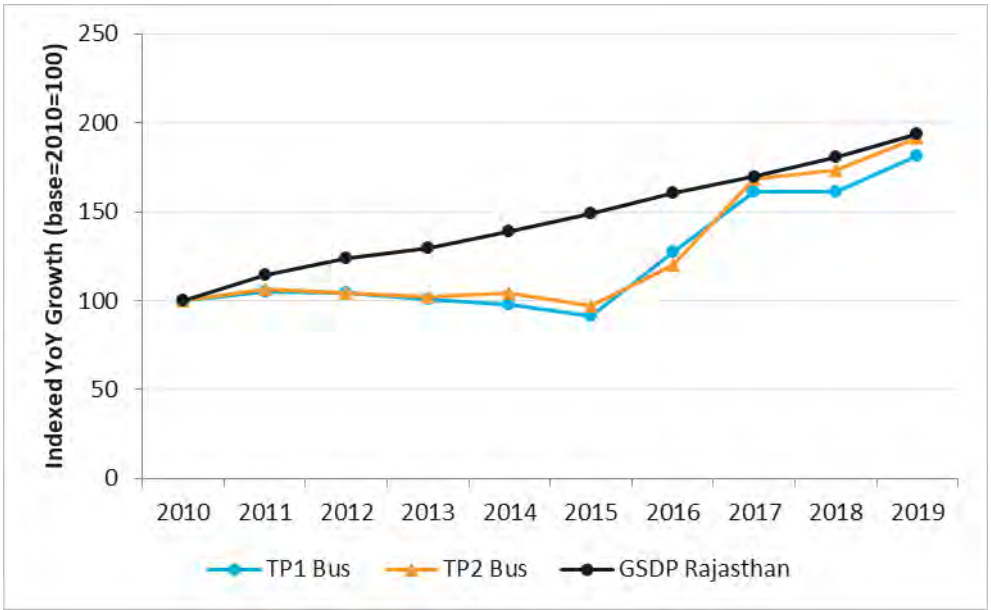
Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.18 As requisite number of years were not available for undertaking regression, we have relied on our experience of working on similar Assets across India and in the vicinity to conclude that LCV will continue to grow albeit at a lower elasticity of 0.3 compared to 0.5 for 2A, with respect to State's GSDP.

Bus

5.19 The following figure shows the relationship between indexed values of bus traffic and Rajasthan's GSDP.

Figure 5.3: Relationship between Bus traffic and Rajasthan GSDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.20 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at different intervals of time. Based on our experience across the country, buses on inter-urban and tourism corridors show elasticities of 0.4 to 0.6 with respect to the GSDP. The regression results for certain reliable years also show elasticities in the range of 0.5 to 0.6 on the Asset. Based on the regression results and benchmarks, we have therefore assumed an elasticity of 0.5 with respect to GSDP Rajasthan.

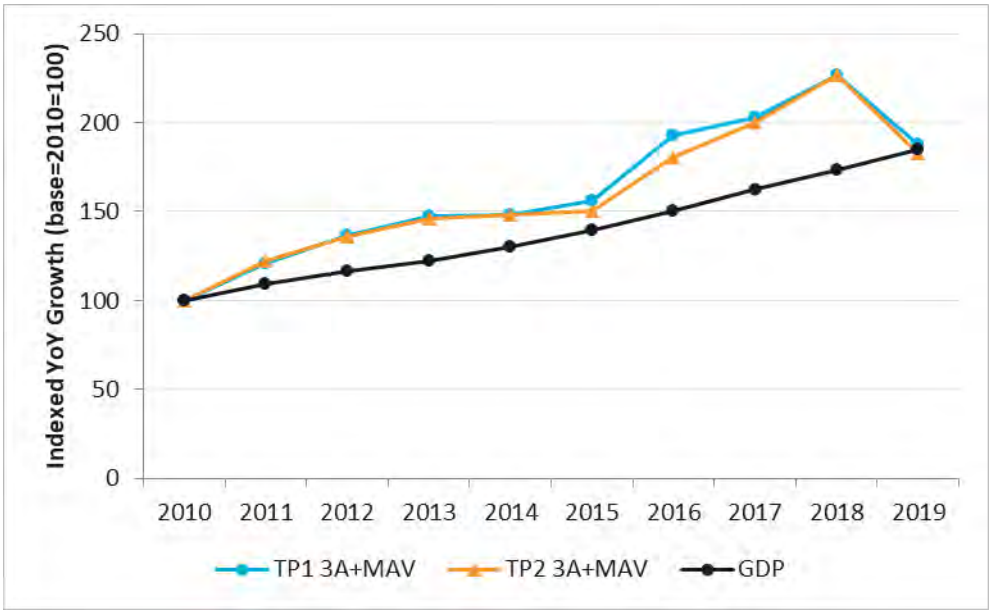
3A/MAV Trucks

5.21 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in the commodity distribution resulting in traffic growth in 3A and MAV to be dependent on industry demand-supply ecosystems spread across the country, therefore we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

5.22 Historically, 3A+MAV combined traffic grew positively in the FY12-FY16 period at 7-9%, growing further in FY17 and FY18, before losing volumes in FY19 and FY20. This was due to:

- Primarily the ban on sand-mining in Rajasthan imposed by a Supreme Court of India's order in November 2017, and
- To a lesser extent: the construction of Dausa-Lalsot road which caused traffic to use alternate routes like Lalsot-Gangapur road.

Figure 5.4: Relationship between 3A+MAV combined traffic and India's GDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.23 As seen in the tables earlier presented in the chapter, though MAV grew strongly in FY12-16, the drop in construction-related traffic in 3A+MAV during FY16-19 period has not shown recovery in FY20. However, given positive developments due to the new policy providing industry status to manufacturing of m-sand, movement of sand in goods vehicles may show recovery.

5.24 We believe 3A to grow slower as compared to MAV due to a shifting preference seen for MAVs from 3As for long-distance movements. This could be because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are best suited for certain commodities or movements.

5.25 Based on the above points, considering the regression results, the earlier ban on sand-mining and potential recovery of the sand industry, we have assumed elasticities of 0.60 and 0.80 for 3A and MAV trucks respectively, with respect to India GDP growth.

Forecasts for background elasticities

5.26 The below table presents a summary of the results of the regression analysis carried out on the historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.27 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle type	Growth driver	History		Forecast	
		Derived elasticity	Years considered	Assumed forecast elasticity	Evolution of elasticity
TP1					
Car	GSDP Rajasthan	1.00	FY12-FY13, FY15, FY18-FY19	1.00	No change
LCV*	GSDP Rajasthan	1.20	FY12-FY15, FY18	0.30	No change
Bus	GSDP Rajasthan	0.60	FY11, FY18-FY19	0.50	No change
2A*	GSDP Rajasthan	1.20	FY12-FY15, FY18	0.50	No change
3A	GDP	1.10	FY12-FY15, FY17-FY18	0.60	No change
MAV	GDP			0.80	No change
TP2					
Car	GSDP Rajasthan	1.10	FY11-FY19	1.00	No change
LCV*	GSDP Rajasthan	1.10	FY12-FY14, FY16, FY18	0.30	No change
Bus	GSDP Rajasthan	0.50	FY11, FY14, FY18-FY19	0.50	No change
2A*	GSDP Rajasthan	1.10	FY12-FY14, FY16, FY18	0.50	No change
3A	GDP	1.00	FY12-FY15, FY17	0.60	No change
MAV	GDP			0.80	No change

Source: Steer analysis of Client data *regression was run on LCV-2A and 3A-MAV combinedly

Forecasts for growth drivers

5.28 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.29 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.30 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in in the figure below.

5.31 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY32, end of concession.

5.32 The India GDP growth provided by the Client is in line with other independent forecasts available form from independent sources such as IMF, World Bank and RBI in the short and medium term, while we believe that longer term GDP forecasts are considered to be optimistic.

State GSDP

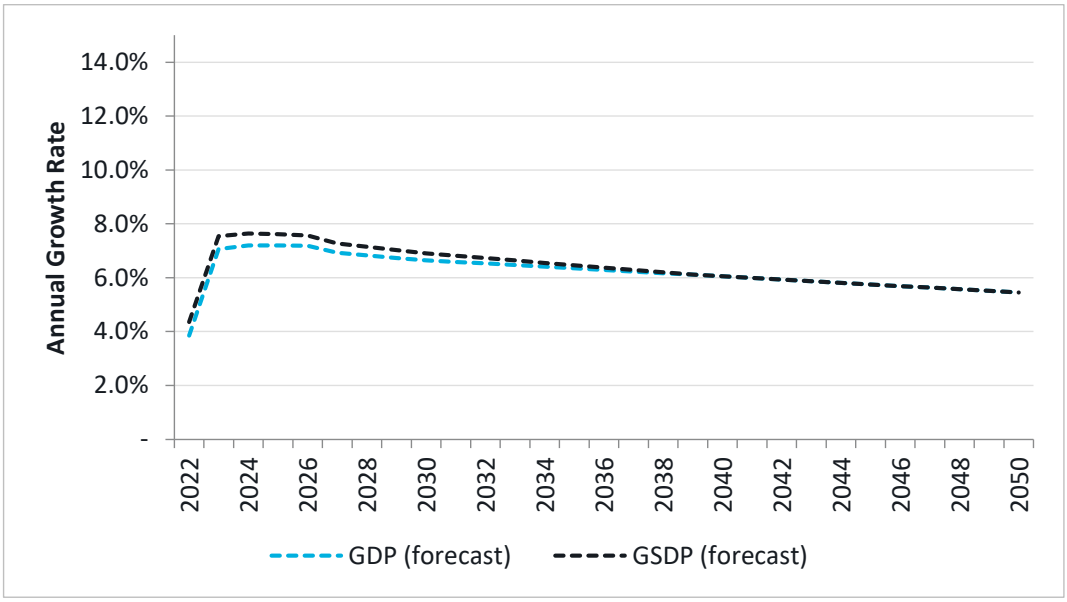
5.33 As per Client projections, Rajasthan's GSDP growth assumes to continue outpacing the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.34 There are significant investments expected to take place as part of the state's plan and Rajasthan is expected to receive a significant proportion of these investments, given its leading position in industrial investments. Higher than expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Rajasthan's state economy.

5.35 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.36 The GDP-GSDP lines are expected to converge by FY38. The chart below shows the forecast growth lines for GDP and Rajasthan GSDP.

Figure 5.5: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP projections based on Steer estimates of historical trends compared to GDP

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of base growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentations, trip factors and evolution of toll rates for the concession period which are used to estimate the traffic and revenue forecast. In the final section, this chapter summarises traffic growth rates for the concession period.

6.2 The following table lists key intermediate and final outputs that have been presented in previous Chapters and in this chapter.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Historical elasticities with respect to growth drivers	Chapter 3,5, Appendix C
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4,5, Appendix C
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2,6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3,6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer analysis

6.3 All traffic is presented as AADT for vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Though FY32 is the last year of concession, we have developed our forecasts until FY34 for the Client's reference.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied the monthly traffic and seasonality. We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. The averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 The seasonality factors assumed for individual vehicle types for each toll plaza are shown in the table below.

Table 6.2: Seasonality correction factors for TP1 Amoli

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.94	1.00	0.97	1.05	1.02	1.17	1.07	0.96	0.98	1.04	0.95	0.90
LCV	0.93	1.06	0.98	1.06	1.12	1.07	0.98	0.94	0.97	1.02	0.94	0.96
Bus	0.93	0.97	1.05	1.08	1.03	1.07	0.99	0.92	1.05	1.05	1.01	0.89
2A	0.97	0.97	0.99	1.09	1.05	1.04	0.96	0.92	1.09	1.09	0.97	0.89
3A/ MAV	1.00	1.00	0.98	1.08	1.14	1.04	0.97	1.04	0.99	0.95	0.90	0.94

Table 6.3: Seasonality correction factors for TP2 Ludhawai

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.95	0.99	0.97	1.06	1.04	1.17	1.06	0.95	0.98	1.03	0.92	0.92
LCV	0.96	1.08	1.00	1.08	1.13	1.06	0.97	0.94	0.94	0.99	0.93	0.96
Bus	0.94	0.97	1.04	1.08	1.03	1.07	1.00	0.92	1.04	1.04	1.01	0.90
2A	0.96	0.96	0.99	1.09	1.06	1.04	0.97	0.93	1.08	1.09	0.98	0.90
3A/ MAV	1.00	1.01	0.99	1.09	1.15	1.03	0.97	1.04	0.98	0.94	0.90	0.93

Source: Steer analysis of Client historical TMS data\

Base year FY22 AADT estimates

6.8 As discussed earlier in chapter 1 and in section 3.11, The second wave of COVID-19 infections peaked in the norther half of the country in the months of April and May 2021. The tourist centres of Jaipur, Delhi, Agra, Mathura had implemented strict COVID-19 related protocols for tourists. As a result, a significant reduction in tourism travel was recorded during this period. Therefore, the traffic volumes on the Asset were impacted during Q1FY22.

6.9 In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.10 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.11 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.4 Monthly AADT and Adopted AADT for FY22 - TP1 Amoli

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	5,404	7,004	6,833	5,090	6,734	7,821	6,531
LCV	310	304	306	268	285	311	287
Bus	1,374	1,497	1,491	1,307	1,363	1,568	1,416
2A	136	135	110	110	106	137	120
3A/MAV	3,753	3,415	3,970	3,852	4,022	3,970	3,685
Total	**10,976**	**12,355**	**12,711**	**10,627**	**12,511**	**13,807**	**12,040**
PCU	**24,782**	**25,445**	**27,313**	**24,508**	**26,986**	**28,621**	**25,697**

Source: Steer analysis FY22* for CJV and Bus is averaged Oct-Mar (excluding Jan) due to 3rd wave COVID-19 impact

Table 6.5 Monthly AADT and Adopted AADT for FY22 - TP1 Ludhawai

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	6,587	8,506	8,280	6,406	8,312	9,020	7,848
LCV	341	351	351	310	341	364	327
Bus	1,277	1,406	1,385	1,281	1,311	1,540	1,344
2A	268	258	257	170	201	183	220
3A/MAV	3,750	3,390	3,959	3,831	3,971	3,893	3,643
Total	**12,223**	**13,910**	**14,233**	**11,999**	**14,135**	**15,000**	**13,383**
PCU	**26,106**	**27,017**	**28,908**	**25,911**	**28,577**	**29,656**	**26,995**

Source: Steer analysis FY22* for CJV and Bus is averaged Oct-Mar (excluding Jan) due to 3rd wave COVID-19 impact

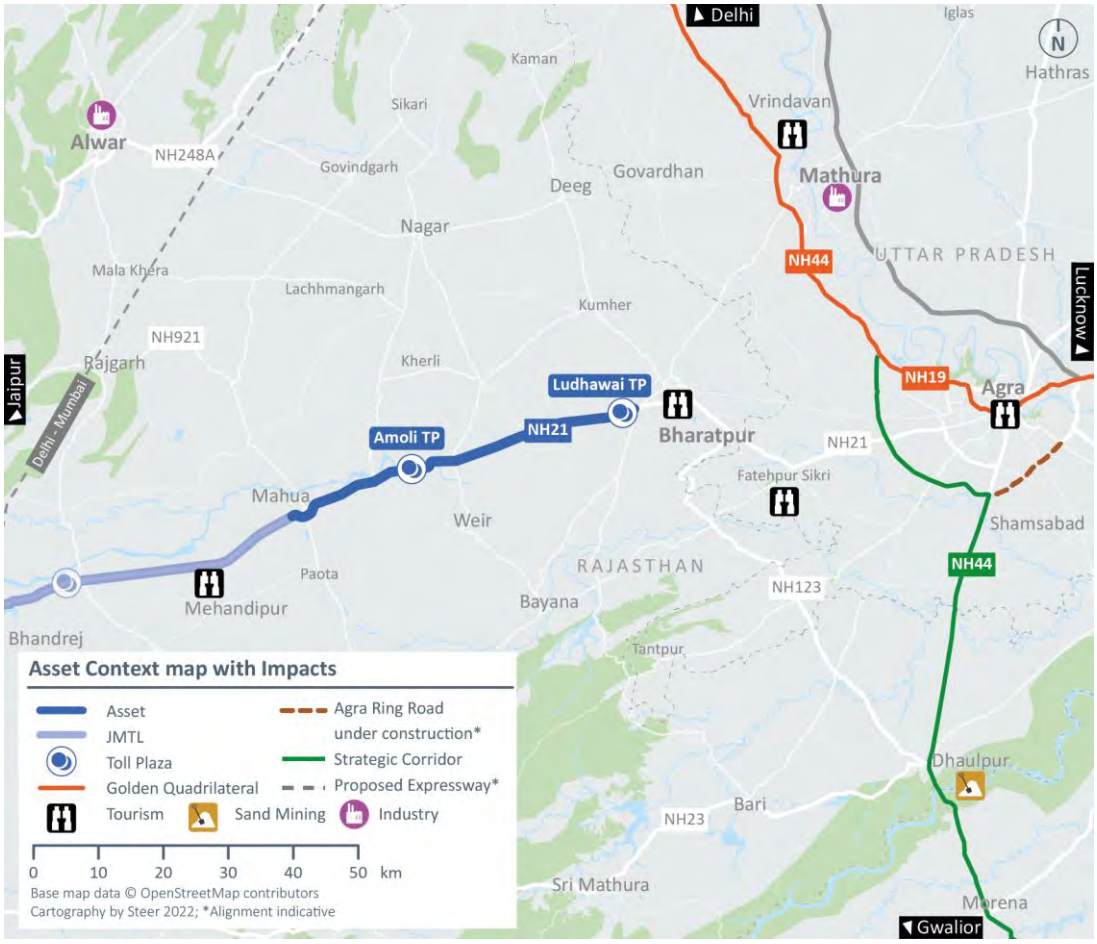
Analysis of potential network/developmental impacts

Summary of alternate routes and planned changes

6.12 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in chapter 2, in order to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.13 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context



Source: Steer analysis and cartography

6.14 Apart from the ban on illegal sandmining by the SC, network developments include the construction of Jaipur Ring Road and Agra Ring Road. The following table presents the upcoming network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6.6: List of network/other developments

S. No.	Development	Route affected	Year of impact	Impact (+/-)	Toll plaza
1.	Ease of ban on illegal sandmining	Vehicles carrying sand and other material dependent on the construction industry	FY23 onwards	+ve	TP1 & TP2

S. No.	Development	Route affected	Year of impact	Impact (+/-)	Toll plaza
2.	Jaipur Ring Road	Trips with one end west of Jaipur	FY23 onwards	+ve	TP1 & TP2
3.	Completion of pending sections on Agra Ring Road	Asset route: Bhilwara/Udaipur-Jaipur-***Asset***-Agra-Kanpur Alternate route: Bhilwara/Udaipur-Chittorgarh-Kota-Jhansi-Kanpur	FY25-FY26 onwards	+ve	TP1 & TP2
4.	Construction-related vehicles for upcoming infrastructure developments	Construction demand for Jewar Airport, Jewar Metro and Delhi-Mumbai Expressway considered to be served by sites in Dausa.	FY23-FY26	+ve	TP1 & TP2

Source: Steer analysis. *Completed in FY21, but impact is expected to continue in FY22 to reach equilibrium levels.

Impact assessment for network/other developments

6.15 As seen in the previous sub-section, the assessed impacts primarily fall into either the category of road network developments or development in other modes of transport. Under network developments, changes in the road network could be either brownfield (upgrade to existing road) or greenfield (development of new road). We typically assess impacts of the changes in costs and travel time on routes in these networks using binary logit models that compare generalised journey costs (GJC) between Asset and alternate routes. Under other developments, we typically use historical occurrences of the future event and benchmark observations from regional reference Assets. However, each case is dealt individually in its own network or industry context.

6.16 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated from each of these. While this section deals with impacts that have been considered in our forecasts, Appendices A (Queries) and C (Other Impacts) present Steer's responses to the Client on queries and on the list of impacts from the scope of works part of this commission.

Ease of ban on sandmining

6.17 As mentioned previously, the ban on sandmining has caused significant negative growth in 3A+MAV traffic up untill FY20. Since FY15, there have been policy changes (through the Ministry for Environment and Forests) and regulatory developments (through the National Green Tribunal) that have been affecting sandmining across the country.

6.18 In Rajasthan particularly, the government made efforts to find alternate means i.e. suitable sand reaches including those that were allotted before the changes in regulation. However, subsequent court judgements, especially the one in November 2018, have laid strict regulations on sand reaches gaining environmental clearance. Existing holders also needed to gain this clearance. The court judgement prohibited 82 large sand-mining lease holders. In November 2021 this sand mining ban which was imposed in 2017 was lifted by Supreme court.

Appendix A presents a chronological summary of developments – policy, regulatory and judicial – surrounding sandmining in India and Rajasthan in particular.

6.19 Dausa-Lalsot road are already being used by traffic since February 2020 and as of February 2021, large sections of the road are already complete and in operation. Based on the efforts by the Rajasthan government and recovery in traffic seen so far in FY20, and a new policy in January 2021 providing industry status to manufacturing of m-sand, we have observed a recovery of traffic for sand-mining. Further sandmining related traffic recovery in traffic volumes in FY22 as well, we believe the majority of the recoverable volumes related to sand mining traffic will start using the Asset by FY23 as more and more sand mines start operating. As seen from the historical OD data, the impact of sandmining traffic is higher on TP2 than TP1 therefore, the traffic recovery with the ease of sandmining is higher at Ludhawai plaza than Amoli. The table below presents the impact of recovery of sand mining traffic on the Asset.

Table 6.7: Impact of government efforts to revive sand industry

Vehicle type	FY23	FY24 onwards
TP1 Amoli		
3A	2.7%	3.4%
MAV	2.7%	3.4%
TP2 Ludhawai		
3A	2.9%	5.8%
MAV	2.9%	5.8%

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Induced traffic following better connectivity due to Jaipur Ring Road

6.20 The Jaipur Ring Road, as shown in the map below, is a new circular road being developed as a more peripheral alternative to the existing Jaipur bypass. Jaipur bypass, though access-controlled both at sections that are grade-level and elevated, is currently congested. For users with trips from one end west of Jaipur, the new ring road is expected to provide higher speeds and improved level of service, apart from clearing up capacity on the existing bypass.

6.21 As of February 2021, the construction of JRR is complete with a cloverleaf junction (Ajmer Road and Tonk Road) yet to be completed, and the ring road has been reportedly operational since November 2020 (through a makeshift connection). Therefore, we expect that a significant proportion of positive impact from Jaipur ring road completion already form a part of base traffic as observed on the Asset. There is some positive impact still expected to take place withing the next year as the travel patterns see a shift to using the ring road.

6.22 The table below summarises the positive impact, estimated using an elasticity-based approach to calculate additional demand generated by improvement in level of service.

Table 6.8: Impact of completion of Jaipur Ring Road

Vehicle type	FY23 onwards	
	TP1 Amoli	**TP2 Ludhawai**
3A	0.4%	0.4%
MAV	0.8%	0.8%

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Diversion due to completion of pending sections on Agra Ring Road

6.23 As shown in the map below, the Asset is part of the long-distance east-west corridor connecting southern Rajasthan (Udaipur, Bhilwara, Chittorgarh) and Uttar Pradesh (Kanpur, Lucknow) and east. While the Asset route passes through Jaipur (NH8), Jaipur-Mahua-Asset and Agra, the alternate route passes through NH27 via Kota and Jhansi. Currently, the NH7 and NH21 connection to NH19 is not directly possible through Agra given entry restrictions from 5 AM to 11 PM. Completion of the pending section of the Agra Ring Road is expected to improve connectivity (seamless and without time restrictions) for long-distance traffic, especially in the scenario of Jaipur Ring Road being operational.

6.24 For long-distance trips connecting Gujarat and southern Rajasthan to Uttar Pradesh and other eastward states, there is an alternative route along NH 27 that joins Udaipur to Kanpur via Chittorgarh-Kota-Jhansi. The completion of the Jaipur Ring Road, which is now operational, and Agra Ring Road improves the relative level of service on the Asset corridor and has a positive impact.

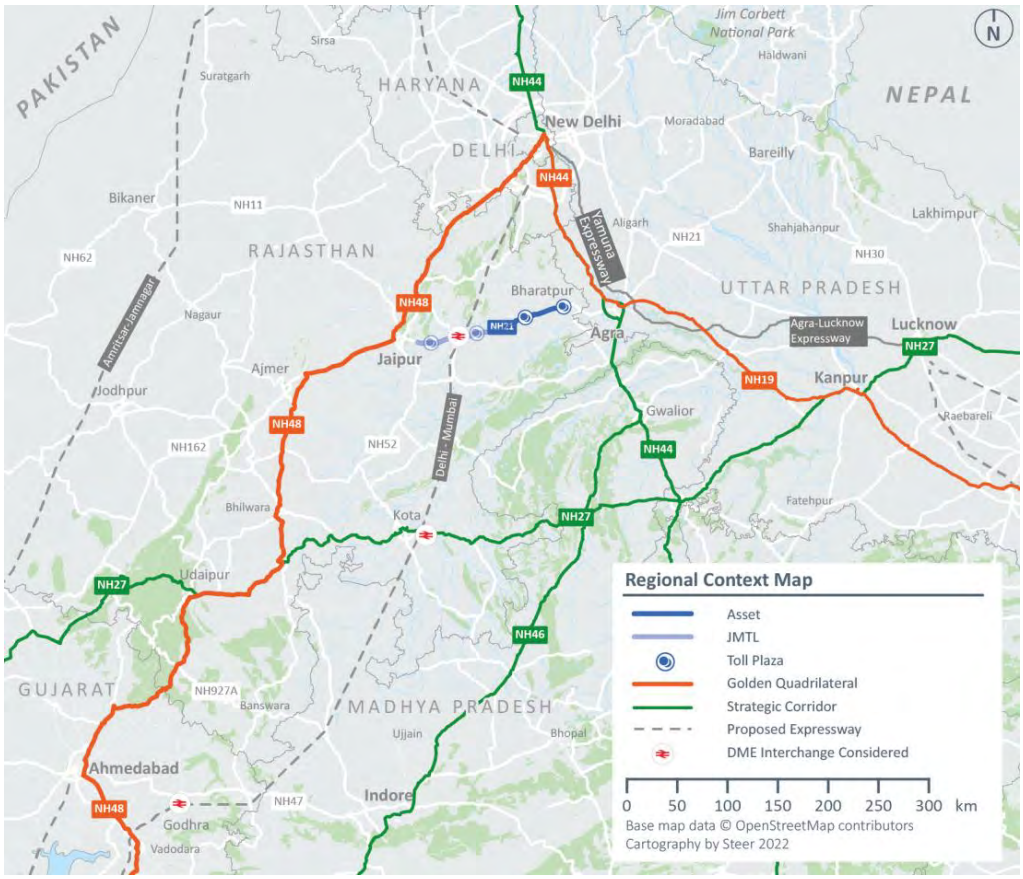
6.25 Based on our Generalised Journey Cost (GJC) based diversion analysis from the strategic route discussed above, we believe the upgrade to Agra Ring Road will result in a small positive impact on the Asset route, as summarised in the table below.

Table 6.9: Impact due to completion of missing section on Agra Ring Road

Vehicle type	FY25 onwards	
	TP1 Amoli	**TP2 Ludhawai**
LCV	(+0.5%)	(+0.4%)
2A	(+2%)	(+3%)
3A	(+3%)	(+3%)
MAV	(+5%)	(+5%)

Source: Steer analysis of OD data, Client TMS data and publicly available information

Figure 6.2: Asset location on long-distance route option between Udaipur/Chittorgarh and Kanpur



Source: Steer analysis and cartography

Construction-related vehicles

6.26 Apart from the diversion-related impacts, we have also separately identified potential for construction-related traffic for large infrastructure projects in the near term to have a traffic impact the Asset. Particularly, we have mapped regions with construction-related material being mined and produced like Dholpur, Dausa, Dadri, Saharanpur, Yamuna Nagar and Haldwani for projects like the Jewar Airport, Jewar Metro and the Delhi-Mumbai Expressway. Please note that these impacts are not included in the generic recovery of construction-related commodities due to government efforts in finding alternate sand reaches that comply with regulatory requirements.

6.27 The table below presents these impacts by each infrastructure development foreseen in the short term. Understandably, impacts in the long term are already part of our background growth forecasted and cannot be separated out.

Table 6.10: Impacts due to construction-related movement for specific upcoming infrastructure projects

Vehicle type	FY23	FY24	FY25	FY26
TP1 Amoli				
Jewar Airport				
2A	3.2%	3.2%	3.2%	3.2%
3A	2.2%	2.2%	2.2%	2.2%
MAV	0.7%	0.7%	0.7%	0.7%

Vehicle type	FY23	FY24	FY25	FY26
TP1 Amoli				
Jewar Airport				
Jewar Metro				
2A		1.8%	1.8%	1.8%
3A		0.7%	0.7%	0.7%
MAV		0.3%	0.3%	0.3%
TP2 Ludhawai				
Jewar Airport				
2A	3.3%	3.3%	3.3%	3.3%
3A	2.2%	2.2%	2.2%	2.2%
MAV	0.7%	0.7%	0.7%	0.7%
Jewar Metro				
2A		1.8%	1.8%	1.8%
3A		0.8%	0.8%	0.8%
MAV		0.3%	0.3%	0.3%

Source: Steer analysis of OD data, Client TMS data and publicly available information

Revenue forecasting assumptions

6.28 To forecast the revenues for a particular year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While “trip factors” provide the conversion factor to the former, i.e. traffic (trips) to tickets sold, “toll segmentation” provides the latter i.e. the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.29 The trip factors assumed remain consistent across each vehicle category. Due to the introduction of FASTag, the trip factor for all ticket types but Return and Monthly is assumed as 1, with Return having a trip factor of 2 and Monthly a trip factor 45. Also, the discounted passes issued at the Asset plazas are for single entry only therefore the assumed trip factor for such trips in estimation years is 1.

Toll segmentation

6.30 As discussed in Chapter 3, segmentation trends have largely been stabilising over the years, with FY22 (shown in the following tables) indicating a significant reduction in the share of exemptions and violations due to better toll plaza management and FASTag implementation and increased penetration of FASTag. This has also led to an increase in the share of Single tickets from FY20 onwards compared to FY19 levels. For 3A/MAV category we believe high level of penetration levels have been achieved and therefore no significant change in segmentation is expected. This is discussed in detail in the sections following the tables below.

6.31 The table below provides the toll segmentation assumed for the period of forecast. We believe with FASTag penetration stabilising and reaching upto 100% in MAVs and minimal impact of

COVID-19 during these months, Oct-Mar FY22 segmentation provide us with stable toll segmentation which can be used for the forecast years.

Table 6.11: Forecast toll segmentation, FY22 onwards at TP1 Amoli

Ticket Category	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	95%	97%	99%	94%	96.3%
Local commercial	0.4%	1%	0.3%	4%	2.3%
Local personal	1%	-	-	-	-
Exemptions	2.9%	2%	0.4%	2%	0.2%
Violations	0.5%	1%	0.3%	-	1.2%

Source: Steer analysis of Client TMS data

Table 6.12: Forecast toll segmentation, FY22 onwards at TP2 Ludhawai

Ticket category	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	94%	93%	99.3%	98%	99%
Local commercial	0.4%	6%	0.3%	0.6%	0.4%
Local personal	2.5%	0%	0%	0%	0%
Exemptions	2.7%	1%	0.4%	1.2%	0.1%
Violations	0.1%	0%	0%	0%	0.1%

Source: Steer analysis of Client TMS data

6.32 While the implementation of FASTag is not likely to directly impact toll revenues as there in no discount for using it, it is in the short-term (FY20/21) impacting toll segmentations. This was because as mandated by NHAI, users paying cash at toll plazas were only eligible for single tickets, and all other categories of tickets was only allowed under fast tag, therefore there has been a recent rise in single ticket proportions across the toll plazas and across categories. However, we believe that by the time the shift to FASTag is completed (described in the tables above), the toll segmentation will return to FY19 levels – which we believe represent a stable state.

6.33 We further believe that the full introduction of this ETC system will limit the number of exemptions recorded, with a subsequent shift of these vehicles to the discounted local personal/commercial categories.

6.34 There is no other toll category being charged, apart from the official list in the gazetted NHAI Revision of User fee rate w.e.f. 01.07.2021. This set of toll segmentation assumes that further changes in toll categories, unless specific discounts are offered, which is unlikely.

Overloading

6.35 Overloaded vehicles on the Asset are charged twice the toll fee they would otherwise pay for their ticket type at the toll plaza. With increased overloading shares reported in FY22, we have assumed that the FY22 averaged Oct-Feb overloading shares would continue in the forecast years. This is consistent with taking stabilised Oct-Mar traffic segmentation for estimation. The table shows the assumptions for share of overloaded vehicles that are considered to pay twice the toll fee of the respective toll segmentation category, due to overloading.

Table 6.13: Overloading assumptions for forecast years FY22 onwards under various ticket categories

Vehicle type	Single	Local Commercial	Traffic through in
TP1 Amoli			
LCV	7.0%	27.9%	NA
2A	31.4%	9.3%	NA
MAV	10.3%	83.9%	NA
TP2 Ludhawai			
LCV	4.5%	0%	NA
Bus	0.6%	0%	NA
2A	9.9%	0%	NA
MAV	10.5%	32.4%	NA

Source: Steer review of Client TMS data

Toll evolution

6.36 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is July) based on WPI-linked inflation (as of March). These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.37 We have used actual toll rates from the FY19 and FY21 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.14: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.55%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: Shared by Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Revenue reconciliation

6.38 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported daily revenue for Feb month of FY22 against the modelled daily revenue for the month. For the Asset we have reconciled reported revenue for the month of Feb 2022 MADT with the modelled revenue estimated based on forecast traffic and forecast assumptions on toll segmentation, trip factors and toll rates.

6.39 The comparison, as shown in the table below, shows that modelled revenue overall is within a variation of 1% from the reported revenue. This gives us confidence that the revenues estimated using the traffic data in our forecasts are accurately representing the revenues being reported from the Asset.

Table 6.15: Revenue reconciliation summary for Feb 2022

TP#	Daily Steer modelled revenue (INR cr)	Daily Reported revenue (INR cr)	Difference (%)
TP1 Amoli	0.17	0.17	1.2%
TP2 Ludhawai	0.09	0.09	(0.5%)

Source: Steer comparison between modelled and reported revenue for Feb 2022

Traffic and Revenue forecasts

6.40 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue for the forecast period for the Asset. The table below presents the AADT/PCU and revenue forecast numbers and CAGRs on this Asset for both TP1 Amoli and TP2 Ludhawai. Further, Appendix B presents the AADT and revenues for the forecast period.

Table 6.16: Traffic forecasts (with impacts) AADT forecast for TP1 Amoli

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	5,920	6,367	7,375	8,509	11,891
Mini LCV	611	625	654	683	757
LCV	287	294	309	323	358
Bus	1,162	1,206	1,300	1,398	1,657
2A	374	400	449	461	546
3A	553	607	690	730	888
MAV	3,124	3,439	4,067	4,498	5,831
OSV	8	8	9	10	14
AADT	**12,040**	**12,946**	**14,854**	**16,613**	**21,942**
PCU's	**25,732**	**27,833**	**32,082**	**35,437**	**45,788**

Source: Steer analysis

Table 6.17: Traffic forecasts (with impacts) CAGR (%) for TP1 Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	7.5%	7.6%	7.4%	7.2%

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
Mini LCV	2.3%	2.3%	2.2%	2.2%
LCV	2.3%	2.6%	2.2%	2.2%
Bus	3.8%	3.8%	3.7%	3.6%
2A	7.1%	5.9%	1.3%	3.9%
3A	9.7%	6.7%	2.8%	4.8%
MAV	10.1%	8.7%	5.2%	6.4%
OSV	5.7%	5.8%	5.6%	5.5%
AADT	**7.5%**	**7.1%**	**5.8%**	**6.2%**
PCU's	**8.2%**	**7.4%**	**5.1%**	**5.9%**

Source: Steer analysis

Table 6.18: Revenue forecasts (INR crores) for TP1 Amoli

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9.0	10.8	15.1	18.9	33.2
Mini LCV	0.9	1.1	1.3	1.5	2.1
LCV	0.9	1.0	1.2	1.4	2.0
Bus	6.9	8.0	9.8	11.8	17.3
2A	2.8	3.4	4.3	4.9	7.2
3A	5.1	6.4	8.3	9.7	14.7
MAV	32.1	40.1	54.1	66.7	107.6
OSV	0.1	0.1	0.1	0.1	0.2
Total	**57.8**	**70.9**	**94.2**	**115.1**	**184.4**

Source: Steer analysis

Table 6.19: Revenue forecasts CAGR (%) for TP1 Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	19.8%	18.2%	11.9%	13.9%
Mini LCV	14.0%	12.3%	6.5%	8.6%
LCV	18.5%	9.3%	7.0%	8.6%
Bus	17.4%	10.3%	9.8%	9.7%
2A	21.1%	12.6%	7.2%	10.0%
3A	24.5%	13.9%	8.6%	11.2%
MAV	24.9%	16.1%	11.1%	12.8%
OSV	19.9%	12.9%	11.6%	11.9%
Total	**22.7%**	**15.3%**	**10.6%**	**12.3%**

Source: Steer analysis

Table 6.20: Traffic forecasts (with impacts) AADT forecast for TP2 Ludhawai

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	7,042	7,574	8,773	10,122	14,145
Mini LCV	806	824	862	901	998
LCV	327	335	352	367	407
Bus	1,196	1,242	1,338	1,439	1,706
2A	368	394	443	453	538
3A	546	601	698	738	898
MAV	3,091	3,409	4,110	4,546	5,894
OSV	6	6	7	8	10
AADT	**13,383**	**14,384**	**16,583**	**18,576**	**24,597**
PCU's	**27,029**	**29,239**	**34,032**	**37,643**	**48,744**

Source: Steer analysis

Table 6.21: Traffic forecasts (with impacts) CAGR(%) for TP2 Ludhawai

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	7.54%	7.63%	7.4%	7.22%
Mini LCV	2.26%	2.29%	2.2%	2.17%
LCV	2.26%	2.51%	2.2%	2.21%
Bus	3.77%	3.81%	3.7%	3.61%
2A	7.17%	6.00%	1.2%	3.87%
3A	9.98%	7.80%	2.8%	5.10%
MAV	10.29%	9.81%	5.2%	6.67%
OSV	5.65%	5.76%	5.6%	5.51%
AADT	**7.48%**	**7.37%**	**5.8%**	**6.28%**
PCU's	**8.17%**	**7.89%**	**5.2%**	**6.07%**

Source: Steer analysis

Table 6.22: Revenue forecasts (INR crores) forecast for TP2 Ludhawai

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	4.9	6.2	7.6	10.5	19.0
Mini LCV	0.6	0.7	0.7	0.9	1.3
LCV	0.5	0.5	0.6	0.7	1.0
Bus	3.4	4.0	4.8	5.7	8.7
2A	1.1	1.4	1.7	1.9	3.0
3A	2.5	3.1	4.1	4.8	7.3
MAV	15.8	19.4	26.9	32.7	52.9
OSV	0.0	0.0	0.0	0.1	0.1
Total	**28.9**	**35.3**	**46.5**	**57.3**	**93.2**

Source: Steer analysis

Table 6.23: Revenue forecasts CAGR (%) for TP2 Ludhawai

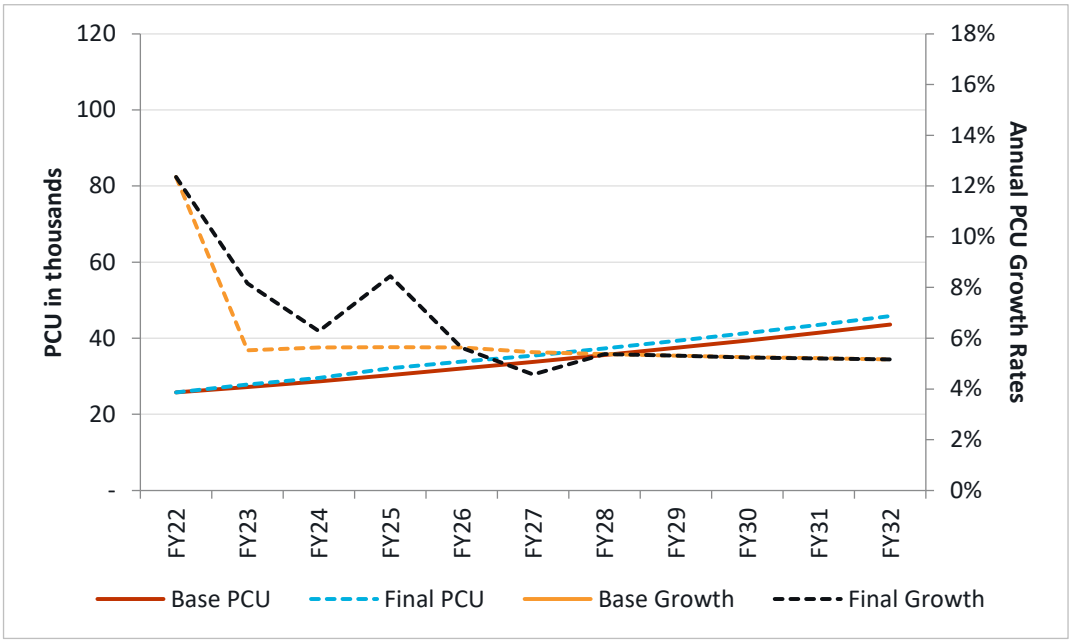
Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY22-FY32
CJV	27.7%	10.4%	17.7%	14.6%
Mini LCV	21.4%	4.9%	12.0%	9.2%
LCV	15.3%	8.3%	7.3%	8.3%
Bus	15.3%	10.3%	8.8%	9.7%
2A	19.1%	12.6%	6.2%	10.0%
3A	21.8%	15.6%	7.9%	11.1%
MAV	22.2%	17.8%	10.3%	12.8%
OSV	17.0%	13.4%	10.8%	11.6%
Total	**22.0%**	**14.9%**	**11.0%**	**12.4%**

Source: Steer analysis

6.41 As presented in the table above, CAGRs (FY22-FY32) in terms of PCUs for the traffic forecasts (with impacts) growth rates are above 5% at TP1 and 6% at TP2 of the Asset. The major uplift in final growth rates (as also seen in the chart below) is driven by:

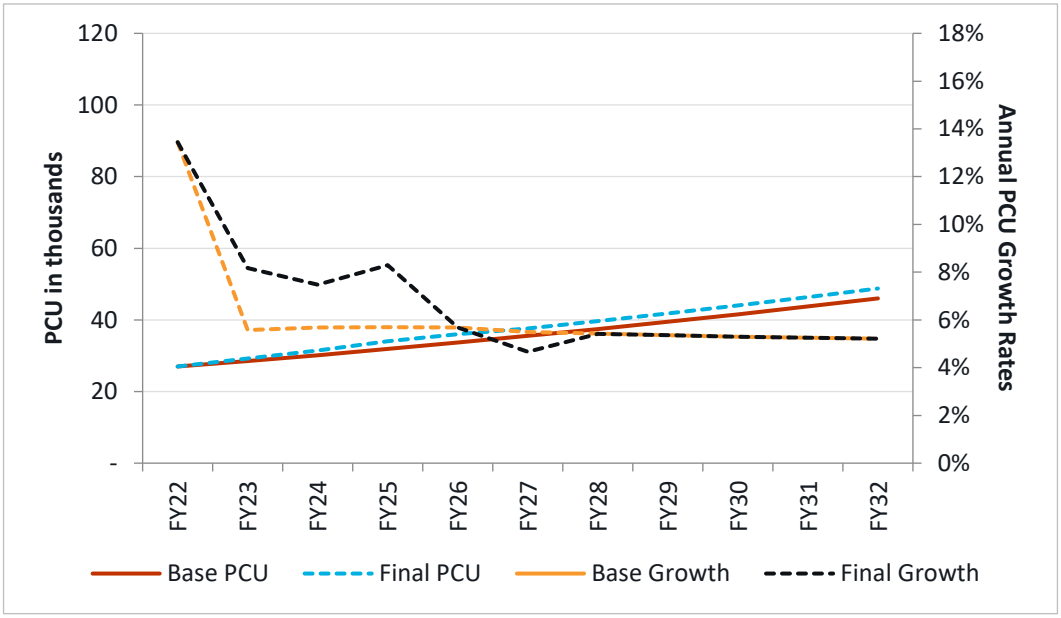
- Four impacts during FY23 onwards – recovery from ban on sandmining and FY20 impact; and completion of construction of Jaipur Ring Road.
- One impact setting in FY25 - the completion of the pending section on Agra Ring road.

Figure 6.3: Traffic and growth rates for forecast PCUs – Base and With Impacts, TP1 Amoli



Source: Steer analysis

Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP2 Ludhawai



Source: Steer analysis

Upside and Downside Cases

6.42 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.43 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.44 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.24: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
MBEL	GDP/GSDP	+1% every year	-1% every year
MBEL	WPI	+1% every year	-1% every year
MBEL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.45 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside

(optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.46 The upside case impacts included in forecasts are summarised in below:

Table 6.25: Summary of impacts on the Assets

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Amoli	TP2 Ludhawai
Easing of ban on sandmining:	FY23 onwards	Medium/Medium	3A+MAV: (+6.8%) And (+8.4%) FY24 onwards	3A+MAV: (+7.2%) And (+14.4%) FY24 onwards
Completion of Jaipur Ring Road: The ring road is expected to release capacity on existing bypass and improve level of service for trips with one end west/southwest of Jaipur.	FY23 onwards	High/Low	3A: (+0.4%) MAV: (+0.8%)	3A: (+0.4%) MAV: (+0.8%)
Construction of Jewar Airport	FY23 to FY26	Medium	2A: (+4.0%) 3A: +(2.7%) MAV: +(0.9%)	2A: (+4.0%) 3A: +(2.7%) MAV: +(0.9%)
Construction of Jewar Metro	FY24 to FY26	Medium	2A: (+2.2%) 3A: +(0.9%) MAV: +(0.4%)	2A: (+2.2%) 3A: +(0.9%) MAV: +(0.4%)
Positive diversion due to completion of Agra Ring Road: Completion of pending sections would improve connectivity – both seamless and without time restrictions	FY25 onwards	Medium/Medium	LCV: (+0.6%) 2A: (+3.1%) 3A: (+4.2%) MAV: (+6.2%)	LCV: (+0.5%) 2A: (+3.2%) 3A: (+4.4%) MAV: (+6.2%)

Source: Steer analysis of OD data, and publicly available information

6.47 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.48 The downside case impacts included in forecasts are summarised in below:

Table 6.26: Summary of impacts on the Assets

Impact	Year of impact	Probability/ scale of impact	Magnitude of impact	
			TP1 Amoli	TP2 Ludhawai
Easing of ban on sandmining:	FY23 onwards	Medium/Medium	3A+MAV: (+4.0%) & (+5.0%) FY24 onwards	3A+MAV: (+4.4%) And (+8.6%) FY24 onwards
Completion of Jaipur Ring Road: The ring road is expected to release capacity on existing bypass and improve level of service for trips with one end west/southwest of Jaipur.	FY23 onwards	High/Low	3A: (+0.4%) MAV: (+0.8%)	3A: (+0.3%) MAV: (+0.6%)
Construction of Jewar Airport	FY23 to FY26	Medium	2A: (+2.4%) 3A: +(1.6%) MAV: +(0.5%)	2A: (+2.4%) 3A: +(1.6%) MAV: +(0.5%)
Construction of Jewar Metro	FY24 to FY26	Medium	2A: (+1.3%) 3A: +(0.6%) MAV: +(0.2%)	2A: (+1.3%) 3A: +(0.6%) MAV: +(0.2%)
Positive diversion due to completion of Agra Ring Road: Completion of pending sections would improve connectivity – both seamless and without time restrictions	FY25 onwards	Medium/Medium	LCV: (+0.4%) 2A: (+2%) 3A: (+3%) MAV: (+4%)	LCV: (+0.2%) 2A: (+2%) 3A: (+3%) MAV: (+3%)

Source: Steer analysis of OD data, and publicly available information

6.49 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.50 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.51 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.27: Traffic forecast (With Upside Impacts) for TP1: Amoli

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	5,920	6,476	7,764	9,268	14,073
Mini LCV	611	628	665	702	799

Vehicle Type	FY22	FY23	FY25	FY27	FY32
Bus	287	295	315	332	378
LCV	1,162	1,217	1,335	1,462	1,809
2A	374	407	469	485	600
3A	553	620	728	781	1,000
MAV	3,124	3,515	4,327	4,907	6,800
OSV	8	8	10	11	15
AADT	**12,040**	**13,168**	**15,613**	**17,947**	**25,474**
PCU's	**25,732**	**28,343**	**33,809**	**38,279**	**52,866**

Source: Steer analysis

Table 6.28: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	9.4%	9.5%	9.3%	8.7%	9.04%
Mini LCV	2.8%	2.8%	2.8%	2.6%	2.71%
Bus	2.8%	3.2%	2.8%	2.6%	2.78%
LCV	4.7%	4.7%	4.6%	4.4%	4.52%
2A	8.9%	7.4%	1.6%	4.4%	4.84%
3A	12.1%	8.3%	3.6%	5.1%	6.10%
MAV	12.5%	11.0%	6.5%	6.7%	8.09%
OSV	7.1%	7.2%	7.1%	6.7%	6.94%
AADT	**9.4%**	**8.9%**	**7.2%**	**7.3%**	**7.78%**
PCU's	**10.1%**	**9.2%**	**6.4%**	**6.7%**	**7.47%**

Source: Steer analysis

Table 6.29: Revenue forecast (With Upside Impacts) for TP1: Amoli (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9.0	11.0	15.9	22.2	44
Mini LCV	0.9	1.1	1.4	1.7	2
Bus	0.9	1.0	1.2	1.5	2
LCV	6.9	8.1	10.2	12.8	21
2A	2.8	3.4	4.6	5.4	9
3A	5.1	6.5	8.9	10.8	18
MAV	32.1	41.0	58.8	75.4	136
OSV	0.1	0.1	0.1	0.2	0
Total Revenue	**57.8**	**72.3**	**101.2**	**130.0**	**232**

Source: Steer analysis

Table 6.30: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	21.9%	20.2%	18.2%	14.5%	17.07%
Mini LCV	14.6%	12.9%	11.2%	8.1%	10.27%
Bus	19.1%	10.0%	10.0%	8.6%	10.19%
LCV	18.4%	12.3%	11.8%	10.1%	11.71%
2A	23.2%	15.2%	8.6%	10.1%	12.05%
3A	27.2%	17.0%	10.1%	10.7%	13.38%
MAV	27.7%	19.8%	13.2%	12.5%	15.51%
OSV	21.5%	15.7%	13.9%	12.5%	14.29%
Total	**25.1%**	**18.3%**	**13.3%**	**12.3%**	**14.91%**

Source: Steer analysis

Table 6.31: Traffic forecast (With Upside Impacts) for TP2: Ludhawai

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	7,042	7,704	9,236	11,025	16,741
Mini LCV	806	828	876	926	1,053
Bus	327	337	358	378	430
LCV	1,196	1,253	1,374	1,505	1,862
2A	368	400	462	477	590
3A	546	614	740	794	1,016
MAV	3,091	3,485	4,394	4,984	6,906
OSV	6	7	8	9	12
AADT	**13,383**	**14,628**	**17,447**	**20,096**	**28,611**
PCU's	**27,029**	**29,774**	**35,942**	**40,768**	**56,457**

Source: Steer analysis

Table 6.32: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Ludhawai

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	9.4%	9.5%	9.3%	8.7%	9.04%
Mini LCV	2.8%	2.8%	2.8%	2.6%	2.71%
Bus	2.8%	3.1%	2.8%	2.6%	2.77%
LCV	4.7%	4.7%	4.6%	4.4%	4.52%
2A	8.9%	7.4%	1.6%	4.4%	4.85%
3A	12.4%	9.7%	3.6%	5.1%	6.40%
MAV	12.8%	12.3%	6.5%	6.7%	8.37%
OSV	7.1%	7.2%	7.1%	6.7%	6.94%
AADT	9.3%	9.2%	7.3%	7.3%	7.89%
PCU's	**10.2%**	**9.9%**	**6.5%**	**6.7%**	**7.64%**

Source: Steer analysis

Table 6.33: Revenue forecast (With Upside Impacts) for TP2: Ludhawai (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	4.9	6.3	9.2	11.4	23
Mini LCV	0.6	0.7	0.9	1.0	1
Bus	0.5	0.5	0.6	0.8	1
LCV	3.4	4.0	5.1	6.2	10
2A	1.1	1.4	1.9	2.1	3
3A	2.5	3.2	4.4	5.4	9
MAV	15.8	19.8	28.7	37.6	68
OSV	0.0	0.0	0.0	0.1	0
Total Revenue	**28.9**	**35.9**	**50.8**	**64.6**	**116.1**

Source: Steer analysis

Table 6.34: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Ludhawai

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	29.9%	20.5%	11.6%	15.2%	16.90%
Mini LCV	22.1%	13.2%	5.0%	8.8%	10.12%
Bus	15.9%	8.9%	9.1%	8.9%	9.62%
LCV	16.3%	13.4%	10.2%	10.2%	11.42%
2A	21.0%	16.3%	7.0%	10.2%	11.77%
3A	24.5%	17.7%	11.3%	10.7%	13.50%
MAV	24.9%	20.4%	14.4%	12.4%	15.60%
OSV	18.6%	15.0%	15.0%	12.4%	14.07%
Total Revenue	**24.3%**	**19.0%**	**12.7%**	**12.4%**	**14.93%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.52 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.53 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.35: Traffic forecast (With Downside Impacts) for TP1: Amoli

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	5,920	6,269	7,039	7,875	10,209
Mini LCV	611	622	644	667	722
Bus	287	292	304	315	341
LCV	1,162	1,197	1,269	1,343	1,532

Vehicle Type	FY22	FY23	FY25	FY27	FY32
2A	374	394	431	440	502
3A	553	594	657	686	797
MAV	3,124	3,370	3,837	4,149	5,067
OSV	8	8	9	10	12
AADT	**12,040**	**12,746**	**14,190**	**15,485**	**19,182**
PCU's	**25,732**	**27,367**	**30,559**	**33,021**	**40,208**

Source: Steer analysis

Table 6.36: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	5.9%	6.0%	5.8%	5.3%	5.60%
Mini LCV	1.8%	1.8%	1.7%	1.8%	1.68%
Bus	1.8%	2.0%	1.7%	1.9%	1.72%
LCV	2.9%	3.0%	2.9%	2.9%	2.80%
2A	5.4%	4.6%	1.0%	2.8%	2.99%
3A	7.4%	5.1%	2.2%	3.7%	3.72%
MAV	7.9%	6.7%	4.0%	5.3%	4.95%
OSV	4.4%	4.5%	4.4%	4.4%	4.24%
AADT	**5.9%**	**5.5%**	**4.5%**	**5.0%**	**4.77%**
PCU's	**6.4%**	**5.7%**	**4.0%**	**4.8%**	**4.56%**

Source: Steer analysis

Table 6.37: Revenue forecast (With Downside Impacts) for TP1: Amoli (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	9.0	10.7	13.5	17.5	26
Mini LCV	0.9	1.1	1.2	1.5	2
Bus	0.9	1.0	1.2	1.3	2
LCV	6.9	8.0	9.4	10.9	15
2A	2.8	3.3	4.0	4.5	6
3A	5.1	6.2	7.7	8.8	12
MAV	32.1	39.3	50.3	59.3	86
OSV	0.1	0.1	0.1	0.1	0
Total Revenue	**57.8**	**69.7**	**87.4**	**103.9**	**149**

Source: Steer analysis

Table 6.38: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Amoli

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	18.0%	12.5%	13.9%	8.5%	11.29%

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
Mini LCV	13.4%	8.1%	9.5%	8.8%	7.16%
Bus	17.9%	6.8%	6.1%	6.4%	6.98%
LCV	16.4%	8.4%	7.5%	8.0%	7.93%
2A	19.2%	10.1%	5.6%	7.8%	8.13%
3A	21.9%	11.4%	6.7%	9.0%	9.05%
MAV	22.4%	13.1%	8.6%	10.8%	10.34%
OSV	18.4%	10.7%	9.0%	9.8%	9.59%
Total Revenue	**20.6%**	**12.0%**	**9.0%**	**10.5%**	**9.93%**

Source: Steer analysis

Table 6.39: Traffic forecast (With Downside Impacts) for TP2: Ludhawai

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	7,042	7,457	8,373	9,368	12,145
Mini LCV	806	820	850	879	952
Bus	327	333	346	358	388
LCV	1,196	1,232	1,306	1,383	1,577
2A	368	387	424	433	494
3A	546	588	660	690	802
MAV	3,091	3,338	3,858	4,173	5,096
OSV	6	6	7	8	9
AADT	**13,383**	**14,162**	**15,824**	**17,291**	**21,462**
PCU's	**27,029**	**28,746**	**32,339**	**34,985**	**42,670**

Source: Steer analysis

Table 6.40: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Ludhawai

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	5.9%	6.0%	5.8%	5.3%	5.60%
Mini LCV	1.8%	1.8%	1.7%	1.6%	1.68%
Bus	1.8%	2.0%	1.7%	1.6%	1.71%
LCV	2.9%	3.0%	2.9%	2.7%	2.80%
2A	5.4%	4.6%	1.0%	2.7%	3.00%
3A	7.6%	6.0%	2.2%	3.1%	3.91%
MAV	8.0%	7.5%	4.0%	4.1%	5.13%
OSV	4.4%	4.5%	4.4%	4.1%	4.24%
AADT	5.8%	5.7%	4.5%	4.4%	4.84%
PCU's	**6.4%**	**6.1%**	**4.0%**	**4.1%**	**4.67%**

Source: Steer analysis

Table 6.41: Revenue forecast (With Downside Impacts) for TP2: Ludhawai (In Cr)

Vehicle Type	FY22	FY23	FY25	FY27	FY32
CJV	4.9	6.1	7.2	9.7	15
Mini LCV	0.6	0.7	0.7	0.9	1
Bus	0.5	0.5	0.6	0.7	1
LCV	3.4	3.9	4.7	5.5	7
2A	1.1	1.3	1.7	1.9	3
3A	2.5	3.0	3.8	4.4	6
MAV	15.8	19.0	24.6	29.2	42
OSV	0.0	0.0	0.0	0.0	0
Total Revenue	**28.9**	**34.6**	**43.4**	**52.2**	**75**

Source: Steer analysis

Table 6.42: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Ludhawai

Vehicle Type	FY22-FY23	FY23-FY25	FY25-FY27	FY27-FY32	FY22-FY32
CJV	25.7%	8.7%	15.9%	8.7%	11.71%
Mini LCV	20.8%	4.4%	11.5%	4.8%	7.56%
Bus	14.7%	7.7%	6.8%	5.2%	6.93%
LCV	14.4%	9.4%	8.0%	6.2%	8.01%
2A	17.1%	11.1%	6.0%	6.2%	8.22%
3A	19.2%	12.3%	6.9%	6.5%	8.93%
MAV	19.7%	14.0%	8.8%	7.5%	10.20%
OSV	15.6%	10.7%	9.2%	7.5%	9.27%
Total Revenue	**19.8%**	**12.0%**	**9.7%**	**10.8%**	**9.96%**

Source: Steer analysis

Summary outlook

6.54 Overall, passenger traffic on the Asset is driven by local movements connecting key urban centres of Jaipur, Agra, Alwar and Bharatpur. Tourism and leisure travel between Jaipur at one end and Bharatpur and Agra at the other also contribute to passenger and bus movements. The Asset is also part of the Golden Triangle corridor consisting of Delhi NCR, Agra and Jaipur which is a key tourism corridor in India. Even though the current ongoing pandemic has impacted the passenger traffic and in particular tourism related traffic, the trend of increased use of personal vehicles has seen good recovery of car traffic in recent months. The commissioning of Dausa- Lalsot section with opening of tourist centres within the Asset state has resulted in a significant increase in traffic volumes in FY22. The subdued level of bus movements has recovered post pandemic.

6.55 Goods traffic are driven by agriculture commodities, construction-related traffic including stone and sand, apart from a good spread of consumption-related commodities meeting urban demand. With the lifting of sandmining ban the Asset hasn't seen healthy recovery in MAVs as compared to pre-COVID-19 traffic levels. The recovery in recent months has shown

underlying strength in the traffic growth drivers along the Asset corridor which is expected to continue driving growth on this corridor.

6.56 With the completion of the Dausa-Lalsot road and Jaipur Ring Road in the immediate forecast period and the Agra Ring Road later, both medium-distance and long-distance traffic are expected to experience positive impacts.

6.57 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be both positive and negative risks associated with assumptions and the forecasts using them as summarised below.

6.58 With regards to the short-term background growth, we see the following risks:

- The nascent recovery from the pandemic could be subdued due stronger lockdowns being implemented and traffic growth not sustaining the coming months. However, as it was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. A similar trend has been repeated in FY22 with first quarter witnessing subdued trend and the following three quarter witnessing healthy recovery.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure have seen a passive growth in FY22 which expected strong recovery in FY23 onwards.

6.59 With regards to impacts, we see the following risks:

- Gain of long distance traffic from NH27 road and the sand movement would depend on the successful completion of Agra Ring Road.

6.60 Overall we see a positive outlook for the region and the Asset, given that it serves major urban centres of Jaipur, Agra, Bharatpur, Alwar and Delhi NCR. It is also the primary route on the tourism corridor connecting Jaipur with Bharatpur and Agra. The underlying growth drivers of the corridor are strong and are expected to deliver long term sustained growth.

Appendices

A Developments in sand-mining

A.1 This appendix provides a chronological account of developments – policy, regulatory and judicial – in sand-mining applicable across India and particularly in Rajasthan. Please note that this list is not exhaustive and is meant to gain a high-level understanding of the issues surrounding sand-mining that affect movement of sand on the Asset.

Table A.1: History of policy and regulatory changes, and court judgements affecting sand-mining

Event	Timeline
National	
Recommendations of MoEF core group	2010
SC ruling - Orders MoEF to formulate guidelines for sustainable sand-mining	Feb FY12
MoEFCC Sustainable Sand Mining Management Guidelines - Calls for site-specific surveys by district administration - Environmental clearance mandatory for all sand mines - DEAC and DEIAA committees for less than 5 hectare mines Stop of mining during monsoon months (June-September)	Mar FY16
Amendment of EIA Notification 2006 - EI clearance mandatory for all small-scale sand mines Treat cluster mines within 500 m as single mine	May FY17
SC ban on sand-mining; prohibits 82 large sand-mining lease holders	Nov FY18
SC refuses to remove ban	Jan, Aug FY19
Rajasthan	
Mining policy	2015
NGT: Even existing licence holders need to get environmental clearance	Jan FY15
Not clear if manufactured sand can meet demand and quality needs	FY19
"Mining ban give rise to sand mafia"	Oct FY19
SC stays Rajasthan HC order that allowed sand-mining at mines with issued LoIs	May FY20
Manufactured sand policy being considered and licences for small plots being allowed	Sept FY19, Jul FY20
Replenishment study of sand mines to be taken up	Aug FY20
Rajasthan HC asks PS (RJ) to issue compounding fee on vehicle – apply consistent approach	Sept FY20
Rajasthan M-sand policy announced	25th Jan 2021

Source: Steer research

B Top 10 OD Pairs

B.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at TP1 Amoli. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Amoli

Table B.1: CJV top 10 OD pair shares at TP1 Amoli

	OD Pair	Share
1.	Agra-Jaipur	21.1%
2.	Bharatpur-Jaipur	16.7%
3.	Rest of Mathura-Jaipur	6.1%
4.	Rest of Dausa-Agra	5.3%
5.	Rest of Dausa-Bharatpur	5.1%
6.	Rest of Mathura-Rest of Dausa	3.0%
7.	Bharatpur-Dausa	2.5%
8.	Bharatpur-Mahwa	2.1%
9.	NCT of Delhi, Central-Rest of Dausa	1.7%
10.	Dhaulpur-Jaipur	1.3%

Source: Steer analysis

Table B.2: MAV top 10 OD pair shares at TP1 Amoli

	OD Pair	Share
1.	Agra-Jaipur	5.4%
2.	Bharatpur-Jaipur	5.3%
3.	Rest of Gujarat-Agra	3.3%
4.	Rest of Gujarat-West Bengal	3.0%
5.	Rest of Mathura-Jaipur	3.0%
6.	West Bengal-Jaipur	2.6%
7.	Rest of Gujarat-Lucknow	2.5%
8.	Jharkhand-Jaipur	2.0%
9.	Bihar-Rest of Gujarat	1.9%
10.	Rest of Gujarat-Nepal	1.8%

C Detailed forecasts

C.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

C.2 This section presents the detailed traffic forecasts for the forecast period until FY34, until two years after the expected close of the concession period in FY32. The following tables show the traffic growth rates and AADT, respectively.

Table C.1: Traffic forecasts (base + impacts) traffic- TP1 Amoli

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY20	4095	355	863	964	265	607	2901	0	10048	22824
FY21	4488	463	451	838	270	545	3078	8	10141	22903
FY22	5920	611	287	1162	374	553	3124	8	12040	25732
FY23	6367	625	294	1206	400	607	3439	8	12946	27833
FY24	6853	639	301	1252	423	642	3672	9	13790	29583
FY25	7375	654	309	1300	449	690	4067	9	14854	32082
FY26	7933	669	316	1349	466	720	4301	10	15764	33888
FY27	8509	683	323	1398	461	730	4498	10	16613	35437
FY28	9117	698	330	1448	477	760	4743	11	17584	37341
FY29	9757	713	337	1499	494	791	4999	12	18600	39323
FY30	10430	727	344	1551	511	822	5264	12	19662	41385
FY31	11141	742	351	1603	528	855	5542	13	20776	43540
FY32	11891	757	358	1657	546	888	5831	14	21942	45788

Source: Steer analysis

Table C.2: Traffic forecasts (base + impacts) traffic- TP2 Ludhawai

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY20	4,730	472	1,045	1,007	235	593	2,908	-	10,991	23,879
FY21	5,223	598	463	871	268	542	3,067	6	11,038	23,825
FY22	7,042	806	327	1,196	368	546	3,091	6	13,383	27,029
FY23	7,574	824	335	1,242	394	601	3,409	6	14,384	29,239

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY24	8,152	843	342	1,289	416	649	3,715	7	15,413	31,425
FY25	8,773	862	352	1,338	443	698	4,110	7	16,583	34,032
FY26	9,436	882	360	1,389	459	728	4,346	8	17,608	35,963
FY27	10,122	901	367	1,439	453	738	4,546	8	18,576	37,643
FY28	10,845	920	375	1,491	470	769	4,794	9	19,673	39,683
FY29	11,607	940	383	1,543	486	800	5,053	9	20,820	41,808
FY30	12,408	959	391	1,596	503	832	5,321	9	22,019	44,019
FY31	13,253	979	399	1,650	520	865	5,602	10	23,277	46,331
FY32	14,145	998	407	1,706	538	898	5,894	10	24,597	48,744

Source: Steer analysis

Revenue forecasts

C.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY35.

Table C.3: Revenue forecasts (INR crores) at TP1 Amoli

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY20	5.6	0.0	2.0	4.2	1.6	0.0	29.9	0.0	43.3
FY21	5.3	0.0	1.0	4.1	1.0	0.0	27.9	0.0	39.3
FY22	9.0	0.9	0.9	6.9	2.8	5.1	32.1	0.1	57.8
FY23	10.8	1.1	1.0	8.0	3.4	6.4	40.1	0.1	70.9
FY24	12.9	1.2	1.1	9.0	3.9	7.3	46.6	0.1	82.1
FY25	15.1	1.3	1.2	9.8	4.3	8.3	54.1	0.1	94.2
FY26	16.6	1.4	1.3	10.8	4.7	9.1	60.4	0.1	104.5
FY27	18.9	1.5	1.4	11.8	4.9	9.7	66.7	0.1	115.1
FY28	21.9	1.7	1.5	12.8	5.3	10.7	74.3	0.2	128.4
FY29	23.8	1.7	1.6	13.9	5.8	11.6	81.3	0.2	140.0
FY30	26.8	1.9	1.7	15.1	6.3	12.6	89.5	0.2	154.1
FY31	30.6	2.0	1.8	16.2	6.7	13.6	97.8	0.2	169.0
FY32	33.2	2.1	2.0	17.3	7.2	14.7	107.6	0.2	184.4

Source: Steer analysis

Table C.4: Revenue forecast (INR crores) at TP2 Ludhawai

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total

FY20	4.8	-	1.7	3.0	1.3	-	18.0	-	28.8
FY21	3.6	-	0.6	2.1	0.7	-	14.5	-	21.6
FY22	4.9	0.6	0.5	3.4	1.1	2.5	15.8	0.0	28.9
FY23	6.2	0.7	0.5	4.0	1.4	3.1	19.4	0.0	35.2
FY24	7.1	0.7	0.6	4.4	1.5	3.6	22.8	0.0	40.8
FY25	7.6	0.7	0.6	4.8	1.7	4.1	26.9	0.0	46.5
FY26	9.4	0.9	0.7	5.3	1.9	4.6	30.1	0.0	52.8
FY27	10.5	0.9	0.7	5.7	1.9	4.8	32.7	0.1	57.3
FY28	11.3	1.0	0.8	6.4	2.2	5.3	36.2	0.1	63.2
FY29	13.5	1.1	0.8	7.0	2.4	5.7	40.1	0.1	70.8
FY30	15.0	1.2	0.9	7.5	2.6	6.3	44.4	0.1	77.9
FY31	16.0	1.2	0.9	8.1	2.7	6.7	48.1	0.1	83.9
FY32	19.0	1.3	1.0	8.7	3.0	7.3	52.9	0.1	93.2

Source: Steer analysis

Table C.5: Averaged forecast revenue (INR crores)- Asset level

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY20	5.2	0.0	1.9	3.6	1.4	0.0	23.9	0.0	36.0
FY21	4.5	0.0	0.8	3.1	0.9	0.0	21.2	0.0	30.4
FY22	6.9	0.7	0.7	5.1	2.0	3.8	24.0	0.1	43.3
FY23	8.5	0.9	0.8	6.0	2.4	4.7	29.8	0.1	53.1
FY24	10.0	1.0	0.8	6.7	2.7	5.5	34.7	0.1	61.4
FY25	11.3	1.0	0.9	7.3	3.0	6.2	40.5	0.1	70.4
FY26	13.0	1.1	1.0	8.0	3.3	6.8	45.2	0.1	78.6
FY27	14.7	1.2	1.1	8.8	3.4	7.3	49.7	0.1	86.2
FY28	16.6	1.3	1.1	9.6	3.8	8.0	55.3	0.1	95.8
FY29	18.7	1.4	1.2	10.5	4.1	8.7	60.7	0.1	105.4
FY30	20.9	1.5	1.3	11.3	4.4	9.4	67.0	0.1	116.0
FY31	23.3	1.6	1.4	12.1	4.7	10.1	73.0	0.1	126.4
FY32	26.1	1.7	1.5	13.0	5.1	11.0	80.2	0.2	138.8

Source: Steer analysis

D Data collection exercise

D.1 In order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7-day TVC counts

Table D.1: 7-day TVC counts at TP1 Amoli

Date	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
27-01-2021	5,638	482	681	779	224	589	3,206	3	11,602
28-01-2021	4,849	547	837	776	197	522	3,234	12	10,974
29-01-2021	5,190	548	875	785	272	641	3,341	7	11,659
30-01-2021	6,055	561	973	796	265	656	3,495	16	12,817
31-01-2021	5,781	570	815	780	312	624	3,643	2	12,527
01-02-2021	5,507	718	783	755	219	586	3,425	11	12,004
02-02-2021	5,825	584	808	762	258	572	3,322	9	12,140

Source: Steer analysis

Table D.2: 7-day TVC counts at TP2 Ludhawai

Date	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
27-01-2021	6,747	688	675	836	247	569	3,248	5	13,015
28-01-2021	5,864	706	766	829	231	518	3,133	8	12,055
29-01-2021	6,292	742	820	855	281	647	3,429	7	13,073
30-01-2021	7,155	706	890	852	279	642	3,475	12	14,011
31-01-2021	6,900	678	811	824	323	636	3,661	6	13,839
01-02-2021	6,662	1,071	770	804	224	605	3,436	6	13,578
02-02-2021	6,891	730	832	852	213	583	3,370	3	13,474

Source: Steer analysis

Table D.3: Consolidated WADT for both TP1 Amoli and TP2 Ludhawai

Toll plaza	Source	CJV+ Mini LCV	LCV	Bus	2A	3A + MAV	OSV	Total
TP1	TVC	6,122	825	776	250	3,979	9	11,960
	TMS	5,558	424	1,172	221	4,066	-	11,441
TP2	TVC	7,405	795	836	257	3,993	7	13,292
	TMS	6,949	422	1,227	201	4,070	-	12,869

Source: Steer analysis

Zone list

Table D.4: Zone list used for OD analysis

Zone Code	Zone Name	State
1	Andaman & Nicobar Island	Andaman & Nicobar Island
2	Andhra Pradesh	Andhra Pradesh
3	Arunanchal Pradesh	Arunanchal Pradesh
4	Assam	Assam
5	Bihar	Bihar
6	Chandigarh	Chandigarh
7	Chhattisgarh	Chhattisgarh
8	Dadara & Nagar Havelli	Dadara & Nagar Havelli
9	Daman & Diu	Daman & Diu
10	Goa	Goa
11	Rest of Gujarat	Rest of Gujarat
12	Rest of Haryana	Rest of Haryana
13	Himachal Pradesh	Himachal Pradesh
14	Jammu & Kashmir	Jammu & Kashmir
15	Jharkhand	Jharkhand
16	Karnataka	Karnataka
17	Kerala	Kerala
18	Lakshadweep	Lakshadweep
19	Rest of Madhya Pradesh	Rest of Madhya Pradesh
20	Maharashtra	Maharashtra
21	Manipur	Manipur
22	Meghalaya	Meghalaya
23	Mizoram	Mizoram
24	Nagaland	Nagaland
25	Rest of NCT of Delhi	Rest of NCT of Delhi
26	Puducherry	Puducherry

Zone Code	Zone Name	State
27	Punjab	Punjab
28	Rest of Rajasthan	Rest of Rajasthan
29	Sikkim	Sikkim
30	Tamil Nadu	Tamil Nadu
31	Telangana	Telangana
32	Tripura	Tripura
33	Rest of Uttar Pradesh	Rest of Uttar Pradesh
34	Uttarakhand	Uttarakhand
35	West Bengal	West Bengal
36	Odisha	Odisha
37	Jhalawar	Rajasthan
38	Rest of Agra	Uttar Pradesh
39	Jhansi	Uttar Pradesh
40	Ahmadabad	Gujarat
41	Sheopur	Madhya Pradesh
42	Jhunjhunun	Rajasthan
43	Jodhpur	Rajasthan
44	Rest of Ajmer	Rajasthan
45	Shivpuri	Madhya Pradesh
46	Junagadh	Gujarat
47	Shrawasti	Uttar Pradesh
48	Jyotiba Phule Nagar	Uttar Pradesh
49	Kachchh	Gujarat
50	Aligarh	Uttar Pradesh
51	Alirajpur	Madhya Pradesh
52	Siddharth Nagar	Uttar Pradesh
53	Kaithal	Haryana
54	Allahabad	Uttar Pradesh
55	Sidhi	Madhya Pradesh
56	Sikar	Rajasthan
57	Rest of Alwar	Rajasthan
58	Ambala	Haryana
59	Ambedkar Nagar	Uttar Pradesh
60	Singrauli	Madhya Pradesh
61	Amreli	Gujarat
62	Sirohi	Rajasthan
63	Sirsa	Haryana

Zone Code	Zone Name	State
64	Kannauj	Uttar Pradesh
65	Anand	Gujarat
66	Sitapur	Uttar Pradesh
67	Kanpur Dehat	Uttar Pradesh
68	Kanpur Nagar	Uttar Pradesh
69	Kansiram Nagar	Uttar Pradesh
70	Anuppur	Madhya Pradesh
71	Sonbhadra	Uttar Pradesh
72	Ashoknagar	Madhya Pradesh
73	Sonipat	Haryana
74	Auraiya	Uttar Pradesh
75	South	NCT of Delhi
76	Karnal	Haryana
77	Azamgarh	Uttar Pradesh
78	Katni	Madhya Pradesh
79	Baghpat	Uttar Pradesh
80	South West	NCT of Delhi
81	Kaushambi	Uttar Pradesh
82	Bahraich	Uttar Pradesh
83	Balaghat	Madhya Pradesh
84	Sultanpur	Uttar Pradesh
85	Kheda	Gujarat
86	Ballia	Uttar Pradesh
87	Surat	Gujarat
88	Kheri	Uttar Pradesh
89	Balrampur	Uttar Pradesh
90	Surendranagar	Gujarat
91	Banas Kantha	Gujarat
92	Banda	Uttar Pradesh
93	Banswara	Rajasthan
94	The Dangs	Gujarat
95	Bara Banki	Uttar Pradesh
96	Baran	Rajasthan
97	Bareilly	Uttar Pradesh
98	Barmer	Rajasthan
99	Tikamgarh	Madhya Pradesh
100	Barwani	Madhya Pradesh

Zone Code	Zone Name	State
101	Basti	Uttar Pradesh
102	Kota	Rajasthan
103	Tonk	Rajasthan
104	Betul	Madhya Pradesh
105	Udaipur	Rajasthan
106	Kurukshetra	Haryana
107	Rest of Bharatpur	Rajasthan
108	Bharuch	Gujarat
109	Kushinagar	Uttar Pradesh
110	Bhavnagar	Gujarat
111	Ujjain	Madhya Pradesh
112	Bhilwara	Rajasthan
113	Bhind	Madhya Pradesh
114	Umaria	Madhya Pradesh
115	Bhiwani	Haryana
116	Lalitpur	Uttar Pradesh
117	Unnao	Uttar Pradesh
118	Bhopal	Madhya Pradesh
119	Bijnor	Uttar Pradesh
120	Vadodara	Gujarat
121	Bikaner	Rajasthan
122	Valsad	Gujarat
123	Varanasi	Uttar Pradesh
124	Lucknow	Uttar Pradesh
125	Vidisha	Madhya Pradesh
126	Budaun	Uttar Pradesh
127	Bulandshahr	Uttar Pradesh
128	Maharajganj	Uttar Pradesh
129	Bundi	Rajasthan
130	Burhanpur	Madhya Pradesh
131	Mahendragarh	Haryana
132	West	NCT of Delhi
133	Mahesana	Gujarat
134	Central	NCT of Delhi
135	Mahoba	Uttar Pradesh
136	Mainpuri	Uttar Pradesh
137	West Nimar	Madhya Pradesh

Zone Code	Zone Name	State
138	Chandauli	Uttar Pradesh
139	Mandla	Madhya Pradesh
140	Mandsaur	Madhya Pradesh
141	Rest of Mathura	Uttar Pradesh
142	Chhatarpur	Madhya Pradesh
143	Yamunanagar	Haryana
144	Mau	Uttar Pradesh
145	Chhindwara	Madhya Pradesh
146	Jind	Haryana
147	Rest of Dausa	Rajasthan
148	Rest of Karauli	Rajasthan
149	Meerut	Uttar Pradesh
150	Sawai Madhopur	Rajasthan
151	Mewat	Haryana
152	Mirzapur	Uttar Pradesh
153	Chitrakoot	Uttar Pradesh
154	Chittaurgarh	Rajasthan
155	Moradabad	Uttar Pradesh
156	Churu	Rajasthan
157	Morena	Madhya Pradesh
158	Tapi	Gujarat
159	Muzaffarnagar	Uttar Pradesh
160	Damoh	Madhya Pradesh
161	Rest of Nagaur	Rajasthan
162	Datia	Madhya Pradesh
163	Deoria	Uttar Pradesh
164	Dewas	Madhya Pradesh
165	Narmada	Gujarat
166	Narsimhapur	Madhya Pradesh
167	Dhar	Madhya Pradesh
168	Navsari	Gujarat
169	Dhaulpur	Rajasthan
170	Neemuch	Madhya Pradesh
171	New Delhi	NCT of Delhi
172	North	NCT of Delhi
173	Dindori	Madhya Pradesh
174	North East	NCT of Delhi

Zone Code	Zone Name	State
175	Dohad	Gujarat
176	North West	NCT of Delhi
177	Dungarpur	Rajasthan
178	East	NCT of Delhi
179	Pali	Rajasthan
180	Palwal	Haryana
181	Panch Mahals	Gujarat
182	Panchkula	Haryana
183	East Nimar	Madhya Pradesh
184	Panipat	Haryana
185	Panna	Madhya Pradesh
186	Etah	Uttar Pradesh
187	Etawah	Uttar Pradesh
188	Faizabad	Uttar Pradesh
189	Faridabad	Haryana
190	Patan	Gujarat
191	Farrukhabad	Uttar Pradesh
192	Fatehabad	Haryana
193	Fatehpur	Uttar Pradesh
194	Firozabad	Uttar Pradesh
195	Pilibhit	Uttar Pradesh
196	Porbandar	Gujarat
197	Gandhinagar	Gujarat
198	Pratapgarh	Rajasthan
199	Ganganagar	Rajasthan
200	Pratapgarh	Uttar Pradesh
201	Rest of Gautam Buddha Nagar	Uttar Pradesh
202	Ghaziabad	Uttar Pradesh
203	Ghazipur	Uttar Pradesh
204	Rae Bareli	Uttar Pradesh
205	Gonda	Uttar Pradesh
206	Gorakhpur	Uttar Pradesh
207	Raisen	Madhya Pradesh
208	Rajgarh	Madhya Pradesh
209	Guna	Madhya Pradesh
210	Rajkot	Gujarat
211	Rajsamand	Rajasthan

Zone Code	Zone Name	State
212	Gurgaon	Haryana
213	Gwalior	Madhya Pradesh
214	Hamirpur	Uttar Pradesh
215	Rampur	Uttar Pradesh
216	Hanumangarh	Rajasthan
217	Harda	Madhya Pradesh
218	Ratlam	Madhya Pradesh
219	Hardoi	Uttar Pradesh
220	Mahamaya Nagar	Uttar Pradesh
221	Rewa	Madhya Pradesh
222	Rewari	Haryana
223	Rohtak	Haryana
224	Hisar	Haryana
225	Hoshangabad	Madhya Pradesh
226	Sabar Kantha	Gujarat
227	Sagar	Madhya Pradesh
228	Saharanpur	Uttar Pradesh
229	Indore	Madhya Pradesh
230	Jabalpur	Madhya Pradesh
231	Rest of Jaipur	Rajasthan
232	Jaisalmer	Rajasthan
233	Jalaun	Uttar Pradesh
234	Sant Kabir Nagar	Uttar Pradesh
235	Sant Ravi Das Nagar(bhadohi)	Uttar Pradesh
236	Jalor	Rajasthan
237	Satna	Madhya Pradesh
238	Jamnagar	Gujarat
239	Sehore	Madhya Pradesh
240	Seoni	Madhya Pradesh
241	Shahdol	Madhya Pradesh
242	Jaunpur	Uttar Pradesh
243	Jhabua	Madhya Pradesh
244	Shahjahanpur	Uttar Pradesh
245	Jhajjar	Haryana
246	Shajapur	Madhya Pradesh
247	Agra	Uttar Pradesh
248	Fatehpur Sikri	Uttar Pradesh

Zone Code	Zone Name	State
249	Vrindavan	Uttar Pradesh
250	Mehandipur	Rajasthan
251	Bharatpur	Rajasthan
252	Mandwar	Rajasthan
253	Jaipur	Rajasthan
254	Mahwa	Rajasthan
255	Balaheri	Rajasthan
256	Bandikui	Rajasthan
257	Banetha	Rajasthan
258	Banskho	Rajasthan
259	Bhangarh	Rajasthan
260	Brahmbad	Rajasthan
261	Chandrana	Rajasthan
262	Chomu	Rajasthan
263	Dhanawar	Rajasthan
264	Dhiradi	Rajasthan
265	Dolika	Rajasthan
266	Hindaun	Rajasthan
267	Kherli	Rajasthan
268	Kumher	Rajasthan
269	Merta	Rajasthan
270	Nadoti	Rajasthan
271	Neemrana	Rajasthan
272	Nihalpura	Rajasthan
273	Paparda	Rajasthan
274	Rajgarh	Rajasthan
275	Arauda	Rajasthan
276	Bagrana	Rajasthan
277	Bamanpura	Rajasthan
278	Banskho	Rajasthan
279	Bassi	Rajasthan
280	Baswa	Rajasthan
281	Bayana	Rajasthan
282	Bhainsa	Rajasthan
283	Bhandana	Rajasthan
284	Bhandrej	Rajasthan
285	Bhot	Rajasthan

Zone Code	Zone Name	State
286	Bhusawar	Rajasthan
287	Binua	Rajasthan
288	Chainpura	Rajasthan
289	Chaksu	Rajasthan
290	Dausa	Rajasthan
291	Deeg	Rajasthan
292	Doodhli	Rajasthan
293	Dopur	Rajasthan
294	Dopur	Rajasthan
295	Dubbi	Rajasthan
296	Geejgarh	Rajasthan
297	Halena	Rajasthan
298	Helak	Rajasthan
299	Jaipur	Rajasthan
300	Jasota	Rajasthan
301	Jhar	Rajasthan
302	Jhera	Rajasthan
303	Kalera	Rajasthan
304	Kanauta	Rajasthan
305	Kanjoli	Rajasthan
306	Khairwal	Rajasthan
307	Khan Bhankri	Rajasthan
308	Kharkara	Rajasthan
309	Kishangarh	Rajasthan
310	Kolwa	Rajasthan
311	Kumha	Rajasthan
312	Lalwas	Rajasthan
313	Lotwara	Rajasthan
314	Lulhara	Rajasthan
315	Luniawas	Rajasthan
316	Madoli	Rajasthan
317	Mahwa	Rajasthan
318	Mariyada	Rajasthan
319	Mehandipur	Rajasthan
320	Mitrapura	Rajasthan
321	Nadbai	Rajasthan
322	Paharsar	Rajasthan

Zone Code	Zone Name	State
323	Paota	Rajasthan
324	Pipalkhera	Rajasthan
325	Ramshighpura	Rajasthan
326	Raniwas	Rajasthan
327	Rohtaspura	Rajasthan
328	Sainthal	Rajasthan
329	Sikindra	Rajasthan
330	Sindoli	Rajasthan
331	Singwara	Rajasthan
332	Sinpini	Rajasthan
333	Somara	Rajasthan
334	Sujanpura	Rajasthan
335	Sukhawali	Rajasthan
336	Todabhim	Rajasthan
337	Vamanpura	Rajasthan
338	Weir	Rajasthan
339	Ludhawai	Rajasthan
340	Amoli	Myanmar
341	Nepal	Nepal
342	Bangaldesh	Bangladesh

Direction-wise commodity distribution

Table D.5: Commodity distribution at TP1 Amoli (towards Jaipur)

Commodities	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	25%	21%	21%	29%
Construction	1%	3%	1%	2%
Stone	0%	1%	0%	2%
Groceries	4%	14%	11%	7%
Minerals	2%	1%	2%	3%
Manufacturing	9%	7%	12%	12%
Petroleum	1%	6%	5%	4%
Chemical	-	-	-	-
Miscellaneous	3%	5%	4%	4%
Machinery	0%	-	1%	1%
Container	-	-	0%	0%
Empty	53%	43%	42%	36%
Sand	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table D.6: Commodity distribution at TP1 Amoli (towards Agra)

Commodities	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	26%	15%	20%	12%
Construction	9%	11%	7%	22%
Stone	1%	3%	6%	8%
Groceries	12%	9%	15%	18%
Minerals	1%	7%	2%	2%
Manufacturing	22%	20%	33%	24%
Petroleum	1%	12%	6%	4%
Chemical	-	-	-	-
Miscellaneous	3%	10%	6%	4%
Machinery	4%	3%	2%	2%
Container	-	-	-	0%
Empty	20%	10%	2%	3%
Sand	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Trip length distribution

Table D.7: Trip length distribution at TP1 Amoli

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
0-65 km	3%	2%	5%	6%	1%	1%
65-300 km	78%	79%	55%	48%	38%	26%
300-500 km	8%	10%	11%	10%	13%	11%
500-1000 km	8%	9%	13%	13%	13%	14%
>1000 km	2%	2%	15%	24%	35%	48%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Chanda Malhotra

Reviewer/approver

Shipra Bhatia

Other contributors

Vaibhav Gupta, Aditya Karan, Anshika Saxena

Distribution

Steer:

Version control/issue number

V1.0

Date

April 2022

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

Final Report
April 2022

Project Transit: Traffic Due Diligence Madurai-Kanyakumari Tollway Limited

Cube Highways Fund Advisors Private Limited

Our ref: 23741304

steer

Report
April 2022

Project Transit: Traffic Due Diligence Madurai-Kanyakumari Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit 4.0
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited . This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Contents

Disclaimer i

Glossary Items iii

1 Introduction i

The assignment i

Our approach ii

Evolution of COVID-19 pandemic in India in FY21 and FY22 iii

Contents of this report v

2 The Assets 6

Introduction 6

Strategic network 6

Concession and tolling details 7

Key economic activities 9

Alternate routes 11

3 Traffic Description 13

Introduction 13

Historical trends 13

Key findings of the TVC data analysis 23

WADT estimates 23

Key findings of origin-destination analysis 26

Overview 26

Sample rates 26

Zone Categories 27

Zonal Influence 28

Internal External analysis 30

Conclusions 43

4 Socio economic context and traffic growth 45

Introduction 45

Population growth 45

Economic growth 46

5 Traffic Growth Analysis 48

Estimation of background elasticities 48

Overview 48

Forecasts for growth drivers 50

6 Forecast: Base year AADT and Impacts 52

Introduction 52

Base year FY22 AADT estimates 53

Analysis of potential network/developmental impacts 55

Revenue forecasting assumptions 57

Toll segmentation 58

Traffic and Revenue forecasts 60

Upside and Downside Cases 68

Traffic and Revenue Forecasts-Upside case 70

Traffic and Revenue Forecasts-Downside case 75

Target revenues and modification of concession period 81

Summary outlook 82

Figures

Figure 1.1: Daily Reported COVID-19 cases in India iv

Figure 2.1: Asset location in the regional network context 6

Figure 2.2: Asset context 7

Figure 2.3: Road cross section 8

Figure 3.1 Vehicle share at TP1 Kappalur 14

Figure 3.2 Vehicle share at TP2 Etturavattam 15

Figure 3.3 Vehicle share at TP3 Salaipudhur 16

Figure 3.4 Vehicle share at TP4 Nanguneri 17

Figure 3.5: Comparison between TVC and TMS daily traffic data on TP1 24

Figure 3.6: Comparison between TVC and TMS daily traffic data on TP2 24

Figure 3.7: Comparison between TVC and TMS daily traffic data on TP3 25

Figure 3.8: Comparison between TVC and TMS daily traffic data on TP4 25

Figure 3.9: Comparison between vehicle shares from TVC and TMS WADTs 26

Figure 3.10: Zonal influence at TP1 Kappalur 29

Figure 3.11: Zonal influence at TP2 Etturvattam 29
Figure 3.12: Zonal influence at TP3 Salaipudhur 30
Figure 3.13: Zonal influence at TP4 Nanguneri 30
Figure 3.14: Internal-external distribution at TP1 Kappalur 31
Figure 3.15: Internal-external distribution at TP2 Etturvattam 32
Figure 3.16: Internal-external distribution at TP3 Salaipudhur 32
Figure 3.17: Internal-external distribution at TP4 Nanguneri 33
Figure 3.18: Commodity distribution at TP1 Kappalur (Total) 35
Figure 3.19: Commodity distribution at TP1 Kappalur (towards Tirunelveli) 35
Figure 3.20: Commodity distribution at TP1 Kappalur (towards Madurai) 36
Figure 3.21: Commodity distribution at TP2 Etturvattam (Total) 36
Figure 3.22: Commodity distribution at TP2 Etturvattam (Towards Kanyakumari) 37
Figure 3.23: Commodity distribution at TP2 Etturvattam (Towards Madurai) 37
Figure 3.24: Commodity distribution at TP3 Salaipudhur 38
Figure 3.25: Commodity distribution at TP3 Salaipudhur (towards Kanyakumari) 38
Figure 3.26: Commodity distribution at TP3 Salaipudhur (towards Madurai) 39
Figure 3.27: Commodity distribution at TP4 Nanguneri (Total) 39
Figure 3.28: Commodity distribution at TP4 Nanguneri (Towards Kanyakumari) 40
Figure 3.29: Commodity distribution at TP4 Nanguneri (Towards Madurai) 40
Figure 3.30: Trip length distribution TP1 Kappalur 41
Figure 3.31: Trip length distribution TP2 Etturvattam 42
Figure 3.32: Trip length distribution TP3 Salaipudhur 42
Figure 3.33: Trip length distribution TP4 Nanguneri 43
Figure 4.1: Evolution of Tamil Nadu's state GDP and National GDP 47
Figure 5.1: GDP-GSDP forecast 51
Figure 6.1: Traffic and growth rates for forecast PCUs - Background and final, TP1 Kappalur .. 66
Figure 6.2: Traffic and growth rates for forecast PCUs - Background and final, TP2 Etturvattam 67
Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP3 Salaipudhur 67
Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP4 Nanguneri 68

Tables

Table 1.1: Scope of work and sources of data i
Table 2.1: Asset description and key metrics 8
Table 2.2: Single toll rates on the Assets (INR), applicable April 2021 to March 2022 9
Table 3.1: PCU factors 13
Table 3.2: Quarterly Traffic Levels at TP1 Kappalur 14
Table 3.3: Quarterly Average Traffic Levels at TP2 Etturavattam 15
Table 3.4: Typical ticket types sold at NHAI plazas 19
Table 3.5: Timeline of national ETC implementation. 20
Table 3.6: Percentage of Traffic via FASTag, March 2022 20
Table 3.7: Ticket Segmentation for CJV category for all the Assets 21
Table 3.8: Ticket Segmentation for MAV category for all the Assets 21
Table 3.9: Ticket Segmentation for Bus category for all the Assets 22
Table 3.10: Data collection exercise 22
Table 3.11: WADT from TVC counts 23
Table 3.12: Sample rates for OD data 27
Table 3.13: Zone aggregations for zonal influence analysis 27
Table 4.1: CAGR of population in India 45
Table 4.2: Population Growth in India (2001 – 2011) 46
Table 5.1: Identified growth drivers to model traffic growth 49
Table 5.2: Elasticity recommendations for the Asset 49
Table 6.1: SCF factors for all toll plazas 52
Table 6.2: Monthly MADT and Base Year FY22 AADT estimation TP1 Kappalur 53
Table 6.3: Monthly MADT and Base Year FY22 AADT estimation TP2 Etturvattam 54
Table 6.4: Monthly MADT and Base Year FY22 AADT estimation TP3 Salaipudhur 54
Table 6.5: Monthly MADT and Base Year FY22 AADT estimation TP4 Nanguneri 54
Table 6.6: Impact of LOS improvement due to six-laning (capacity augmentation) 55
Table 6.7: NH744 upgrade: Madurai Kollam 56
Table 6.8: Four-laning of Trivandrum-Nagercoil 56
Table 6.9: Trip factors for the forecast years for TP1 Kappalur 57
Table 6.10: Trip factors for the forecast years for TP2 Etturvattam 57
Table 6.11: Trip factors for the forecast years for TP3 Salaipudhur 57

Table 6.12: Trip factors for the forecast years for TP4 Nanguneri 58
Table 6.13: Toll segmentation for FY22, TP1 Kappalur 58
Table 6.14: Toll segmentation for FY22, TP2 Etturvattam 59
Table 6.15: Toll segmentation for FY22, TP3 Salaipudhur 59
Table 6.16: Toll segmentation for FY22, TP4 Nanguneri 59
Table 6.17: WPI growth forecast assumptions 60
Table 6.18: FY22 Revenue reconciliation summary (INR Lakhs) 60
Table 6.19: Traffic forecast (With Impacts) for TP1 Kappalur 61
Table 6.20: Traffic growth CAGR (%) for TP1 Kappalur 61
Table 6.21: Revenue forecast (With Impacts) for TP1 Kappalur (INR Cr) 61
Table 6.22: Revenue growth CAGR (%) for TP1 Kappalur 62
Table 6.23: Traffic forecast (With Impacts) for TP2 Etturvattam 62
Table 6.24: Traffic growth CAGR (%) TP2 Etturvattam 62
Table 6.25: Revenue forecast (with impacts) for TP2 Etturvattam (INR Cr) 63
Table 6.26: Revenue growth CAGR (%) for TP2 Etturvattam 63
Table 6.27: Traffic forecast (With Impacts) for TP3 Salaipudhur 63
Table 6.28: Traffic growth CAGR (%) for TP3 Salaipudhur 64
Table 6.29: Revenue forecast (with impacts) for TP3 Salaipudhur (INR Cr) 64
Table 6.30: Revenue growth CAGR (%) for TP3 Salaipudhur 64
Table 6.31: Traffic forecast (With Impacts) for TP4 Nanguneri 65
Table 6.32: Traffic growth CAGR (%) for TP4 Nanguneri 65
Table 6.33: Revenue forecast (with impacts) for TP4 Nanguneri (INR Cr) 65
Table 6.34: Revenue growth CAGR (%) for TP4 Nanguneri 66
Table 6.35: Summary of Macro Assumptions for upside and downside cases 68
Table 6.36: Summary of impacts on the Assets 69
Table 6.37: Summary of impacts on the Assets 69
Table 6.38: Traffic forecast (With Upside Impacts) for TP1: Kappalur 70
Table 6.39: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Kappalur 70
Table 6.40: Revenue forecast (With Upside Impacts) for TP1: Kappalur (In Cr) 71
Table 6.41: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Kappalur 71
Table 6.42: Traffic forecast (With Upside Impacts) for TP2: Etturvattam 71
Table 6.43: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Etturvattam 72

Table 6.44: Revenue forecast (With Upside Impacts) for TP2: Etturvattam (In Cr) 72
Table 6.45: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Etturvattam..... 72
Table 6.46: Traffic forecast (With Upside Impacts) for TP3: Salaipudhur 73
Table 6.47: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP3: Salaipudhur..... 73
Table 6.48: Revenue forecast (With Upside Impacts) for TP3: Salaipudhur (In Cr)..... 73
Table 6.49: Revenue growth (With Upside Impacts) CAGR (%) for TP3: Salaipudhur..... 74
Table 6.50: Traffic forecast (With Upside Impacts) for TP4: Nanguneri..... 74
Table 6.51: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP4: Nanguneri 74
Table 6.52: Revenue forecast (With Upside Impacts) for TP4: Nanguneri (In Cr) 75
Table 6.53: Revenue growth (With Upside Impacts) CAGR (%) for TP4: Nanguneri 75
Table 6.54: Traffic forecast (With Downside Impacts) for TP1: Kappalur 75
Table 6.55: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Kappalur..... 76
Table 6.56: Revenue forecast (With Downside Impacts) for TP1: Kappalur (In Cr)..... 76
Table 6.57: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Kappalur..... 76
Table 6.58: Traffic forecast (With Downside Impacts) for TP2: Etturvattam 77
Table 6.59: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Etturvattam..... 77
Table 6.60: Revenue forecast (With Downside Impacts) for TP2: Etturvattam (In Cr) 77
Table 6.61: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Etturvattam..... 78
Table 6.62: Traffic forecast (With Downside Impacts) for TP3: Salaipudhur 78
Table 6.63: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP3: Salaipudhur..... 78
Table 6.64: Revenue forecast (With Downside Impacts) for TP3: Salaipudhur (In Cr)..... 79
Table 6.65: Revenue growth (With Downside Impacts) CAGR (%) for TP3: Salaipudhur 79
Table 6.66: Traffic forecast (With Downside Impacts) for TP4: Nanguneri..... 79
Table 6.67: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP4: Nanguneri 80
Table 6.68: Revenue forecast (With Downside Impacts) for TP4: Nanguneri (In Cr) 80
Table 6.69: Revenue growth (With Downside Impacts) CAGR (%) for TP4: Nanguneri 80
Table 6.70: Target Revenues for Extension 1 81
Table 6.71: Target Revenues for Extension 2 81

Appendices

A **Top 10 OD Pairs**

B **Detailed forecasts**

C **Data Collection exercise**

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19and post-COVID-19views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an Asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get normalised AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic due diligence to be carried out on the Madurai-Kanyakumari Toll Road (hereafter called "Assets").

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination (OD) surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line based on forecast published by Consensus and RBI (FY23)

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data Oct 2020 to Mar 2022
  - Concession agreement and toll notifications
  - Previous studies
  - Bid and Lender studies.
  - Steer-commissioned TVC counts from 18th January to 24th January 2021, and OD data from surveys conducted on 20-22 January 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the Annual Average Daily Traffic (AADT) reported for each of the toll plaza.

1.7 The estimation of future traffic demand on the Asset was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset

against our Steer knowledge base (e.g., similar asset types in the same state or on the same corridor), to derive appropriate elasticities.
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.8 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until 03rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March 2020 and 20th April 2020. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery etc.

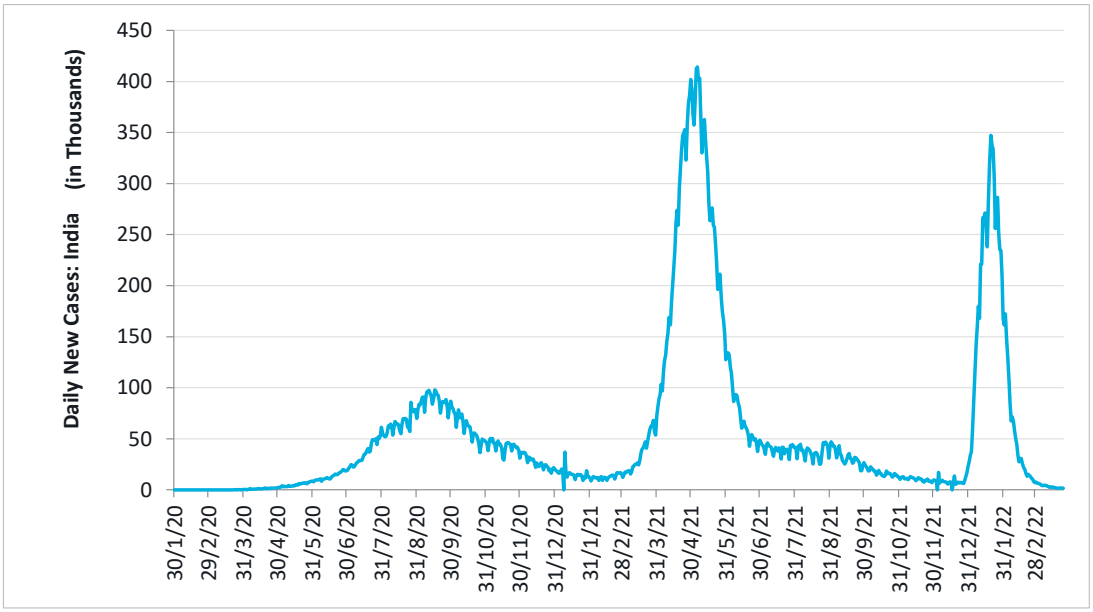
1.9 The traffic volumes since then gradually started recovering on most assets in India, with varying extent. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

1.10 As the TMS data for the Asset is available from Oct 2020, the observation is that the traffic volumes have ramped up in the Q3FY21 and Q4FY21, which can be driven by following factors - a release of pent-up demand in certain vehicle categories, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network as well as the stabilization of the tolling systems on the Asset. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.11 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.12 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to Feb 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, **https://data.COVID19india.org/**

1.13 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as the first wave when the whole country went under strict lockdown for one quarter. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.14 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe on the health, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.15 Now that COVID-19 has an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network. This shift is expected to sustain and continue in the short term as such perception shifts for longer periods of time could result in more permanent changes in passenger choices. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles

even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this report

1.16 The report has been divided into the following chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence ;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analyses;
- Chapter 4 presents the socio-economic context of the corridor and region/state containing the Asset, along with our approach and results on estimating background traffic demand growth; and
- Chapter 5 summarises our key forecasting assumptions, assessment of network impacts, and presents our traffic and revenue forecasts for the Asset.

2 The Assets

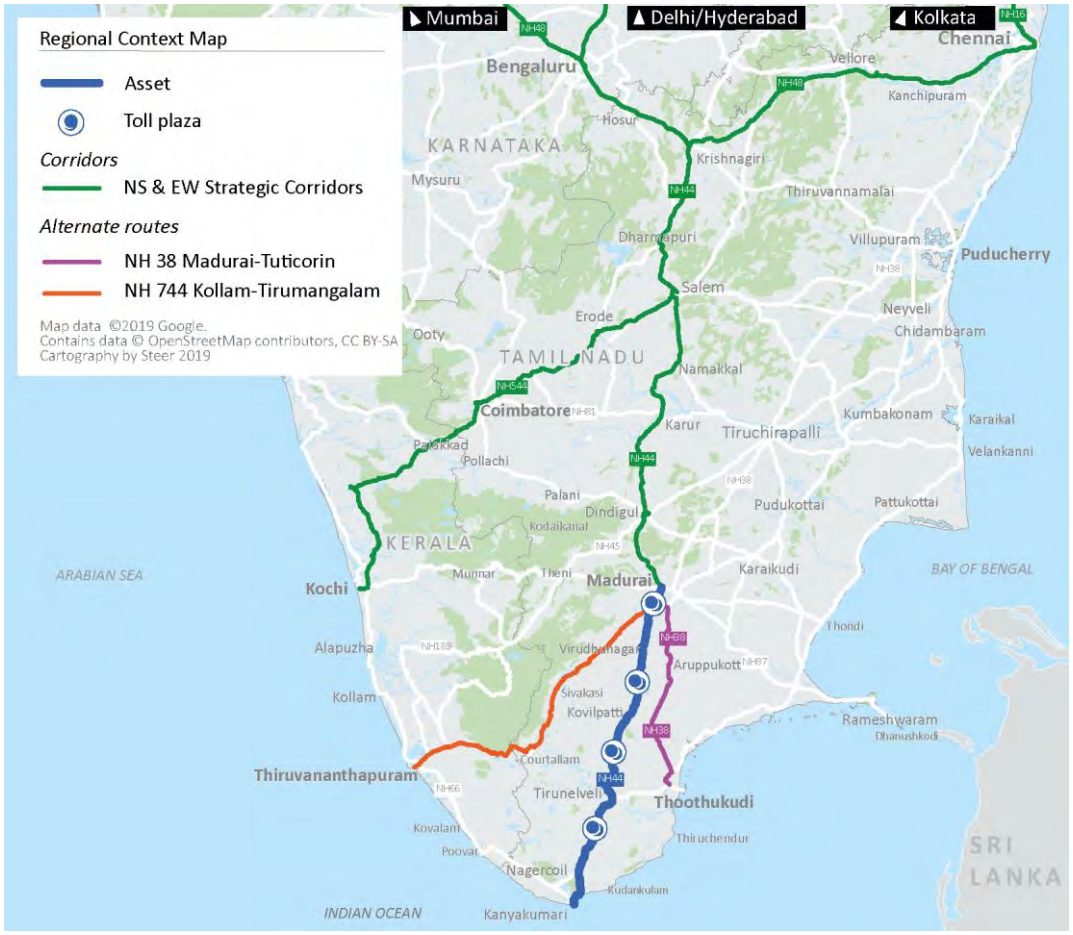
Introduction

2.1 This chapter provides a description of the Asset, based on both primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Tamil Nadu, connecting Madurai, northern Tamil Nadu and states north of Tamil Nadu with cities and towns in southern Tamil Nadu and Thiruvananthapuram in Kerala. The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



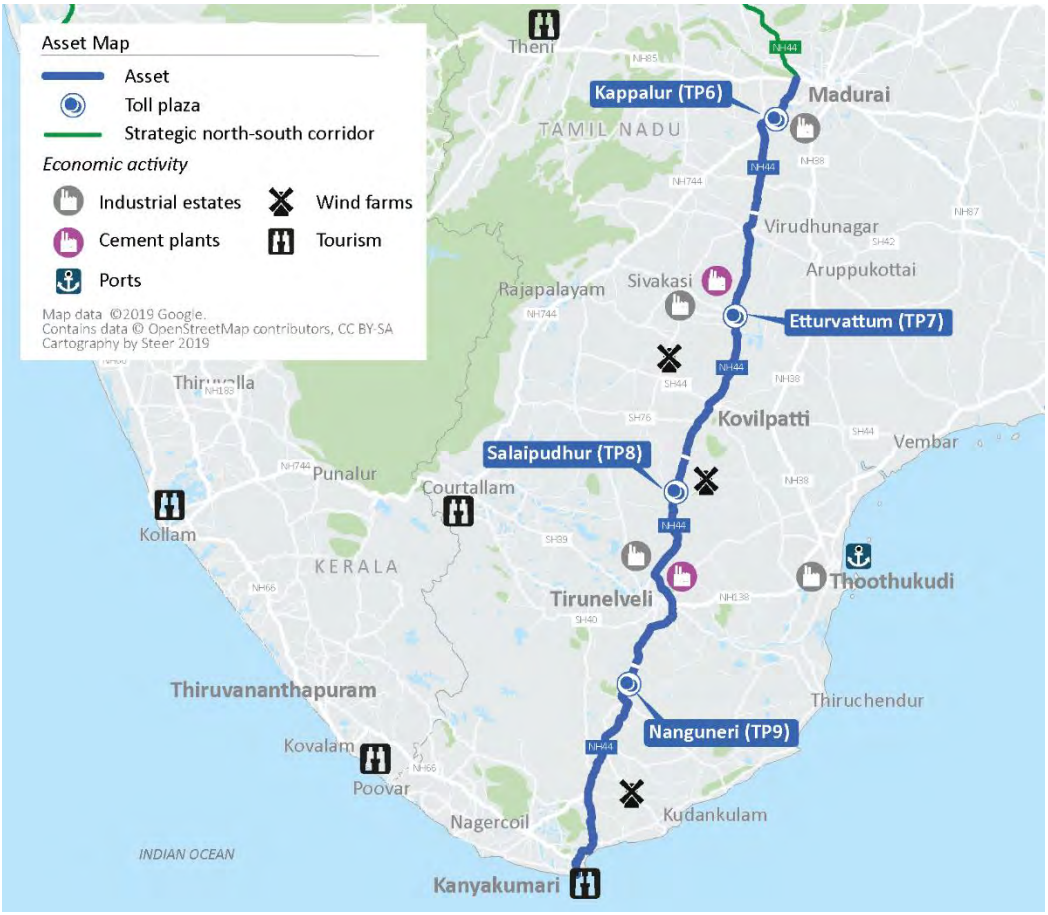
Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to three different types of strategic movements:

- **Long-distance trips** between North India and Southern states like Andhra Pradesh, Telangana and Karnataka at one end and southern Tamil Nadu and Thiruvananthapuram at the other end.
- **Medium-distance trips** between northern Tamil Nadu including Chennai and southern Karnataka including Bangalore at one end and southern parts of Tamil Nadu and Thiruvananthapuram.
- **Short-distance trips** between cities and towns in southern Tamil Nadu including Madurai, Thirumangalam, Virudhunagar, Sivakasi, Kovilpatti, Tirunelveli and Thiruvananthapuram.

2.4 The Asset is a 243-km toll road which lies on NH 44 in Tamil Nadu. It is a four-lane road with four toll plazas. The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The three southern toll plazas (Etturvattam, Salaipudhur and Nanguneri) on the Assets have been operational since FY12 while the northernmost toll plaza (Kappalur) has been operational since FY11. The Client took over operations in October 2020.

2.6 The following table provides a key metrics of the Assets that have their chainage from KM 0.0 to KM 243.470 of NH44 (old NH7).

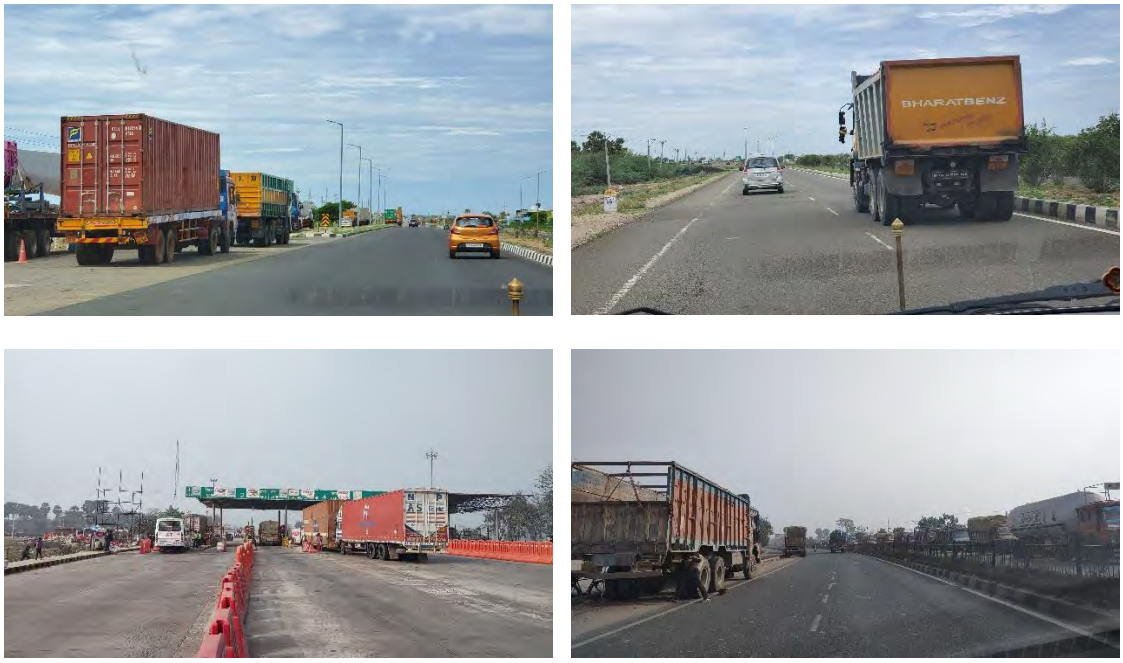
Table 2.1: Asset description and key metrics

Asset	Particulars
State	Tamil Nadu
Highway and lane configuration	NH 44 four-lane
Toll plazas	• TP1: Kappalur • TP2: Etturvattam • TP3: Salaipudhur • TP4: Nanguneri
Length (km) as per concession agreement	• TP1: 52.30km • TP2: 64.20km • TP3: 63.50km • TP4: 63.47km
Commencement of operations	• TP1: Sep 2012 • TP2: 15 2011 • TP3: 23 2011 • TP4: 23 2011
Operated by Client since	October 2020
Concession period	30 years
Last year of concession	FY51

Source: Client data

2.7 The figure below shows a typical cross-section of the Assets and its toll plazas.

Figure 2.3: Road cross section



Source: Steer site visits

2.8 Tolls are collected for the toll categories and rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Assets (INR), applicable April 2021 to March 2022

Type of Vehicle	Single Journey Fee			
	TP1 Kappalur	TP2 Etturvattam	TP3 Salaipudhur	TP4 Nanguneri
CJV	85	85	105	95
LCV	135	140	170	150
Bus/Truck	290	290	355	315
3A	315	315	385	345
HCM/EME	450	455	555	495
OSV	550	555	675	605

Source: NHAI Revision of User fee rate w.e.f. 01.04.2021

Key economic activities

2.9 The Asset is located in a highly urbanised region of Tamil Nadu and southern Kerala, with densities peaking at either ends of the Asset cluster – i.e., at Madurai and Kanyakumari. Demand is driven by a consumption-based economy with major economic activities surrounding cement manufacture, wind power and industrial estates.

Cement

2.10 The toll plazas Etturvattam and Salaipudhur have two large cement plants close to them, namely Ramco Cements at RR Nagar (near Virudhunagar) and India Cements at Sankarnagar (north of Tirunelveli).

2.11 The India Cements factory, set up in 1949 and located just north of Tirunelveli on the Asset, has an annual production capacity of 2.05 million tonnes. Limestone is one of the main raw materials for cement manufacture and Nanjankulam Limestone Mines, located nearby, is one of the captive limestone mines of the Sankar Nagar factory. Besides, the Ramco Cements factory at RR Nagar in Virudhunagar is another large cement plant with an annual capacity of 2 million tonnes.[1]

Industrial estates

2.12 The southern Tamil Nadu region in the immediate area of influence of the Assets hosts several industrial estates including at Kappalur (Madurai), Gangaikondan (Tirunelveli) and Nanguneri. While Kappalur and Gangaikondan are already operational, the Nanguneri SEZ already has land allotted but not operational yet.

2.13 The Tamil Nadu Small Industries Corporation (SIDCO) industrial estate at Kappalur, located on the southern part of the Madurai bypass, is a 700-acre facility established in 1974.[2] It has 400 units related to food processing, fabrication, textile and hardware industries and employs

[1] http://www.ramcocements.in/rr-nagar.aspx, accessed 31 March 2021

[2] https://www.thehindu.com/news/cities/Madurai/the-dark-side-of-kappalur-industrial-estate/article27259403.ece, accessed on 30 March 2021

around 20,000 people.[3] The State Industries Promotion Corporation (SIPCOT) industrial estate at Gangaikondan houses units like the LPG storage godowns of the Indian Oil Corporation, South India Bottling Company, ATC Tyres Private Limited, Nova Carbon Company and Bosch Limited.[4]

2.14 The industrial city of Tuticorin and the surrounding region hosts the Tuticorin Port which is one of the 12 'major' ports of the country and has two container terminals.[5] There are several power plants including the Tuticorin Thermal Power Station and private ones like the captive Sterlite Industries plant. Other industries include salt pans, oil mills, chemical factories and export-based businesses.[6]

2.15 The Asset also lies on the Chennai-Kanyakumari Industrial Corridor (CKIC) which covers 23 districts and aims to promote port-based economic development. The project aims to promote balanced regional growth and development of the southern districts. Six industrial nodes have been identified as part of the Comprehensive Development Plan of which Madurai-Dindigul-Virudhunagar-Theni and Thoothukudi-Tirunelveli have been prioritised as part of Phase-I.[7] The State plans to target the southern districts for the development of renewable energy-based power generation.[8]

Wind power

2.16 Tamil Nadu is the top producer of wind energy in the country with an installed capacity of about 8.5 GW across Coimbatore, Tiruppur, Tirunelveli, Thoothukudi and Kanyakumari districts.[9] [10] About 40% of the installed wind energy capacity is for captive use by industries.[11]

2.17 Though the Madurai and Tirunelveli region were traditionally agricultural regions, with older wind farms primarily located in the southern Tirunelveli/Kanyakumari region, commissioning of wind farms in other parts of these southern districts and even western districts like Coimbatore have expanded the wind energy business. For example, recent installations at Kayathar (north of Tirunelveli) have shown installation activity and linked goods traffic in the vicinity of the Asset.

---

[3] **https://www.thehindu.com/news/national/tamil-nadu/industrial-estates-in-wait-and-watch-mode/article31674890.ece**, accessed on 30 March 2021

[4] **https://timesofindia.indiatimes.com/city/madurai/tirunelveli-industrial-hub-relies-on-remote-access-to-fire-station/articleshow/61696063.cms**, accessed on 30 March 2021

[5] **https://www.vocport.gov.in/knowyourport.aspx**, accessed on 31 March 2021

[6] **https://www.fundoodata.com/companies-in/tuticorin-l277**, accessed on 31 March 2021

[7] **http://tidco.com/chennai-kanyakumari-industrial-corridor/#:~:text=The%20Chennai%20Kanyakumari%20Industrial%20Corridor,Tamil%20Nadu**, accessed on 31 March 2021

[8] **https://www.thehindubusinessline.com/news/adb-clears-451-m-loan-for-power-connectivity-in-chennai-kanyakumari-industrial-corridor/article29881254.ece**, accessed on 31 March 2021

[9] **https://www.thenewsminute.com/article/tamil-nadu-india-s-top-producer-wind-energy-challenges-are-many-114448**, accessed on 31 March 2021

[10] **https://www.thehindu.com/news/national/tamil-nadu/wind-energy-generation-picks-up-in-tamil-nadu/article32294775.ece**, accessed on 31 March 2021

[11] **https://www.thehindu.com/news/national/tamil-nadu/wind-mills-in-state-plagued-by-frequent-shutdowns-tamil-nadu-electricity-consumers-association/article28816561.ece**, accessed on 31 March 2021

Urban consumption centres

2.18 Given the highly urbanised nature of the region including cities like Madurai, Tirunelveli and Trivandrum, and towns like Virudhunagar, Kovilpatti and Tuticorin, there is a lot of consumption-related retail activity in the region. A lot of this regional consumption demand is met by LCVs and 2As, apart from 3As. MAVs primarily serve long-distance traffic part of the strategic movement from and to northern states.

2.19 The cities and towns in the region are culturally connected and show leisure-based car and bus travel not only between cities and towns in the southern districts but also to and from Chennai. Tourism includes both pilgrimage and leisure travel. Destinations like Rameswaram and Kanyakumari are renowned pilgrimage destinations while other cities that have religious destinations include Madurai and Tirunelveli. Leisure destinations in the immediate vicinity of the Asset like Courtallam, Cape Comorin and Manjolai Estates in Tenkasi, Kanyakumari and Tirunelvei districts, respectively.

2.20 Besides the urban centres mentioned above, the Asset also serves as the highway link between southern Tamil Nadu and Kerala. Hill stations (Thekkady, Kodaikanal and Munnar), beaches in Kerala are popular tourist destinations for domestic tourists from Tamil Nadu. Besides, Thiruvananthapuram and Kanyakumari districts are culturally connected and show inter-urban passenger movements.

Alternate routes

2.21 As seen in the map in an earlier section, the Assets lie at the southern end of NH 44, the traditional north-south corridor connecting North India with South India terminating at Kanyakumari.

2.22 For the three types of movements observed on the Asset – long-distance, medium-distance and short-distance trips – that were explained earlier in this chapter, this section provides an introduction to potential alternate routes available for diversion.

- **Long-distance:** There is no long-distance alternate to the Assets. NH 66 - the long-distance north-south corridor along the western coast connecting Mumbai with Kanyakumari, does not directly compete with the Asset as it passes through highly urban and congested areas in Kerala. The Asset is the primary link between northern Tamil Nadu and states north of Tamil Nadu at one end and the southern districts of Tamil Nadu including Madurai, Virudhunagar, Tirunelveli, Kanyakumari and Thiruvananthapuram (Kerala) at the other end.
- **Medium-distance**: There are two major medium-distance alternatives available.
  - The Madurai-Tuticorin Expressway (MTEL) on NH 38 connects Madurai more directly with Tuticorin (2.5 hours, 150 km) compared to the Assets through Kovilpatti (3 hours, 170 km). Port traffic between the northern Tamil Nadu hinterland and the Tuticorin Port primarily use this route. The distribution of traffic markets between the Asset and the MTEL corridors in their current road conditions is quite mature and we do not expect any diversions from/to the Asset.
  - The NH 744 route between Madurai and Kollam, through Rajapalayam, is another competitive alternate for road users having Courtallam and Kollam district (Kerala) as destinations. Currently two-lane, un-tolled and in good condition, this alternate is the preferred choice compared to the Asset, especially for cars. However, planned four-laning of this road may improve levels of service, while at the same time increasing toll costs for users, thereby potentially changing the relative advantage that the

alternate currently holds. Chapter 6 presents the analysis of potential impacts due to the planned upgrade of NH 744.

- **Micro-diversion**: There are local roads that help road users bypass the toll plazas at certain Assets. While certain of these movements have already been contained and the issues being addressed, two alternates had significant amount of traffic. We believe these micro-diversions have achieved equilibrium and matured in their diversion behaviour and therefore no impacts were considered in Chapter 6.
  - There is an urban road that provides diversion around Kappalur toll plaza through Uchapatti area to the west of the toll plaza. A considerable number of both cars and LCVs/2As were observed to use this local diversion. Though, part of the traffic that uses this road are local and related to the settlement (cars), factories and godowns (LCVs and 2As) located in the area.
  - There is a rural road that provides diversion around Nanguneri toll plaza on its western side. A considerable number of both cars and LCVs/2As were observed to use this local diversion.

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year Monthly Average Daily Traffic (MADT) is established. This data is typically provided by the Client and independently analysed and validated by us using Traffic Volume Count (TVC) information.

PCU Factor assumption

3.4 The PCU values have been taken from '*IRC 64:1990- Guidelines for Capacity of Roads in Rural Areas'*. For MAV, based on the discussion with the Client, we have referred to the rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAVs. For rigid trailer trucks we have assumed a PCU factor of 3, whereas for trailer trucks we have assumed a PCU factor of 4.5.

Table 3.1: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	3.0
Bus	1.5
2A	3.0
3A	3.0
MAV*	3.3
OSV	4.5

Source: Steer analysis, * Rigid-Trailer PCU

Historical trends

3.5 The following table illustrates the quarterly recorded MADT by vehicle class, at the Asset's toll plaza over the period of 17 months from October 2020 – March 2022 (provided by the Client).

3.6 From the historical data presented below, it is be inferred that dominant mode in the traffic mix are CJVs (70%) while all the goods vehicles make up for around 20% of the traffic. This is because of the location of the Asset; it is located in the vicinity of the two consumption centres of Madurai and Thirumangalam and around 25% of the CJV traffic present on the toll plaza is generated from/to these consumption centres and rest of the CJV traffic is mainly originated and destined on the Asset. This Asset acts like an interurban link between these urban settlements.

Table 3.2: Quarterly Traffic Levels at TP1 Kappalur

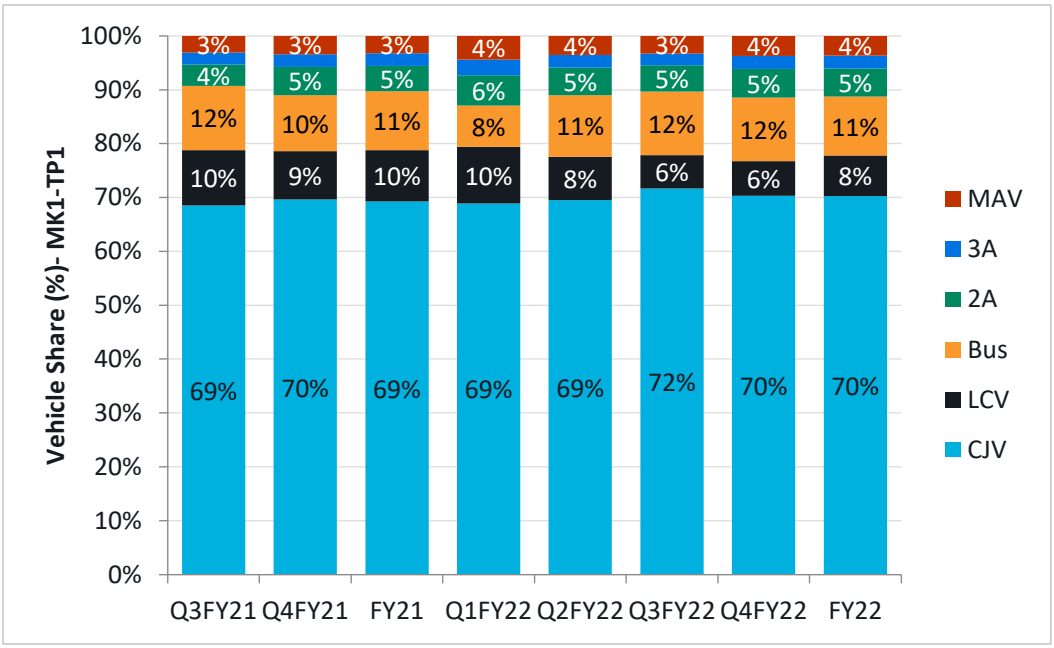
Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	17,285	17,307	17,284	10,888	16,158	17,633	16,874	15,384	17,262	(0.1%)
LCV	2,587	2,240	2,381	1,659	1,875	1,529	1,547	1,652	1,539	(35.4%)
Bus	3,009	2,577	2,728	1,211	2,660	2,895	2,834	2,398	2,864	5.0%
2A	996	1,301	1,178	894	1,188	1,199	1,280	1,140	1,240	5.2%
3A	564	597	580	458	545	540	579	530	560	(3.5%)
MAV	787	841	809	693	823	805	886	802	846	4.5%
Total	**25,228**	**24,863**	**24,960**	**15,803**	**23,249**	**24,601**	**23,999**	**21,906**	**24,309**	**(2.6%)**
PCU	**37,485**	**36,882**	**36,998**	**23,364**	**34,882**	**36,502**	**36,213**	**32,727**	**36,366**	**(1.7%)**

Source: Steer analysis of Client data, #FY22 is the average traffic from Oct-21 to Mar-22 for comparison with FY21

3.7 There is lack of long-term historical data available on the Asset since tolling was started by the client only in October 2020 and both the available years of data, FY21 and FY22 were impacted by COVID-19 related restrictions.

3.8 For a like to like comparison we have compared Q3 and Q4 FY21 with Q3 and Q4 FY22. 2A truck traffic volume is mainly stable over the dataset with a minor increase of around 5%, when Q3 and Q4 of FY21 and FY22 are compared. MAVs have also seen a minor growth of around 4.5%. CJV's have remained flat over the two years.

Figure 3.1 Vehicle share at TP1 Kappalur



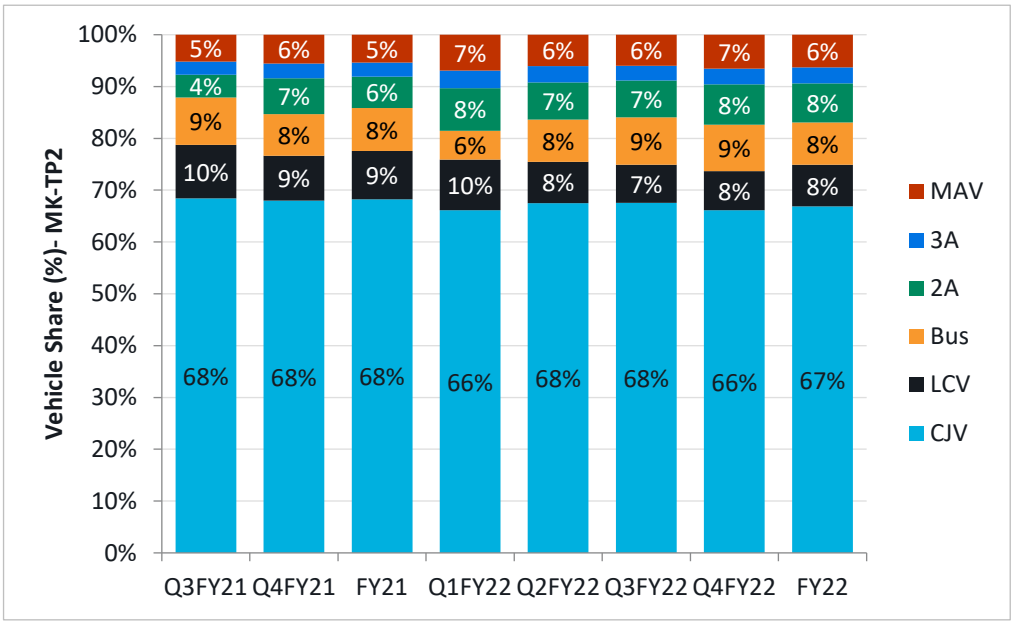
Source: Steer analysis of Client data

Table 3.3: Quarterly Average Traffic Levels at TP2 Etturavattam

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	8,011	7,751	7,858	4,584	6,908	7,160	7,095	6,436	7,131	(9.2%)
LCV	1,207	983	1,074	676	816	779	813	771	796	(25.9%)
Bus	1,071	916	947	388	834	971	958	787	964	1.8%
2A	513	787	703	568	734	752	839	723	795	13.2%
3A	295	325	312	235	320	301	328	296	315	0.9%
MAV	608	634	618	481	620	637	700	609	668	8.2%
Total	**11,704**	**11,397**	**11,511**	**6,931**	**10,234**	**10,599**	**10,733**	**9,621**	**10,670**	**(7.3%)**
PCU	**17,475**	**17,416**	**17,405**	**10,764**	**15,857**	**16,512**	**17,012**	**15,029**	**16,765**	**(3.7%)**

Source: Steer analysis of Client data, #FY22 is the average traffic from Oct-21 to Mar-22 for comparison with FY21

Figure 3.2 Vehicle share at TP2 Etturavattam



Source: Steer analysis of Client data

3.9 As seen in the chart and the figure above, traffic at TP2 Etturavattam, Cars have lower traffic volumes in comparison to volumes at TP1 Kappalur, but is still the largest contributor to the overall traffic. CJVs have a share of around 67% while all the goods vehicles make up for around 25% of the traffic. The rationale for high shares of CJV traffic can be attributed to the presence of the large urban settlements and pilgrim sites on the Asset.

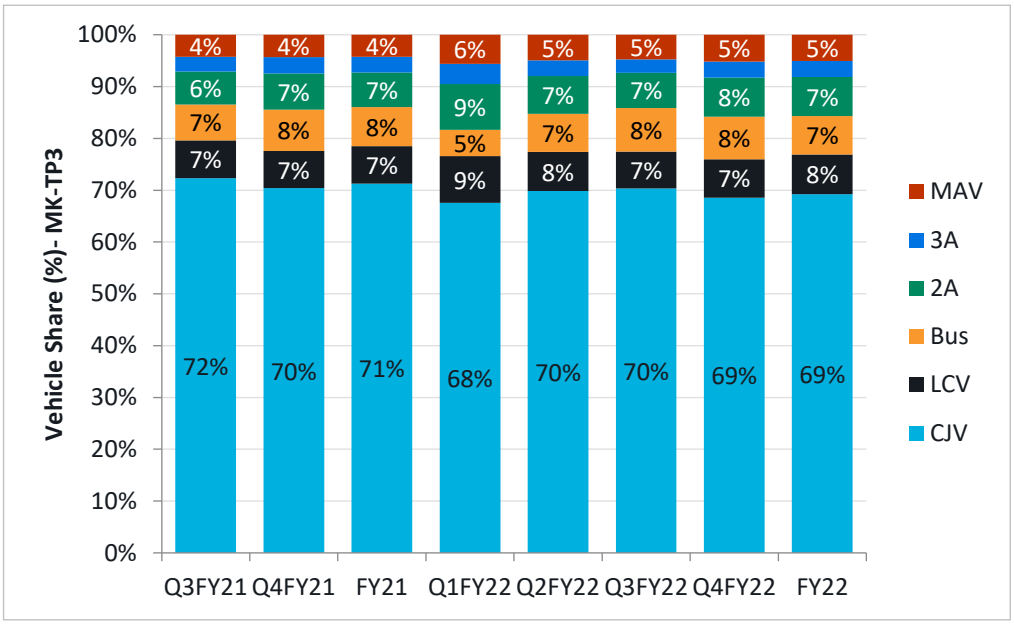
3.10 Major trip generators on this Asset are Madurai, Tirunelveli, Kovilpatti etc. and around 26% of the trips are generated from/to these settlements. The levels of Goods vehicles can be rationalised by the presence of cement plants in the vicinity of the Asset and can be confirmed by the commodity analysis as well, the major trip generators for the goods traffic are Madurai, Tirunelveli, Dindigul etc.

Table 3.3: Quarterly Average Traffic Levels at TP3 Salaipudhur

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	7,762	7,374	7,545	4,333	6,632	6,777	6,680	6,104	6,731	(10.8%)
LCV	780	750	761	581	714	687	725	676	706	(7.1%)
Bus	742	835	801	325	698	810	799	658	805	0.5%
2A	684	732	706	566	694	652	731	660	691	(2.1%)
3A	302	333	320	248	287	252	302	272	277	(13.3%)
MAV	459	451	451	362	469	458	506	448	482	6.9%
Total	**10,730**	**10,476**	**10,583**	**6,414**	**9,494**	**9,637**	**9,743**	**8,819**	**9,692**	**(8.4%)**
PCU	**15,640**	**15,697**	**15,661**	**9,822**	**14,296**	**14,472**	**14,943**	**13,377**	**14,709**	**(6.1%)**

Source: Steer analysis of Client data, #FY22 is the average traffic from Oct-21 to Mar-22 for comparison with FY21

Figure 3.3 Vehicle share at TP3 Salaipudhur



Source: Steer analysis of Client data

3.11 The chart and the figure above depict the variation of traffic at TP3 Salaipudhur over different quarters in FY21 and FY22. Cars are the predominant category at this Asset and have the similar levels of average traffic volumes when compared to TP2 Etturavattam as these Assets are located in a similar inter-urban location and in a region with high urbanisation. This Asset attracts the trips generated from/to Madurai, Tirunelveli, Kovilpatti and tourism trips towards Kanyakumari as well. The goods vehicles share on this Asset is ranging above 20% over the dataset and this traffic is majorly linked to the presence of cement factories and SIDCO industrial complexes in the vicinity of the Asset.

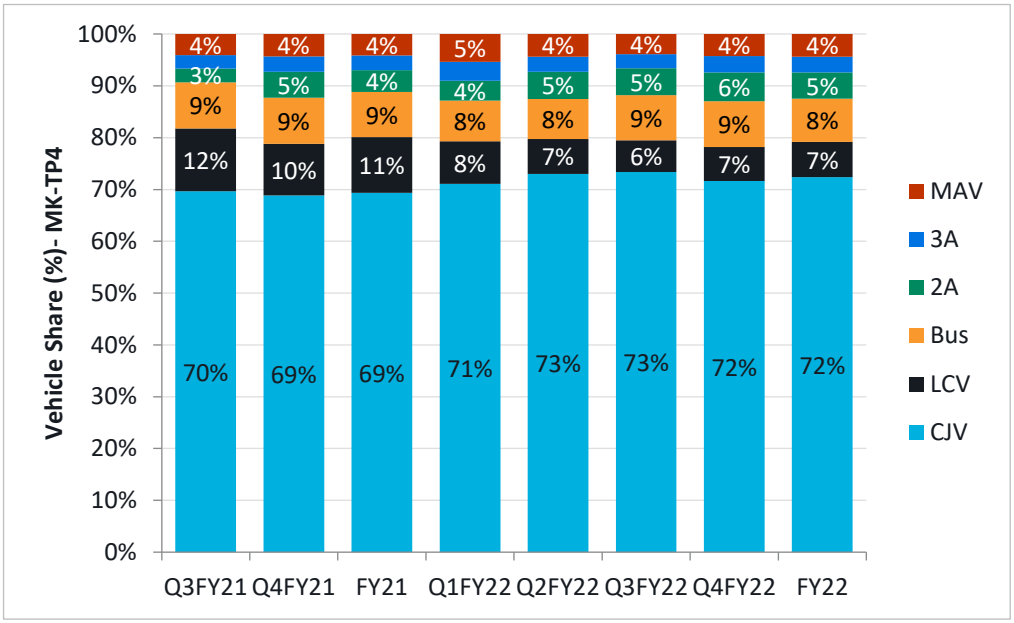
Table 3.4: Historical traffic at TP4 Nanguneri

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
CJV	8,351	8,429	8,412	5,401	8,395	8,732	8,429	7,736	8,583	2.0%

Mode	Q3FY21	Q4FY21	FY21	Q1FY22	Q2FY22	Q3FY22	Q4FY22	FY22	FY22#	FY22# vs FY21
LCV	1,446	1,218	1,308	626	776	726	772	725	749	(42.8%)
Bus	1,072	1,092	1,055	599	884	1,040	1,045	891	1,042	(1.2%)
2A	317	612	516	291	608	620	650	542	635	23.0%
3A	313	370	343	275	331	319	374	324	346	0.8%
MAV	487	525	500	409	506	465	501	470	483	(3.4%)
Total	**11,985**	**12,245**	**12,133**	**7,601**	**11,500**	**11,900**	**11,771**	**10,689**	**11,837**	**(2.4%)**
PCU	**17,239**	**18,219**	**17,772**	**11,192**	**16,707**	**17,297**	**17,456**	**15,655**	**17,377**	**(2.2%)**

Source: Steer analysis of Client data, #FY22 is the average traffic from Oct-21 to Mar-22 for comparison with FY21

Figure 3.4 Vehicle share at TP4 Nanguneri



Source: Steer analysis of Client data

3.12 As seen in the chart and the figure above, traffic at TP4 Nanguneri over the data period of 17 months follow the similar trend as the TP-2 and TP-3 because of the similar characteristics in terms being located in a highly urbanised area. The major trip generators for the CJV traffic on this Asset are Tirunelveli and Kanyakumari as more than 20% of the trips are attributed to these settlements. As for the goods traffic on this Asset major contributors of the trips are generated from/to Tirunelveli, Kanyakumari and Tuticorin which is a port city. Average traffic overall has reduced by 2.4% over Q3 and Q4 of FY22 and FY21.

3.13 Overall traffic has seen a minor drop in the FY22 which can be attributed to the two COVID-19 waves in Q1FY22 and Q4FY22 and the above average rainfall across the Asset, and more importantly the FY21 average traffic data is of the period which had a pent-up demand post first wave of COVID-19.

3.14 As the Assets form one contiguous road section, the traffic composition is almost similar across all Assets i.e.; CJVs having the dominant share of the traffic, because of the interurban characteristic of the corridor, location of tourist and pilgrim sites in the vicinity of the corridor. TP1 therefore observes the highest MADT among the four toll plazas as it is situated in the

vicinity of Madurai and the suburb of Tirumangalam. A similar observation can also be made for TP4 as it is situated between Tirunelveli and Kanyakumari and hence observes greater MADT than TP2 and TP3.

3.15 A major reduction of traffic numbers of the LCV category in the FY22 over MK1, MK2 and MK4 Assets as compared to historical volumes observed on the Asset. This can be explained partly by a reclassification of a number of LCV's into Mini-LCV, which are now reported under the CJV category. This reclassification is driven by the mandatory implementation of FASTag starting Feb-21, where several Mini-LCV's which were being tolled as LCV's are now being tolled under the Mini-LCV category. As per the vehicle classes defined by National Electronic Toll Collection (NETC) and Motor Vehicle act, if the Gross Vehicle Weight (GVW) of the vehicle does not exceed 7,500kg should be classified as a "Light Motor Vehicle (LMV)". Hence, the mini-LCVs which were being classified as the LCVs are now being reported under the CJV category.

Historical Revenue

3.16 The following table shows the revenue (in INR Lakhs) by each vehicle type at the toll plaza for FY21 and FY22.

Table 3.5: Revenue (INR Lakhs) by vehicle type at TP1 Kappalur

FY	CJV	LCV	Bus	2A	3A	MAV	OSV	Total	AADC (lakhs/day)
FY21*	1,694	363	291	395	247	531	2	**3,522**	**22**
FY22	3,412	589	824	927	522	1,248	3	**7,526**	**20**

Source: Steer analysis of Client data, * From Oct-20 (last 12 days) to Mar-21

Table 3.6: Revenue (INR Lakhs) by vehicle type at TP2 Etturavattam

FY	CJV	LCV	Bus	2A	3A	MAV	OSV	Total	AADC (lakhs/day)
FY21*	919	210	254	265	144	398	2	**2,193**	**13.5**
FY22	1,645	327	470	625	299	905	4	**4,275**	**11.7**

Source: Steer analysis of Client data, * From Oct-20 (last 12 days) to Mar-21

Table 3.7: Revenue (INR Lakhs) by vehicle type at TP3 Salaipudhur

FY	CJV	LCV	Bus	2A	3A	MAV	OSV	Total	AADC (lakhs/day)
FY21*	1,030	170	222	285	143	348	3	**2,202**	**13.5**
FY22	1,853	349	503	646	300	820	5	**4,476**	**12.3**

Source: Steer analysis of Client data, * From Oct-20 (last 12 days) to Mar-21,

Table 3.7: Revenue (INR Lakhs) by vehicle type at TP4 Nanguneri

FY	CJV	LCV	Bus	2A	3A	MAV	OSV	Total	AADC (lakhs/day)
FY21*	1,059	281	229	219	170	359	3	**2,320**	**14**
FY22	2,008	305	539	465	342	734	4	**4,398**	**12**

Source: Steer analysis of Client data, * From Oct-20 (last 12 days) to Mar-21,

3.17 Tables above present, the revenue for all the Assets on the Madurai Kanyakumari section. It can be inferred from the data that major contributor to the revenue of the Assets is the CJV

category which has a share ranging from 38% to 45% of overall revenue across the Assets followed by MAVs which contribute to over 17% of the overall revenue in case of MK1, MK3 and MK4 Assets whereas for the MK2 asset the MAV revenue share is around 21%. The annual average daily collection (AADC) has reduced over all the Assets for the FY22 in comparison to FY21. The reduction is average daily revenue in FY22 can be a result of multiple factors—two COVID-19 waves in Q1FY22 and Q4FY22, above average monsoon witnessed in FY22 and the dataset for FY21 being partial and more importantly of the period (Q3FY2 and Q4FY21) which had a pent-up demand post first wave of COVID-19.

Toll Frequencies

3.18 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculated the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.19 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets as long haul trips are attributed to this vehicle category. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the Asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.20 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows for a return journey within a day with a 50% discount on the return trip.
Monthly Pass	Discounted single entry ticket for users who undertake multiple trips within a month can buy the monthly pass.
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.21 Further, the toll plazas also record violations which are non-paying users, who are not officially allowed under exemptions category but are forced exemptions. For the Asset, the segmentation discussed below reports Exemption and violations together.

3.22 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year,

two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

Impact of FASTag implementation

3.23 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.5: Timeline of national ETC implementation.

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: Source: NHAI.gov.in and Wikipedia

3.24 With the FASTag implementation in December 2019, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation. The main advantage of FASTag can be seen in efficient tolling operations as well as increased compliance at tolls.

3.25 On the Assets, for March-22 the MAVs have reached almost 100% ETC penetration over all the Assets. While for CJV category the ETC penetration levels are >90% except for the Kappalur Asset where the ETC share for the CJV traffic is around 80%. The increased use of FASTag in FY22 ensured efficient tolling operations as well as increased compliance. These high penetration levels have led to improvement in overall service levels of the toll plaza and reduction in the transaction time.

Table 3.6: Percentage of Traffic via FASTag, March 2022

Toll Plaza	CJV	LCV	Bus	MAV
Kappalur	81%	91%	44%	99%
Etturavattam	92%	98%	65%	99%
Salaipudhur	91%	98%	66%	99%
Nanguneri	92%	92%	59%	100%

Source: Steer Analysis of Client Data

Share of traffic by payment type

3.26 FY21 was a partial year in terms of operation of the toll plazas. Further, there was a change in ticket patterns due to the mandatory implementation of FASTag as a mode of payment (share of single tickets increased in FY21). FY22 was also impacted by 2nd wave of COVID-19 in Q1 and Q2 of FY22. Hence during this period travel patterns were also disrupted, with more shorter trips being undertaken since several states implemented state entry barriers, resulting in an increase in the proportion of short distance trips. By Q3FY22 travel patterns returned to

normal levels and hence, it is assumed that segmentation from Oct-21 onwards can be following normal travel behaviour on the Assets.

3.27 The table below show ticket segmentation for CJV category over FY21 and FY22.

Table 3.7: Ticket Segmentation for CJV category for all the Assets

Ticket Category	MK1			MK2			MK3			MK4		
	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#
Single	48%	32%	32%	59%	47%	48%	58%	44%	45%	51%	31%	31%
Return	32%	47%	47%	30%	44%	44%	30%	46%	46%	35%	56%	57%
Local commercial	2%	3%	2%	1%	1%	1%	1%	1%	1%	2%	3%	3%
Monthly	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Local personal	2%	2%	2%	3%	3%	3%	1%	2%	1%	3%	4%	4%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exemption	16%	16%	17%	7%	5%	5%	9%	7%	7%	9%	6%	4%

Source: Steer Analysis, #FY22 is the average segmentation from Oct-21 to Mar-22

3.28 As shown in the table above it can be seen that single ticket journeys have reduced in the FY22# (Oct-21 to Mar-22) in comparison to FY21 while the maximum change can be seen in MK4. The exemptions have decreased over all the Assets except the MK1 Asset. Looking at the Assets overall, the share of return tickets has increased. This shift of segmentation can be attributed to the strict implementation of FASTag all over the country. This can also be inferred by the OD analysis, discussed in detail in subsequent sections, more than 60% of the CJV traffic has the trip length in the range of (0-300 kms) that is most of the traffic is doing local and medium distance trips, hence higher share of the return trips on the Assets.

3.29 The table below show ticket segmentation for MAV category over FY21 and FY22

Table 3.8: Ticket Segmentation for MAV category for all the Assets

Ticket Category	MK1			MK2			MK3			MK4		
	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#
Single	83%	82%	82%	65%	64%	61%	68%	68%	68%	57%	47%	47%
Return	16%	17%	17%	30%	32%	34%	28%	28%	29%	41%	52%	52%
Local commercial	0%	1%	1%	4%	3%	4%	3%	3%	2%	1%	0%	0%
Monthly	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Exemption	1%	1%	1%	1%	1%	1%	1%	1%	2%	1%	0%	0%

Source: Steer Analysis, #FY22 is the average segmentation from Oct-21 to Mar-22

3.30 As shown in the table above it can be seen that single ticket journeys have remained constant over all the Assets in the FY22# (Oct-21 to Mar-22) in comparison to FY21 except for MK4 where the single category has reduced in the FY22 from 57% to 48% and return has increased by 10% at MK4 which can be explained by following factors – over 60% of local and short trips

as per the OD analysis on the MK4 Asset, hence, the high share of return trips which are being discounted after the implementation of FASTag.

3.31 The table below show ticket segmentation for MAV category over FY21 and FY22

Table 3.9: Ticket Segmentation for Bus category for all the Assets

Ticket Category	MK1			MK2			MK3			MK4		
	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#	FY21	FY22	FY22#
Single	8%	6%	6%	14%	11%	10%	11%	11%	11%	10%	9%	7%
Return	14%	19%	19%	36%	36%	34%	33%	37%	37%	27%	33%	24%
Local commercial	3%	6%	6%	3%	4%	5%	1%	1%	1%	3%	3%	3%
Monthly	2%	11%	12%	8%	22%	18%	8%	24%	20%	14%	25%	24%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	0%	0%	0%	0%	0%	27%	0%	0%	0%	41%
Exemption	73%	59%	57%	40%	27%	33%	48%	11%	33%	47%	30%	7%

Source: Steer Analysis, #FY22 is the average segmentation from Oct-21 to Mar-22

3.32 As shown in the table above it can be seen that single ticket journeys have reduced over all the Assets in the FY22# (Oct-21 to Mar-22) in comparison to FY21 except MK3 where this share has remained stable. A high share of non-tollable exempted traffic is seen across the Assets, because of the local nature of the bus traffic. A major reduction can be seen in the exemption category because of the strict implementation of FASTag and this exempted non-paying category traffic has been converted into the Monthly passes and local commercial tickets. However a large proportion of buses continue to not pay on each of the toll plazas.

Data Collection exercise

3.33 As mentioned previously, to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. Both OD surveys and TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.10: Data collection exercise

Asset	7-day videography-based TVC			1-day OD survey	
	Start date	End date	Time (hrs)	Start date	Start time
Kappalur	18 Jan 2021	24 Jan 2021	0000-2359	20 Jan 2021	0900 hours
Etturvattam	18 Jan 2021	24 Jan 2021	0000-2359	20 Jan 2021	0900 hours
Salaipudhur	18 Jan 2021	24 Jan 2021	0000-2359	21 Jan 2021	0900 hours
Nanguneri	18 Jan 2021	24 Jan 2021	0000-2359	21 Jan 2021	0900 hours

Source: Steer analysis

3.34 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.35 Taking an average of the seven-day TVC counts (18th Jan – 24th Feb 2021), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Table 3.11: WADT from TVC counts

Toll Plaza	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
Kappalur	16,703	2,189	2,628	3,414	1,072	613	791	-	27,409
Etturvattam	7,526	806	1,391	1,172	638	306	699	-	12,538
Salaipudhur	6,974	828	1,333	1,044	608	282	458	-	11,527
Nanguneri	8,452	930	1,331	1,167	527	327	532	-	13,266

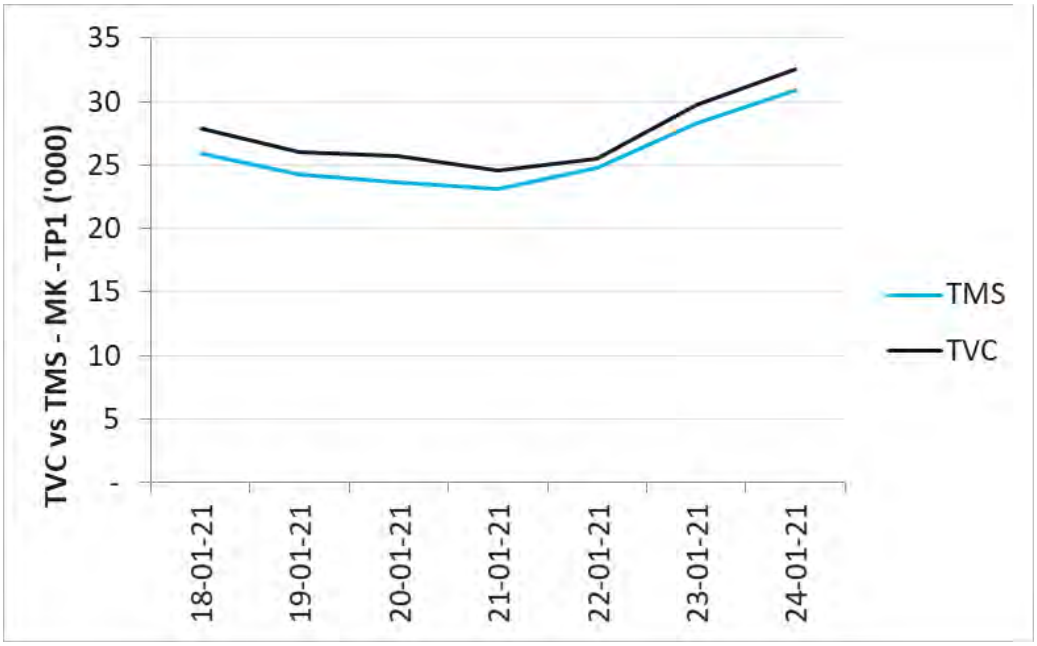
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.36 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those days, as provided by the Client.

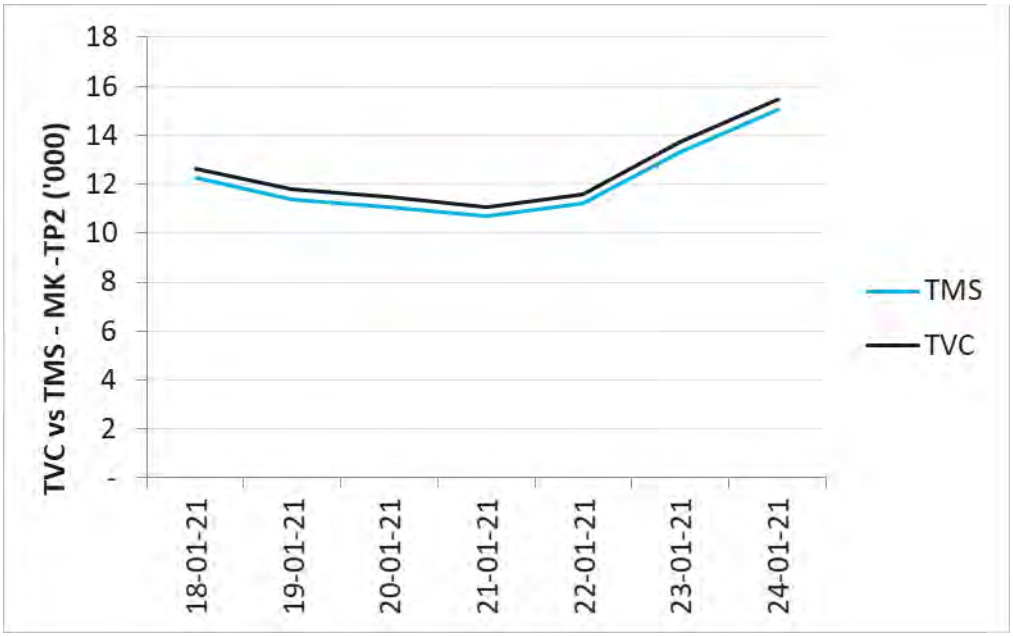
3.37 The following figures show the comparison between the daily traffic observed by TVC and TMS for the four toll plazas. As can be seen from the figures, the overall difference between TVC and TMS over the week for the four toll plazas is within the acceptable range of variation.

Figure 3.5: Comparison between TVC and TMS daily traffic data on TP1



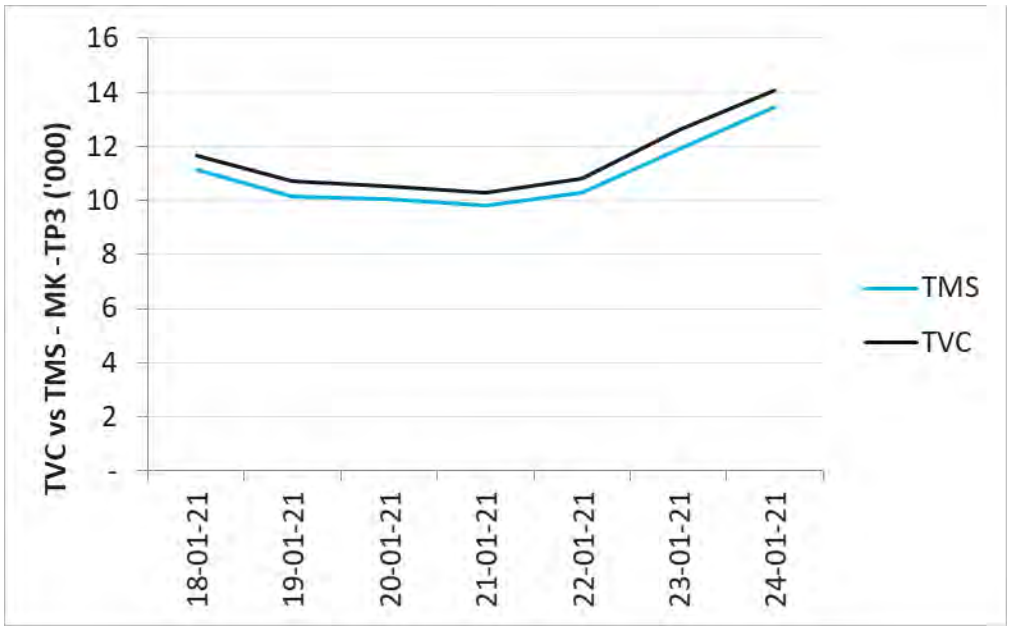
Source: Steer analysis of TVC and Client TMS data

Figure 3.6: Comparison between TVC and TMS daily traffic data on TP2



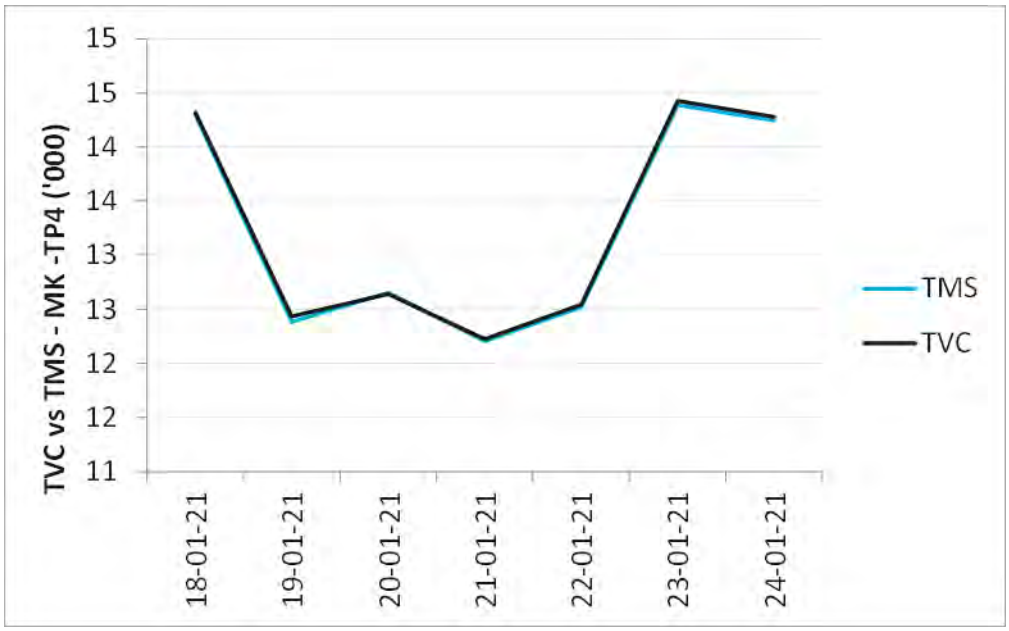
Source: Steer analysis of TVC and Client TMS data

Figure 3.7: Comparison between TVC and TMS daily traffic data on TP3



Source: Steer analysis of TVC and Client TMS data

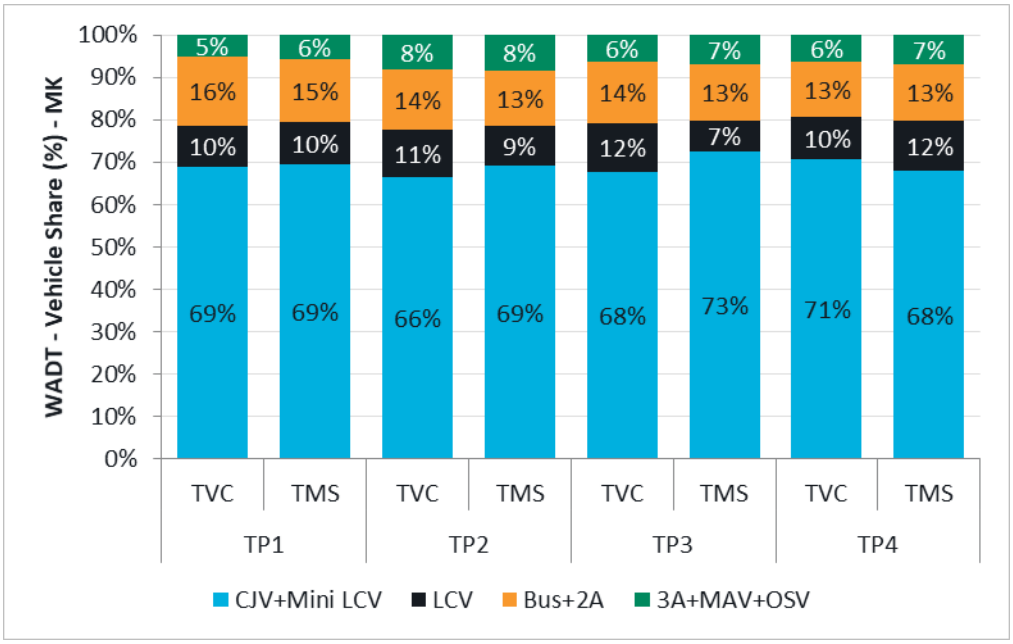
Figure 3.8: Comparison between TVC and TMS daily traffic data on TP4



Source: Steer analysis of TVC and Client TMS data

3.38 The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. As can be seen, whilst the share of CJVs and 3A+MAV+OSV is marginally higher for TMS compared to TVC, it is equal for bus/2A and lower for LCV category. This difference can be attributed to common misclassification of vehicle categories.

Figure 3.9: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.39 Considering the smaller variation between the TVC and TMS data for the largest revenue generator 3A+MAVs, and an overall match in the traffic volumes, our TVC-TMS analysis gives us confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.40 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. As mentioned previously, the OD analysis presented here has been based on the data collected on 20th-21st January 2021.

3.41 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.42 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.43 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TMS data) during the same time period.

The table below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.12: Sample rates for OD data

Vehicle type	TP1 Kappalur	TP2 Etturvattam	TP3 Salaipudhur	TP4 Nanguneri
Car	20%	16%	43%	30%
Mini Bus + Bus	57%	38%	67%	83%
Mini LCV + LCV	39%	34%	48%	43%
2A Truck	111%	35%	110%	79%
3A Truck	71%	35%	83%	81%
MAV + OSV	47%	28%	52%	42%
Total	34%	23%	52%	41%

Source: Steer analysis of OD data

Zone Categories

3.44 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.13: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Tamil Nadu (TN)	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Kerala	Kerala
Karnataka	Karnataka
AP & Telangana	Andhra Pradesh and Telangana
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir etc
West India	Gujarat and Maharashtra
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states

Source: Steer analysis

Zonal Influence

3.45 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[12] at each toll plaza of each Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.46 It is seen that the local, IAOI, and Rest of TN zonal shares – making up Tamil Nadu together - constitute the majority of zonal influence for all vehicle types – with more than 95% for CJVs to about 85% for MAVs. As expected, heavier vehicles have more movement to/from the rest of the state and country. This analysis is further supported by the top 10 OD pairs, given in the appendix which show that the majority of the trips originate and end in areas which are in either of the three zonal categories mentioned above.

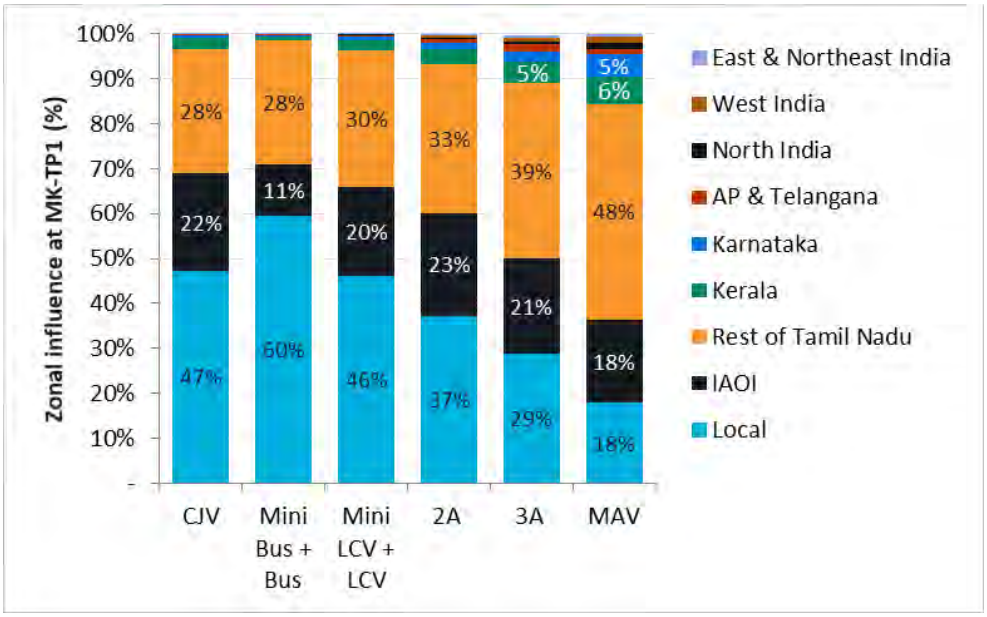
3.47 As can be seen from the following figures, at TP1 Kappalur, there is a higher share of local trips for both the passenger and commercial vehicles wherein Local and IAOI zones such as Madurai, Tirumangalam, Virudhunagar etc have the greatest influence on CJV, Buses and LCV, with around 70% of the total share. These shares decrease with axle numbers, indicating that majority of the local movement is led by smaller vehicles. There is also a significant influence on the heavy goods traffic from areas in rest of the state like Tirunelveli, Chennai, Kanyakumari and Coimbatore with 39% and 48% influence on 3A and MAV traffic respectively.

3.48 Going from Kappalur towards Nanguneri, the local zones have decreasing influence while IAOI and rest of Tamil Nadu zones have increasing influence. This is understandable given that the southern stretch of the Asset has more urban villages and towns located further away from the highway. For example, at TP2 Etturvattam and TP4 Nanguneri, more than 50% of the zonal influence across all vehicle categories are from areas in the rest of the state and at TP3 Salaipudhur, majority of the influence on traffic is from IAOI areas such as Madurai, Kanyakumari, Kovilpatti, Virudhunagar etc with 38% and 33% influence on 3A and MAV traffic respectively.

3.49 Outside Tamil Nadu, areas in Kerala such as Thiruvananthapuram has the highest influence of about 5-6% on traffic across all toll plazas because the Asset connects the southern part of Tamil Nadu to Kerala, wherein Thiruvananthapuram and Kanyakumari districts are culturally connected cities with inter-urban traffic movements.

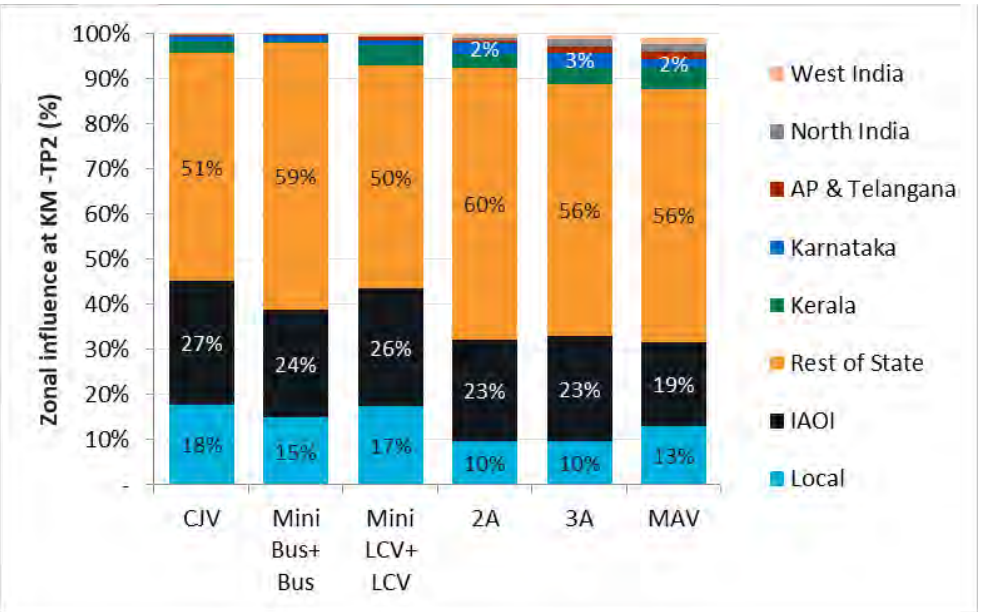
[12] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.10: Zonal influence at TP1 Kappalur



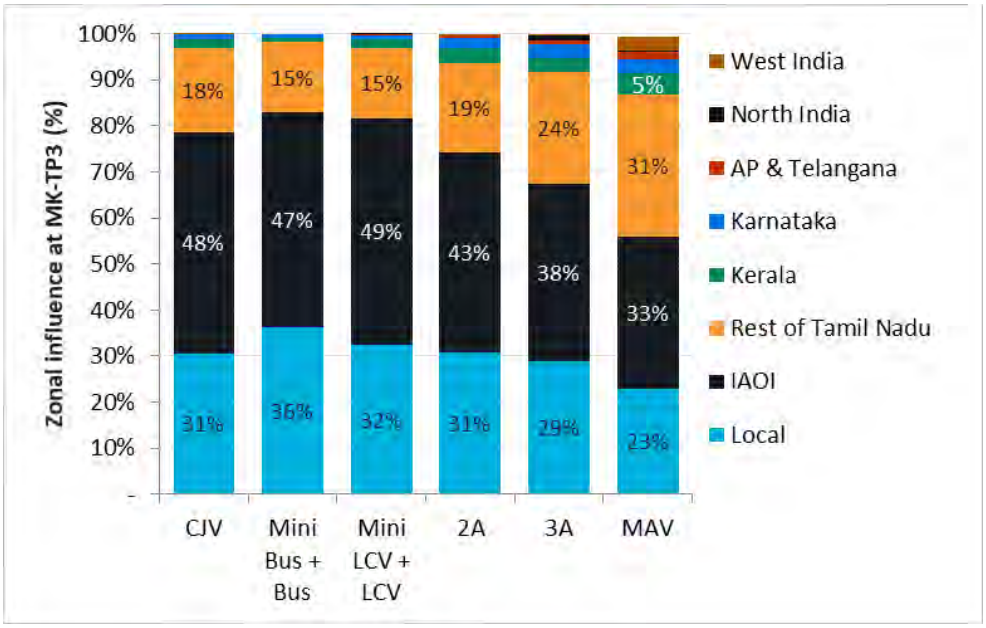
Source: Steer analysis of OD data

Figure 3.11: Zonal influence at TP2 Etturvattam



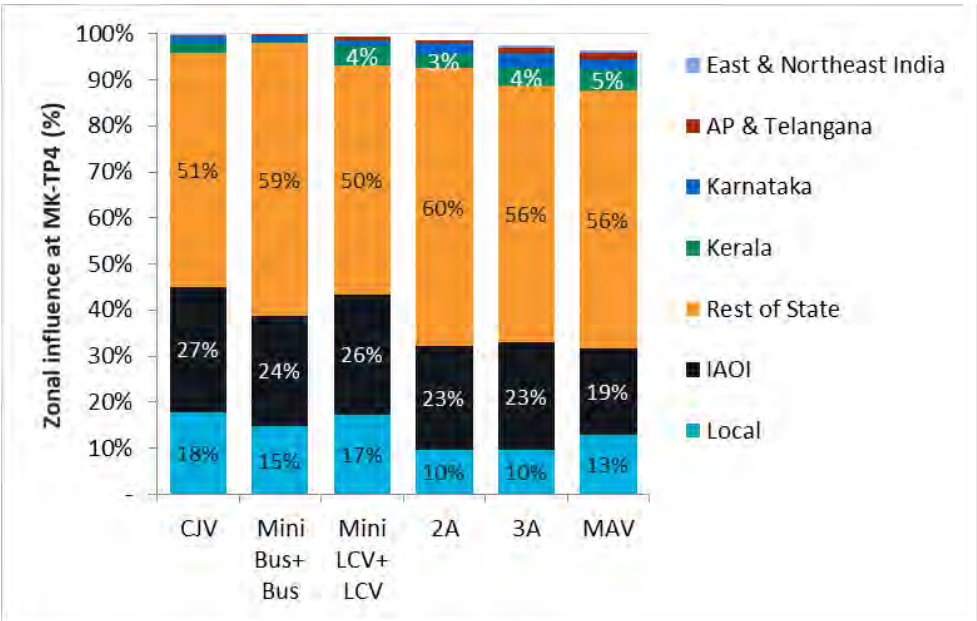
Source: Steer analysis of OD data

Figure 3.12: Zonal influence at TP3 Salaipudhur



Source: Steer analysis of OD data

Figure 3.13: Zonal influence at TP4 Nanguneri



Source: Steer analysis of OD data

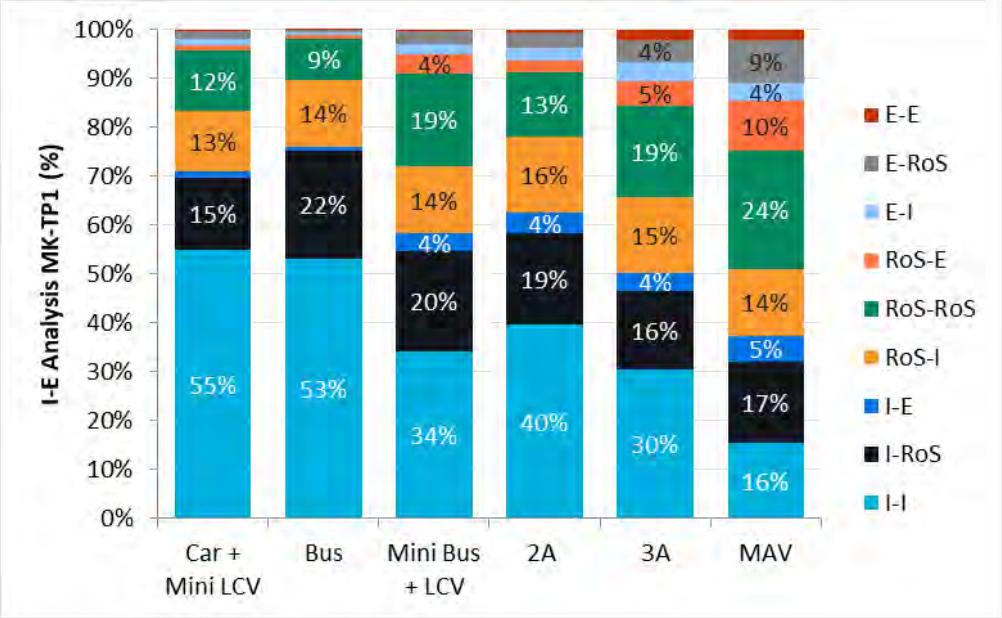
Internal External analysis

3.50 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local or IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

3.51 The figure below shows the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

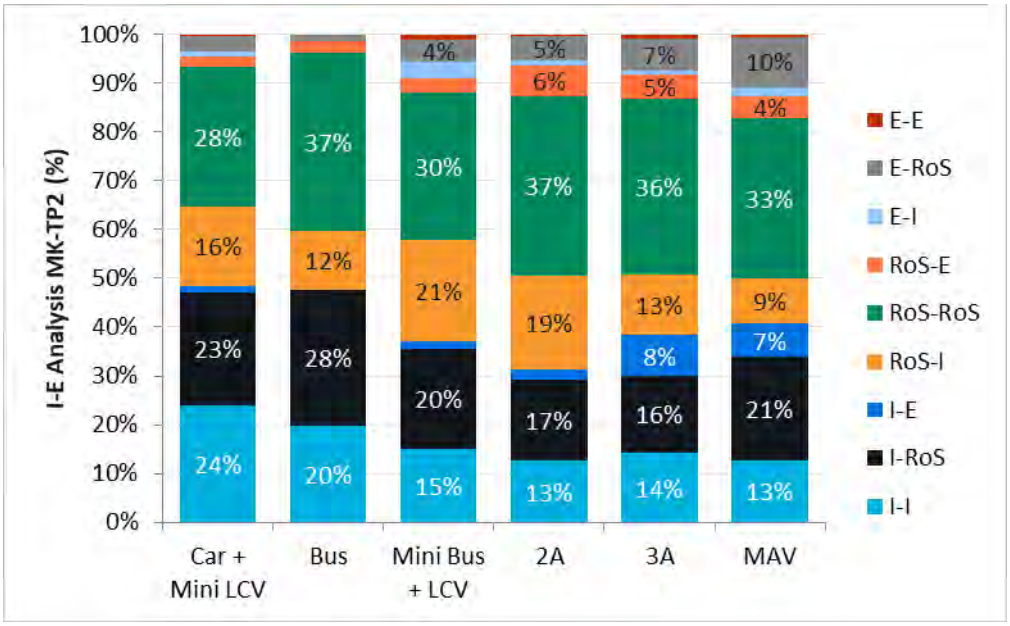
3.52 In line with our understanding from zonal influence analysis above and site visits, it is seen that a significant amount of trips either originate and end internally i.e within local or IAOI zones or have at least one end of the trip in RoS with very less E-E movement of traffic on the Asset across all toll plazas. At TP1 Kappalur, more than 50% of the passenger trips are Internal-Internal with this share decreasing for the goods vehicle traffic wherein the majority of the trips originate in and are destined towards areas in the rest of the state like Chennai, Coimbatore, Tirunelveli etc. This share is even higher at TP2 Ettuvartam wherein RoS-RoS trips are the highest across all vehicle categories. At TP3 Salaipudhur and TP4 Nanguneri, apart from the high I-I movement seen especially in passenger traffic, the goods vehicle traffic sees a high number of trips originating from RoS and ending at internal areas near the Asset.

Figure 3.14: Internal-external distribution at TP1 Kappalur



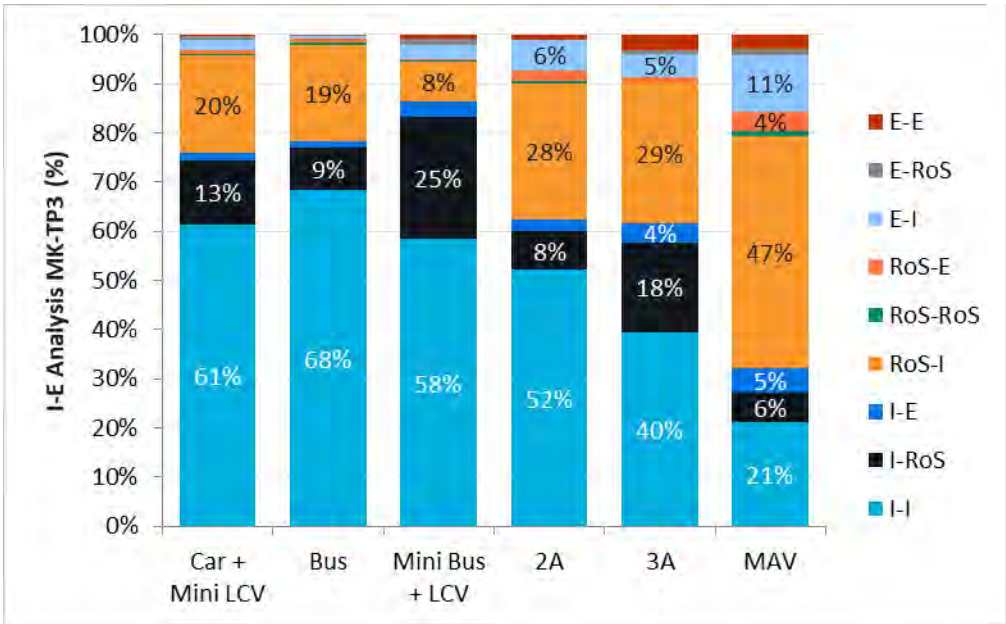
Source: Steer analysis of OD data

Figure 3.15: Internal-external distribution at TP2 Etturvattam



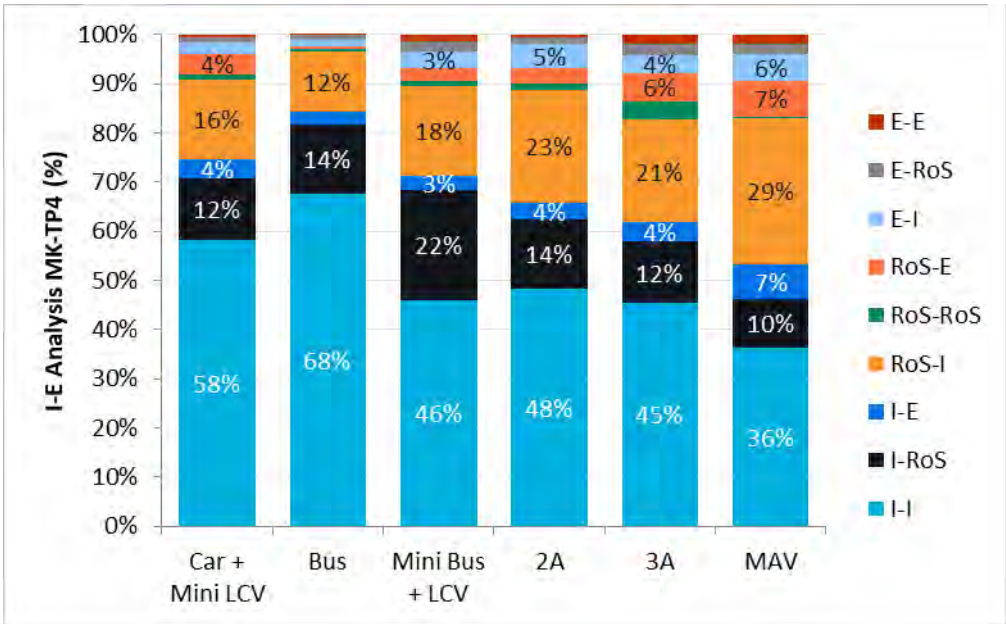
Source: Steer analysis of OD data

Figure 3.16: Internal-external distribution at TP3 Salaipudhur



Source: Steer analysis of OD data

Figure 3.17: Internal-external distribution at TP4 Nanguneri



Source: Steer analysis of OD data

Commodity distribution

3.53 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Live Stock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN

Commodity Description	Code	Combined codes used for charts
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN
Cement	CMT	CMT

Source: Steer analysis

3.54 The commodity analysis from the OD data shows that overall manufacturing items is the main commodity item being carried on the Asset across all toll plazas followed by agricultural and grocery items. Also, cement seems to be a key commodity that is carried by MAVs especially at TP3 Salaipudhur wherein more than 40% of the MAVs transported Cement on the Asset. The high commodity share of manufacturing items could be attributed to the presence of several industrial estates along the Asset such as the Tamil Nadu Small Industries Corporation (SIDCO) industrial estate at Kappalur, industrial city of Tuticorin and an industrial estate in Gangaikondan, Tirunelveli.

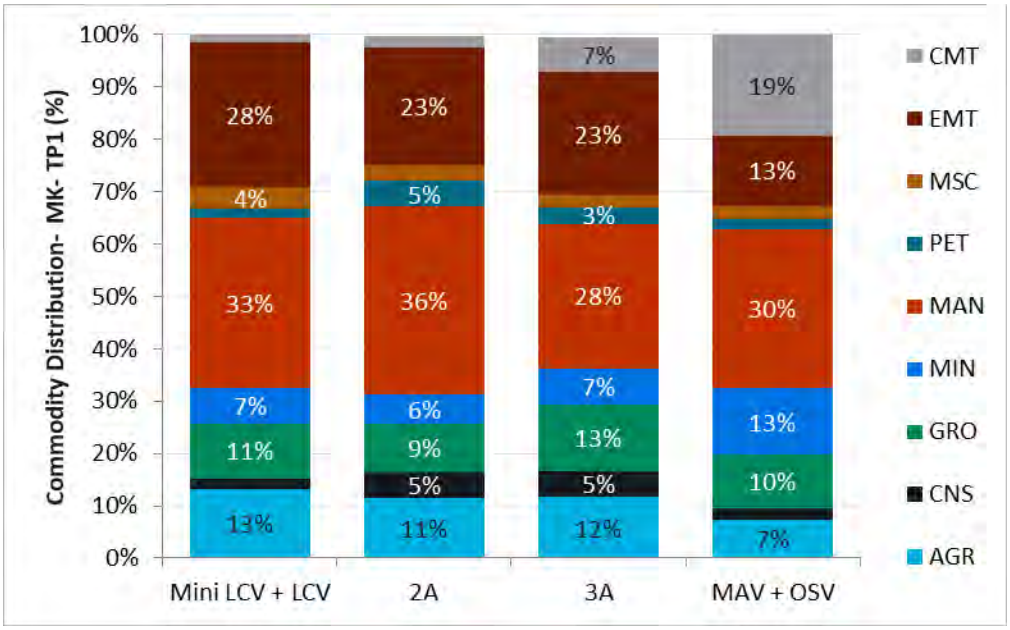
3.55 At TP1 Kappular, manufacturing items such as medicines, machine parts, paint etc is the key commodity carried by both light and heavy goods vehicle making up for a 30% share across all vehicle categories. Direction wise, it is seen that a significantly higher share (26%) of MAV and OSV carried cement in the direction of Tirunelveli compared to those moving towards Madurai which could be attributed to the presence of India Cements plant just north of Tirunelveli and Ramco Cements near Virudhunagar.

3.56 At TP2 Etturvattam, grocery items such as biscuits, juice, sweets and other household items make up for the top commodity item that is carried by both the light and heavy goods vehicle with a 17% share for MAV and 22% share for 3A traffic, given the proximity of highly urbanised cities such as Madurai, Virudhunagar,Tirunelveli making up for the regional consumption demand. Direction wise, a relatively higher share of MAVs (more than 30%) moving towards Kanyakumari carried cement compared to those moving in the direction of Madurai.

3.57 At TP3 Salaipudhur, manufacturing items are at the top of the commodity mix for light good vehicles and 3A traffic, however, more than 40% of the MAV traffic is dedicated towards carrying cement given the proximity of the toll plaza to cement plants nearby. Direction wise, there is a higher share of light good vehicles carrying agriculture and grocery items in the direction of Kanyakumari with around 44% of the MAV carrying cement. A larger share of light good vehicles at several plazas show a considerable share of empty vehicles, given the regional and short- to medium-distance movement of commodities.

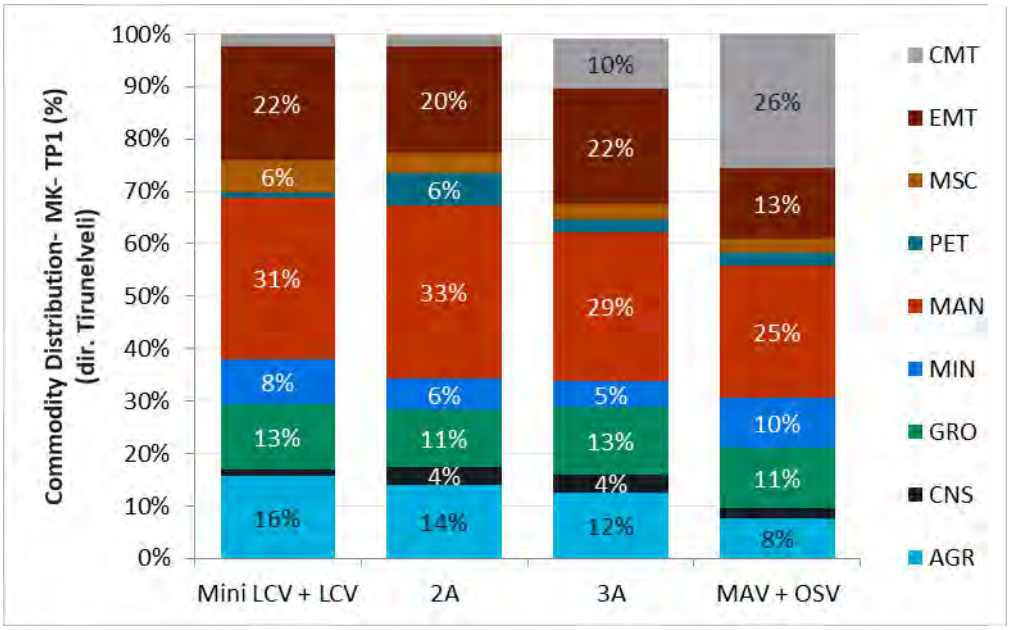
3.58 At TP4 Nanguneri, agriculture items are the top commodity category for light good vehicles whereas manufacturing items, cement and construction items make up for a high share in the overall commodity mix for 3A and MAV traffic. Direction wise, there is a relatively higher share of heavy goods traffic carrying cement, agriculture items and construction material in the direction of Kanyakumari and a very high share of empty light and heavy goods vehicle moving in the direction of Madurai.

Figure 3.18: Commodity distribution at TP1 Kappalur (Total)



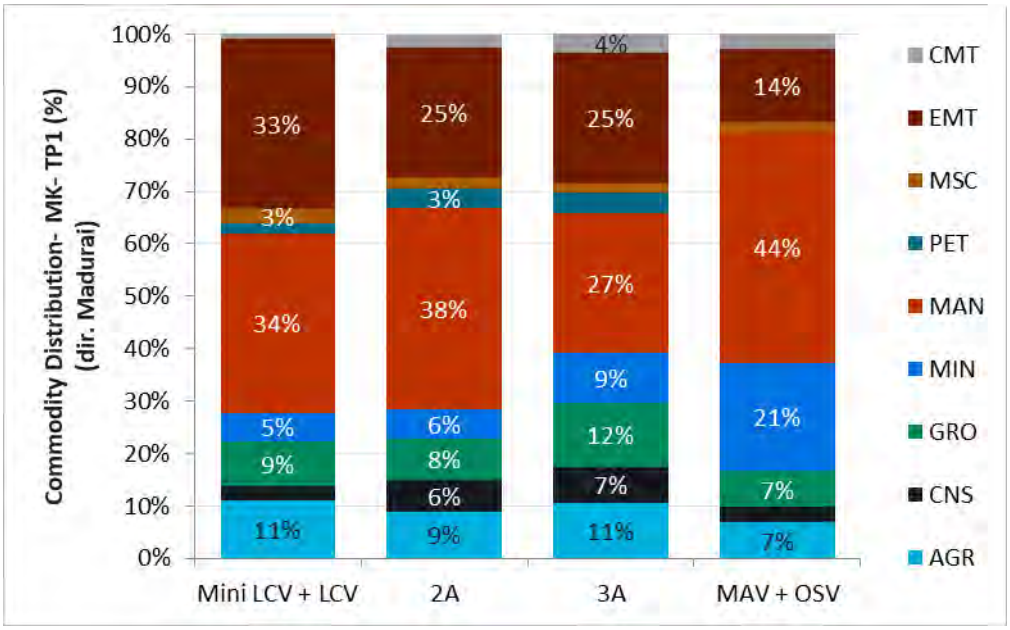
Source: Steer analysis of OD data

Figure 3.19: Commodity distribution at TP1 Kappalur (towards Tirunelveli)



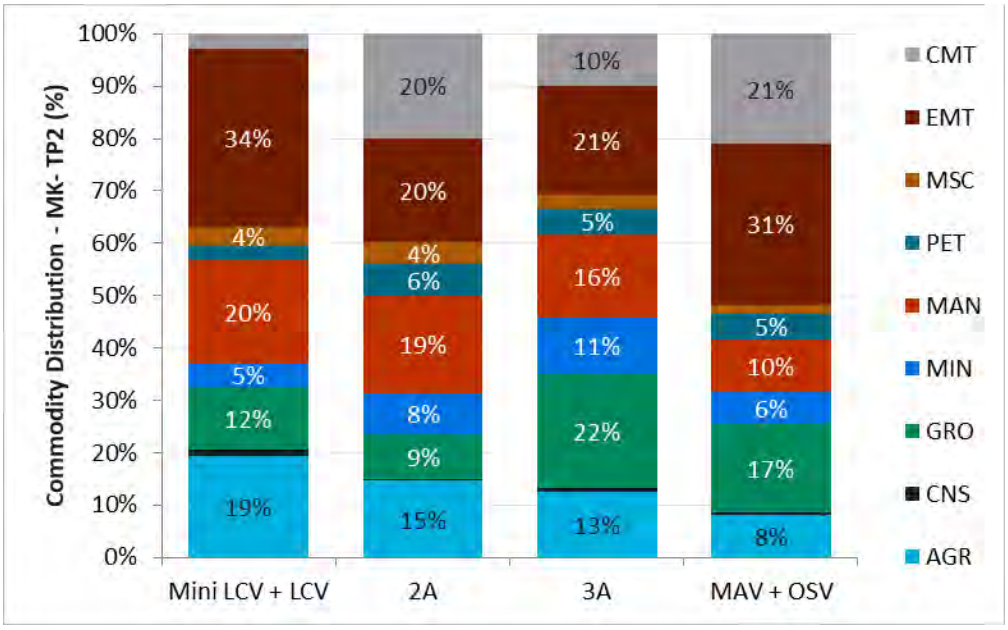
Source: Steer analysis of OD data

Figure 3.20: Commodity distribution at TP1 Kappalur (towards Madurai)



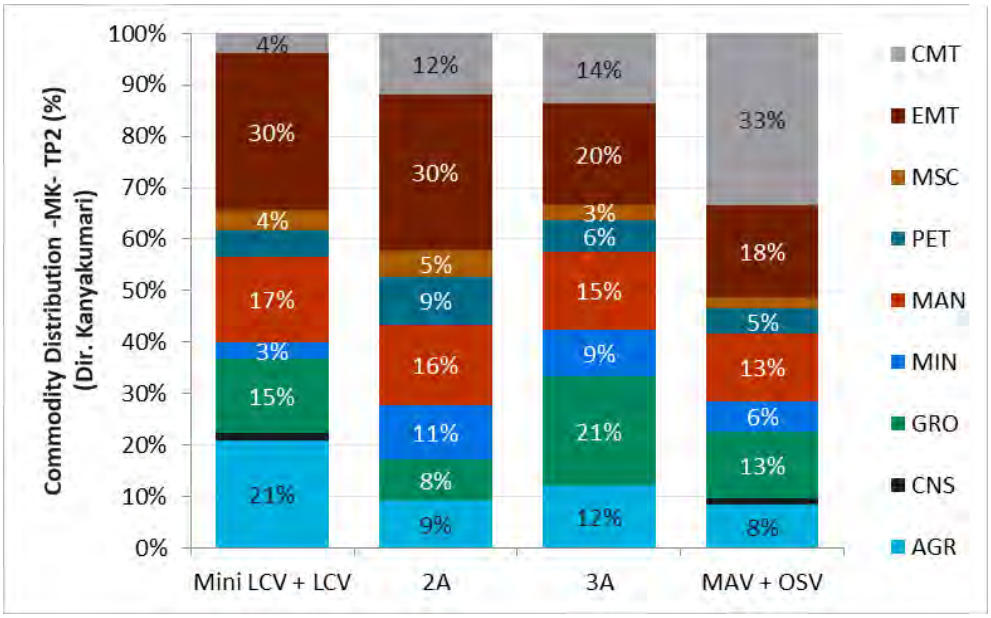
Source: Steer analysis of OD data

Figure 3.21: Commodity distribution at TP2 Etturvattam (Total)



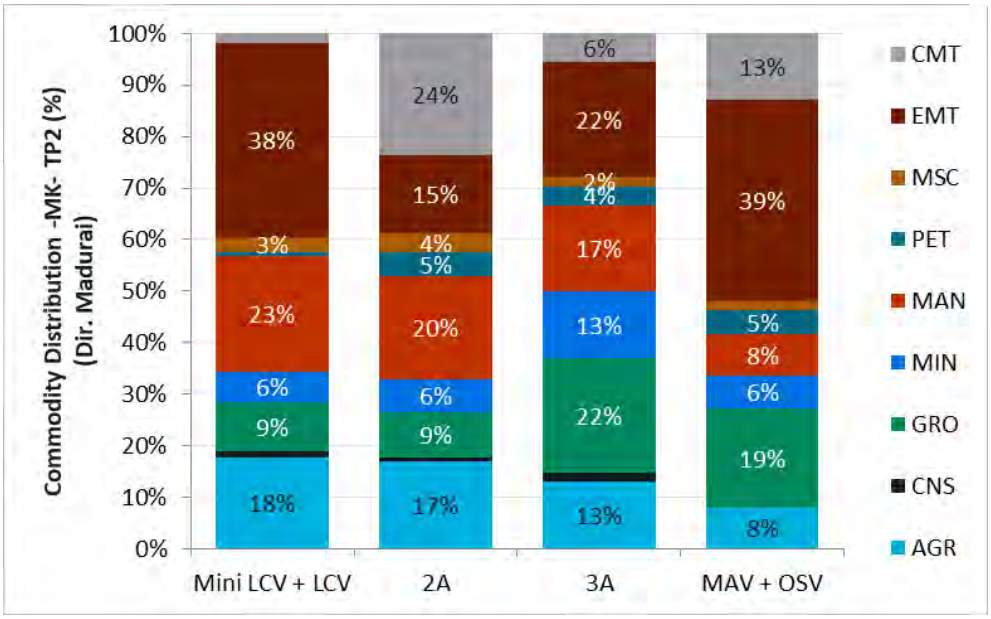
Source: Steer analysis of OD data

Figure 3.22: Commodity distribution at TP2 Etturvattam (Towards Kanyakumari)



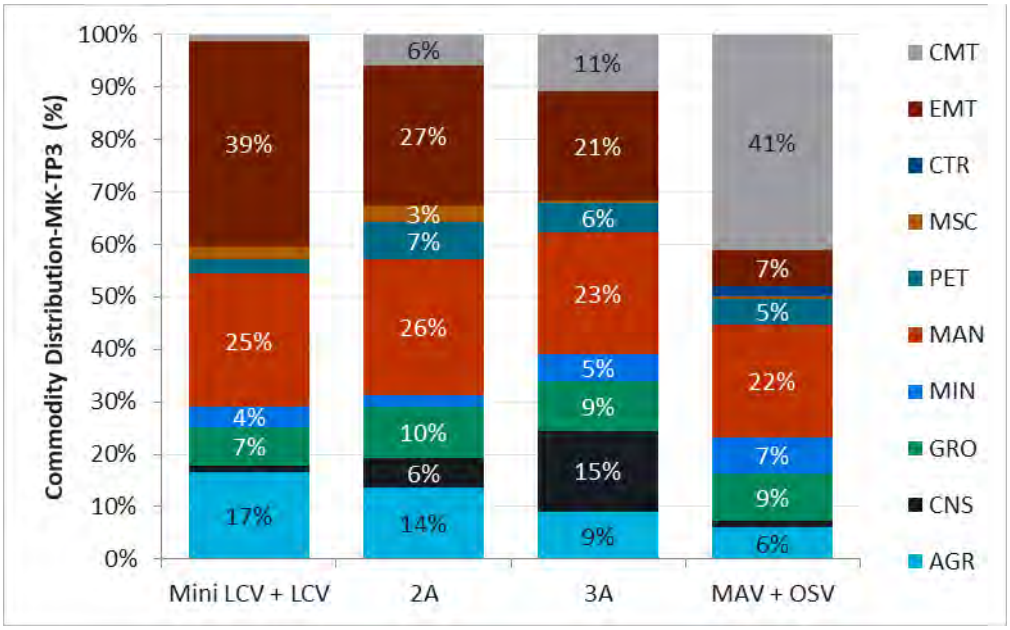
Source: Steer analysis of OD data

Figure 3.23: Commodity distribution at TP2 Etturvattam (Towards Madurai)



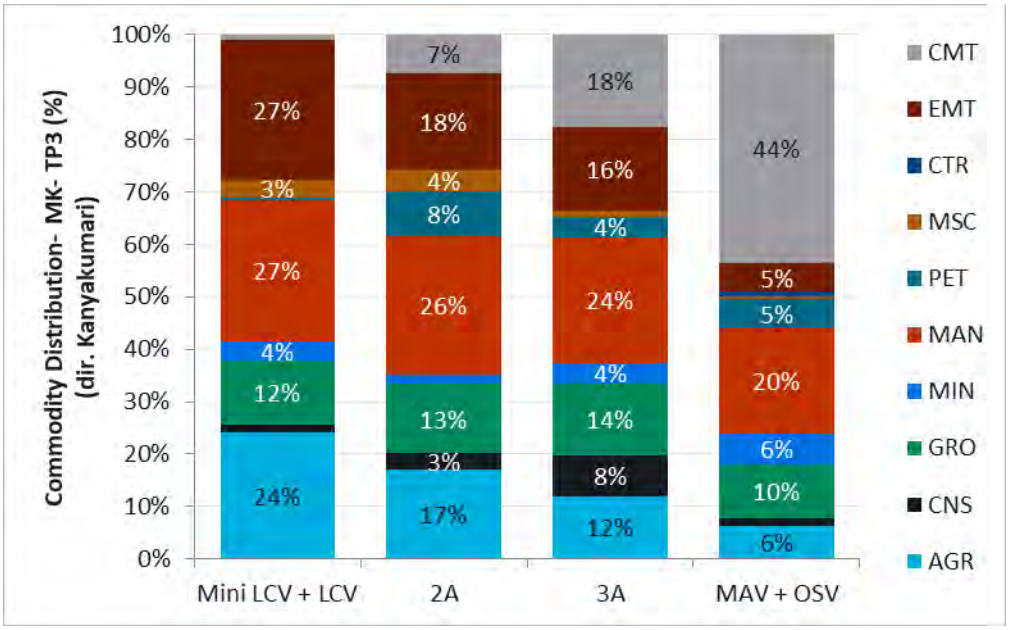
Source: Steer analysis of OD data

Figure 3.24: Commodity distribution at TP3 Salaipudhur



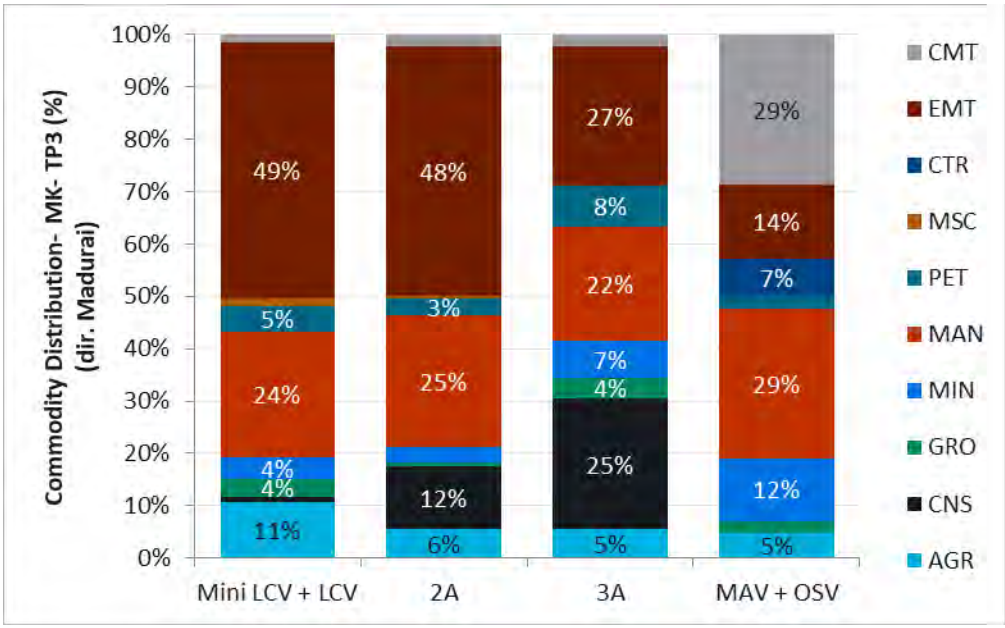
Source: Steer analysis of OD data

Figure 3.25: Commodity distribution at TP3 Salaipudhur (towards Kanyakumari)



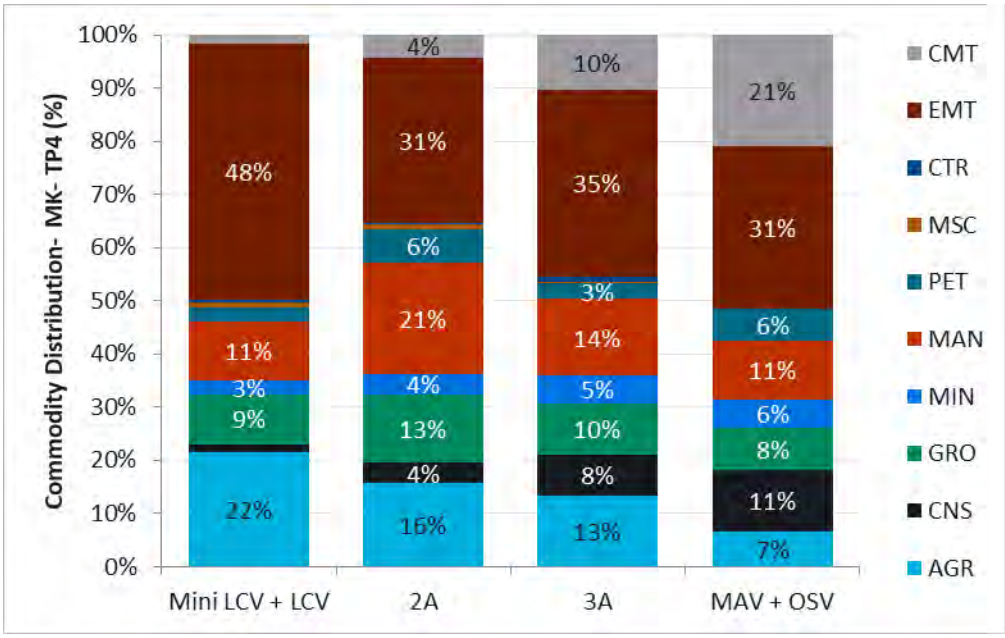
Source: Steer analysis of OD data

Figure 3.26: Commodity distribution at TP3 Salaipudhur (towards Madurai)



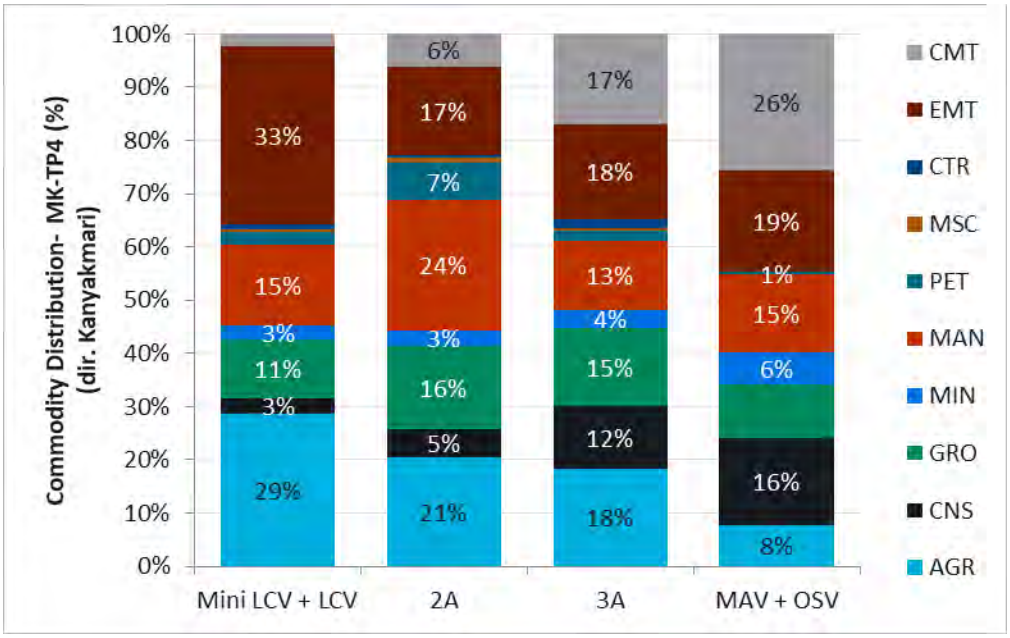
Source: Steer analysis of OD data

Figure 3.27: Commodity distribution at TP4 Nanguneri (Total)



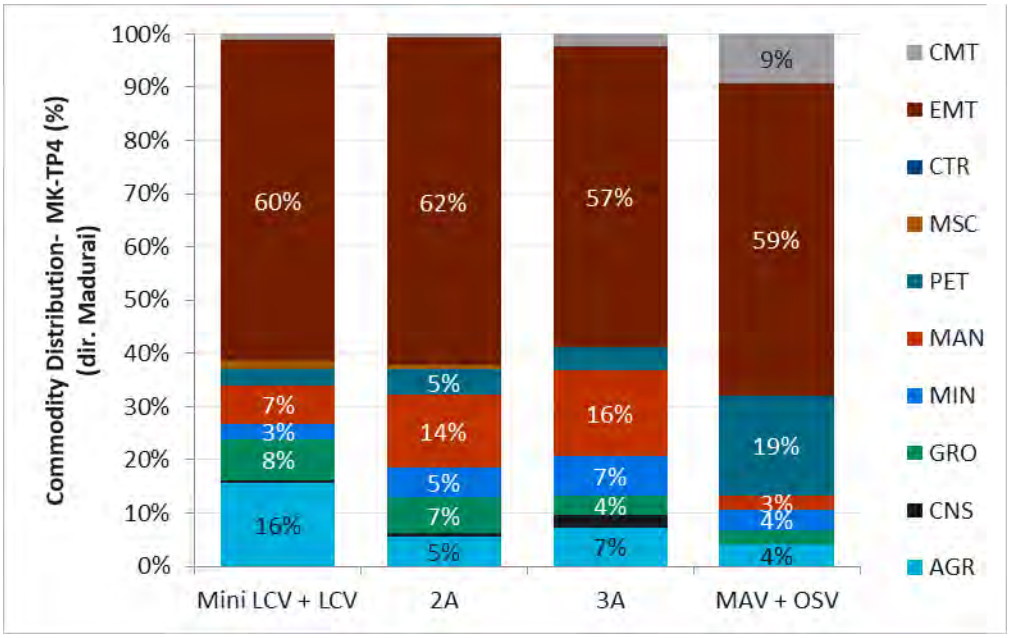
Source: Steer analysis of OD data

Figure 3.28: Commodity distribution at TP4 Nanguneri (Towards Kanyakumari)



Source: Steer analysis of OD data

Figure 3.29: Commodity distribution at TP4 Nanguneri (Towards Madurai)



Source: Steer analysis of OD data

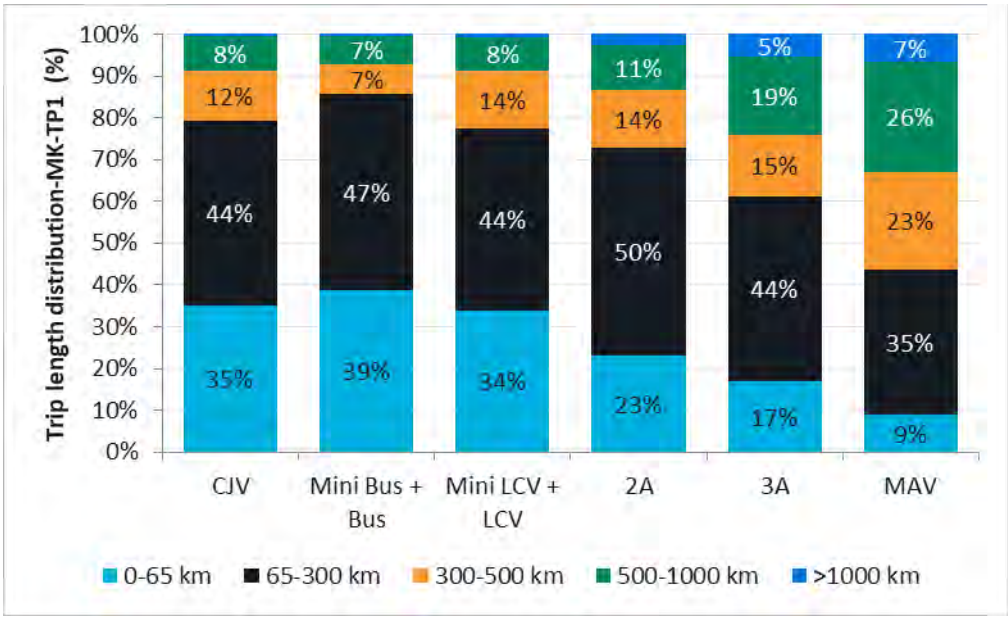
Trip length analysis

3.59 Trip-length distribution provides the distance-based profile of various vehicle types. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[13]

3.60 Supporting the observations made in zonal & internal-external analysis in the previous sections, the figure below highlights that between 50-70% of the passenger traffic travel shorter distances of up to 300 km, contributing to local movements on the Asset. The major proportion of the heavy goods traffic covers longer distances of 300-500 km and 500-1000 km to places such as Tirunelveli, Chennai, Coimbatore etc with TP2 Etturvattam and TP3 Salaipudhur showing 8-9% of the MAV traffic covering distances of more than 1000 km to places such as Mumbai, Uttar Pradesh and Hyderabad.

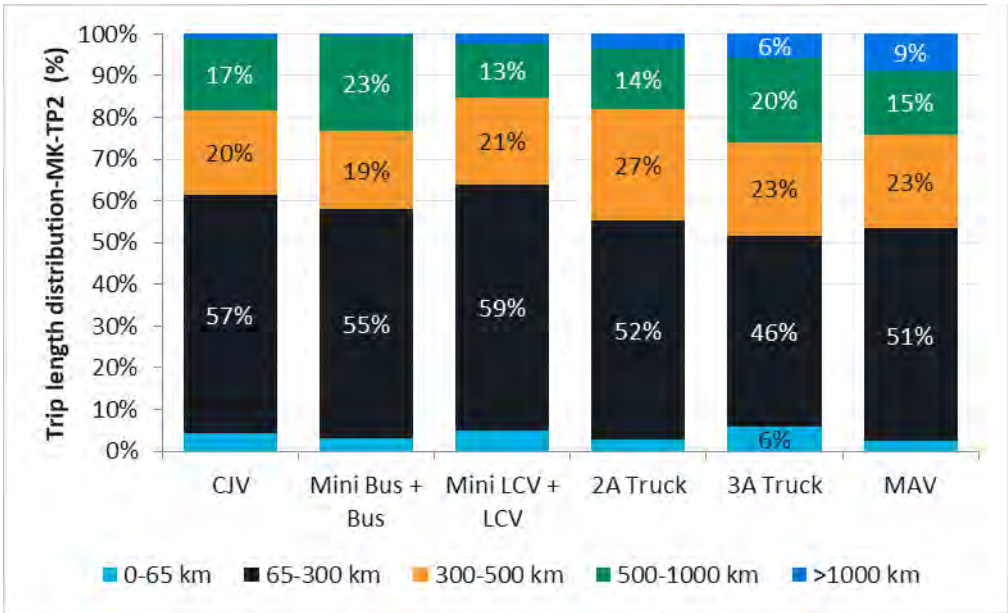
Figure 3.30: Trip length distribution TP1 Kappalur



Source: Steer analysis of OD data

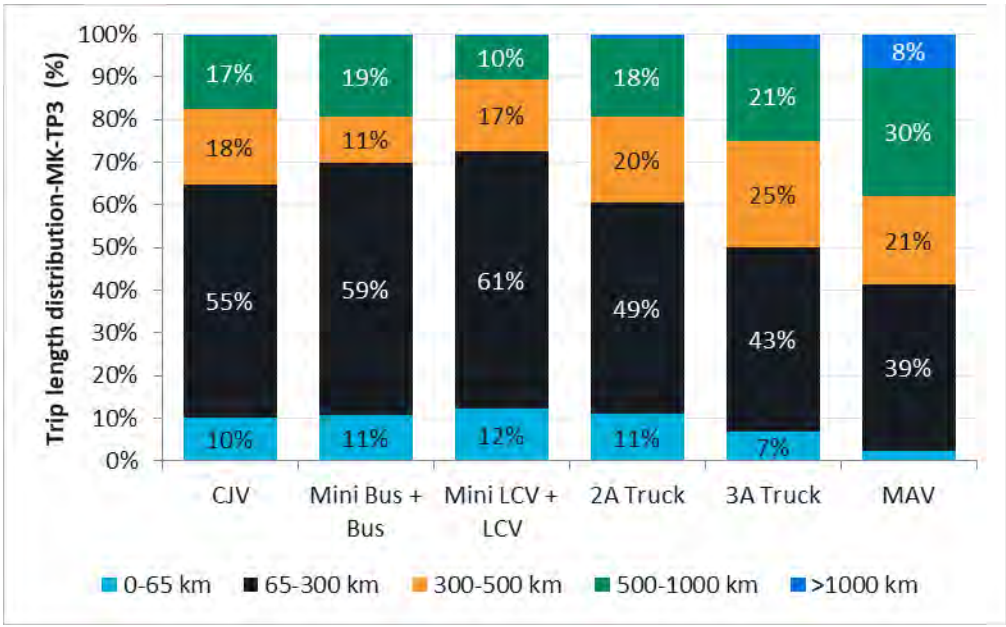
[13] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: **https://developers.google.com/maps/documentation/distance-matrix/start**. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.31: Trip length distribution TP2 Etturvattam



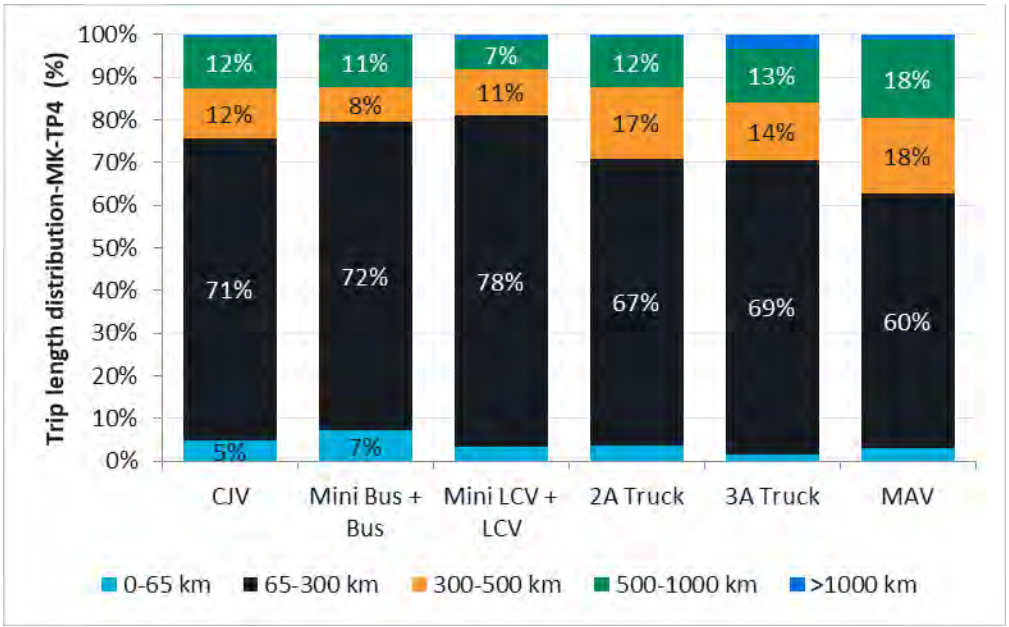
Source: Steer analysis of OD data

Figure 3.32: Trip length distribution TP3 Salaipudhur



Source: Steer analysis of OD data

Figure 3.33: Trip length distribution TP4 Nanguneri



Source: Steer analysis of OD data

Conclusions

3.61 Traffic on the Asset is dominated by CJVs which make up approximately 70% of the total vehicle composition at every plaza, with the rest dominated by buses, 2As and LCVs – the last two being the dominant goods vehicle type carrying regional movement of goods on the Asset. Heavy goods vehicles (3As and MAVs) make up a small but considerable share of the total traffic.

3.62 CJVs, having the highest share in vehicle proposition, contribute the maximum in the revenue as well. Across all the plazas, CJVs make up around 45% of the total revenue with MAVs contributing to 16-21% to the total share.

3.63 There has been a significant growth in ETC traffic due to recent government mandate aimed at 100% FASTag penetration. The proportion of vehicles with active FASTag grew to 86% in month of March-22, while the MAVs share of ETC traffic has reached around 100% across all the Assets while the ETC share of the CJV traffic is >90% except the MK1 Asset where the share is around 81%.

3.64 With the onset of strict FASTag implementation, the share of single journeys has reduced across the categories as the share of return journey tickets increased. For MAVs, Single tickets have remained dominant on TP1, holding a share of 82% in March 22 whereas the share has considerably decreased at other plazas with 61% single tickets at TP2, 68% single tickets at TP3, and 47% single tickets at TP4 in the month of Mar-22. The proportion of local personal tickets as well as exemptions has remained constant over the months. The Asset observes 4%-17% violations for CJVs, with the highest being at TP1 Kappalur.

3.65 The TVC data shows minor variation on the TMS data, where at a total level, the TVC data is approximately 3% higher than the TMS data. This gives us confidence that the base year traffic calculated using the Client traffic data forms a reliable base year traffic estimate.

3.66 The OD analysis found that in terms of zonal influence, at TP1 Kappalur, local and IAOI zones have the greatest influence on CJV, Buses and LCV and as we towards the southern part of the Asset (to Nanguneri), the local zones have decreasing influence while IAOI and rest of Tamil Nadu zones have major influence on the traffic, especially the heavy goods vehicles. Outside Tamil Nadu, Thiruvananthapuram in Kerala has the most significant influence given its cultural connection with Kanyakumari and the resultant inter-urban traffic movements.

3.67 The key commodity transported on the Asset across all four toll plazas are manufacturing items such as medicines, machine parts, electronics etc followed by agricultural and grocery items. Also, MAV's carrying cement make up for a very high share of traffic on the Asset especially at TP3 Salaipudhur given the proximity to cement plants such as India Cements plant just north of Tirunelveli and Ramco Cements near Virudhunagar.

3.68 The internal and external distribution highlights the majority of trips either originate and end internally i.e within local or IAOI zones or have at least one end of the trip in RoS with very less E-E movement of traffic on the Asset across all toll plazas. This is further supported by the trip length distribution analysis which shows that between 50-70% of the passenger traffic travel shorter distances of up to 300 km, contributing to local movements on the Asset whereas most of the heavy goods vehicle travel longer distances of 300-500km and 500-1000 km to places such as Tirunelveli, Chennai, Coimbatore etc with very few longer external movements to places such as Mumbai, Uttar Pradesh and Hyderabad. Overall, the OD analysis shows that the Asset has significant inter-urban traffic and regional economies of wind, cement and industrial estates providing captive traffic.

4 Socio economic context and traffic growth

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the roads are in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions in the region where the Asset is located and the country. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Asset.

4.2 In turn, the change in the relative competitive position of the Asset (and thus of the traffic capture they can achieve) derives from how the relative offer for the roads changes, i.e. the service offered, and the tolls charged on the project roads, in comparison to that on competing roads; and whether any competing road facilities are planned.

4.3 In this chapter, we have assessed the trends of the above growth drivers, as indicators of the socio-economic conditions in the regions surrounding the Asset.

Population growth

4.4 We have analysed the key socioeconomic drivers of the background traffic demand in Tamil Nadu state, where the Asset is located.

National level

4.5 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth.

State level

4.6 The following table shows the evolution of population in Tamil Nadu state, compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, the state has grown at a rate similar to the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Tamil Nadu	62.4	34.9	27.5	72.1	37.2	34.9	1.5%	0.6%	2.4%
India	**1,028.7**	**742.6**	**286.1**	**1,210.9**	**833.7**	**377.1**	**1.6%**	**1.2%**	**2.8%**

Source: Ministry of Housing and Urban Affairs – Census Data, http://mohua.gov.in/pdf/5c80e2225a124Handbook%20of%20Urban%20Statistics%202019.pdf

4.7 Due to the complexities of the patterns in which urbanisation takes place, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide a socio-economic context of the state/trends in the regions in which the Asset is located.

Economic growth

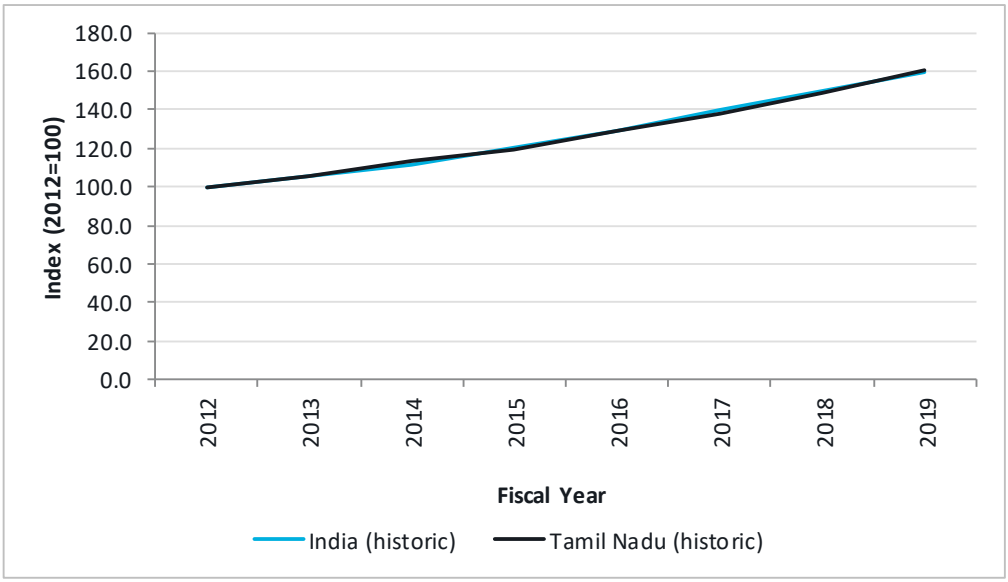
GDP and GSDP Growth

4.8 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.9 TN 1-4, Madurai-Kanyakumari, lie in the state of Tamil Nadu. Tamil Nadu's state GSDP has Historically grown at a rate that is equal or slightly lower than the national trend. However, the per capita GDP is still considerably higher in this state than the Indian average despite the lower growth in recent years.

4.10 The following figures illustrates the evolution of Tamil Nadu's GSDP during FY12-FY19.

Figure 4.1: Evolution of Tamil Nadu's state GDP and National GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

5 Traffic Growth Analysis

Introduction

5.1 In this section, we present our approach, assumptions, and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 In the absence of Historical data on the Asset, the option of running statistical method to estimate background growth relationships was not available, therefore we have undertaken a detailed benchmarking exercise, coupled with trip length and OD analysis to estimate the elasticities. These are discussed in detail below.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

Overview

5.5 For brownfield assets, where sufficient historical traffic evolution is available, it is common practice to use regression model analysis to determine the relationship, expressed as elasticity, between traffic growth and key socioeconomic drivers. This relationship is then applied to assumptions of future socio-economic evolution to estimate future traffic growth.

5.6 As for the Asset under consideration, a consistent historical trend was not available. Therefore, we undertook a benchmark in order to estimate our forecast elasticities, Sources used included our understanding of the Asset, the elasticities used during the bid for TOT3 package by the client and the subsequent lender study that was undertaken by the Client. We have also undertaken a regional benchmarking against Assets having similar traffic profiles, which give us reasonable confidence the relationships proposed.

5.7 In terms of selection of growth drivers for vehicle types, in general we have assumed state GDP as the key driving factor for the passenger traffic given this traffic is generally driven by the local economies of the cities and state containing the Asset. The heavier commercial vehicles generally ply long-distance and the underlying growth is governed by the general economies of several states or nation as whole.

5.8 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

5.9 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.1: Identified growth drivers to model traffic growth

Vehicle type	GSDP Tamil Nadu
Car	100%
LCV	100%
Bus	100%
2A	100%
3A	100%
MAV	100%

Source: Steer

5.10 The sections below detail out the reasoning for selection of respective growth driver(s) for each vehicle category.

Table 5.2: Elasticity recommendations for the Asset

Vehicle Category	Proposed	Growth Driver	Comments
CJV and Mini-LCV	TP1: 1.09 TP2-4: 1.0	GSDP Tamil Nadu	Primarily inter-urban/local movements between Madurai, Tirunelveli, Virudhunagar, Sivakasi, Nagercoil/KK. Since Madurai has higher urban density, we grow TP1 Kappalur at higher elasticity of 1.09 compared to 1.0 at TP2-4 respectively.
Buses	0.4	GSDP Tamil Nadu	Mix of public and private inter-city buses, with a higher share of public buses at TP1 Kappalur. Tamil Nadu has a high volume of mofussil and intercity buses serving public transport demand. As the cities and towns grow and become more urbanised, the buses are also expected to respond to the increasing demand however at a 0.4 relationship to GSDP. This is higher than low bus-volume regions in other parts of the country.
LCV	0.7	GSDP Tamil Nadu	LCVs and 2As are the major goods vehicle types and are expected to have the highest growth amongst goods vehicle types. As discussed in Chapter 3, the trip lengths of LCV and 2A category (more than 50%) are predominantly short distance, confirming the understanding that the movements cater to regional demand. Considering the above observations, and our experience across other toll roads in the region, we believe that elasticities of 0.6 with respect to state GSDP are considered reasonable.
2A	0.6	GSDP Tamil Nadu	

Vehicle Category	Proposed	Growth Driver	Comments
3A	0.3	GSDP Tamil Nadu	3As and MAVs cater to both regional and long-distance movement of a wide range of consumption-based commodities. Most of the traffic is within 1000km and more than 85% of trips are within the State. Given TN is an industrialised state and the region is particularly more developed and has consumption-driven traffic, we have considered elasticities of 0.3 for 3A and 0.5 for MAV.
MAV	0.5	GSDP Tamil Nadu	

Source: Steer Analysis

Forecasts for growth drivers

5.12 Following the discussion in Chapter 4 on the nature of economic activity in the state of Rajasthan, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.13 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.14 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in figure below. .

5.15 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.16 The India GDP growth provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

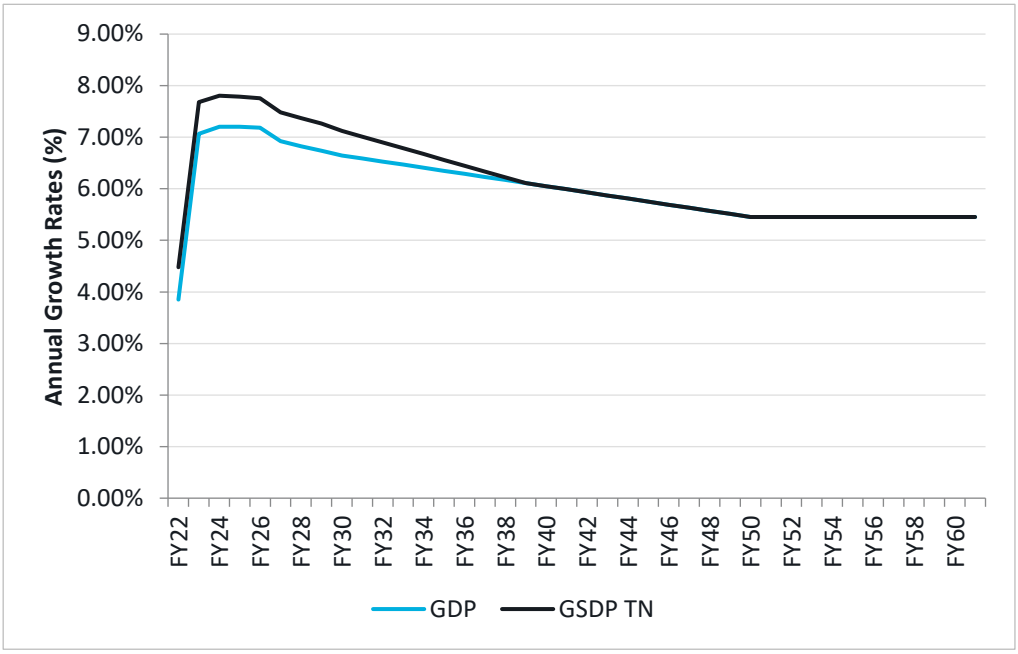
State GSDP

5.17 As per Client projections, Tamil Nadu's GSDP growth assumes to continue outpacing the national GDP throughout the concession period. This assumption is considered to be reasonable given that there are significant investments expected to take place as part of the state's plan and Tamil Nadu is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher-than-expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Tamil Nadu's state economy.

5.18 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.19 The GDP-GSDP lines are expected to converge by FY38. The chart below shows the forecast growth lines for GDP and Tamil Nadu GSDP.

Figure 5.1: GDP-GSDP forecast



Source: GDP and GSDP forecast provided by Client

6 Forecast: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of background growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years.

Seasonal Correction Factors

6.2 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.3 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.4 Historical traffic data was available for all toll vehicle categories starting October 2020 up-to March 2021. Therefore, in absence of longer-term historical data to arrive at the SCF, we have benchmarked our SCFs from various sources:

- Assets in the vicinity, south or north of the Asset carrying very similar traffic profiles
- SCF assumptions assumed during the Bid by the Client, and
- Site observations and information provided by the toll plaza.

6.5 The below tables present the assumptions in SCF used to estimate the AADT for the four toll plazas.

Table 6.1: SCF factors for all toll plazas

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	1.00	0.89	0.97	1.10	1.00	1.05	1.02	1.06	0.95	0.93	1.00	1.03

Vehicle Category	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
LCV	0.96	0.91	0.96	1.01	1.00	1.02	1.06	1.05	1.02	1.04	0.98	0.94
Bus	0.97	0.94	1.00	1.00	0.99	1.00	1.03	1.01	1.03	1.03	1.01	0.96
2A	0.95	0.94	0.96	1.00	0.97	0.98	1.02	1.05	1.06	1.05	1.02	0.97
3A	0.95	0.94	0.96	0.97	0.96	1.04	1.00	1.07	1.03	1.06	1.01	0.98
MAV	0.95	0.94	0.96	0.97	0.96	1.04	1.00	1.07	1.03	1.06	1.01	0.98

Source: Steer analysis of various sources.

Base year FY22 AADT estimates

FY22 AADT Estimation

6.6 As discussed earlier in chapter 1 and 3, the second wave of COVID-19 infections peaked in the northern half of the country in the months of April and May 2021. Therefore, the traffic volumes on the Assets were impacted during Q1FY22. Further, an above normal monsoon in Q2FY22 and Oct-21 resulted in a higher drop in traffic volumes as compared to normal monsoon periods. The period starting November 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected passenger traffic volumes, hence, has not been considered for the determination for AADT for the CJVs and Buses, while the looking at the month of Oct-21, being an outlier datapoint because of the monsoons, was also taken out of consideration for AADT of the goods vehicles.

6.7 We believe that the traffic levels observed during the November 2021 - March 2022 period excluding January 2022 for CJVs and Bus category and further excluding October 2021 for goods vehicles, when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. The adopted AADT for FY22 is presented below:

Table 6.2: Monthly MADT and Base Year FY22 AADT estimation TP1 Kappalur

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	17,811	16,767	18,320	15,651	16,891	18,079	17,720
LCV	1,634	1,346	1,608	1,435	1,561	1,644	1,528
Bus	2,958	2,807	2,920	2,644	2,924	2,933	2,923
2A	1,226	1,068	1,302	1,246	1,273	1,321	1,264
3A	578	450	593	552	577	608	567
MAV	855	704	858	798	912	949	871
Total AADT	**25,062**	**23,143**	**25,604**	**22,328**	**24,141**	**25,535**	**24,873**
PCU[#]	**37,382**	**34,097**	**38,027**	**33,778**	**36,583**	**38,278**	**37,165**

Source: Steer Analysis, [#]Rigid Trailer PCU factor used for MAV, October-21 has been excluded for the AADT determination of goods vehicles

Table 6.3: Monthly MADT and Base Year FY22 AADT estimation TP2 Etturvattam

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	7,102	6,705	7,673	6,619	7,029	7,637	7,286
LCV	829	694	814	749	819	870	793
Bus	940	964	1,009	908	974	992	980
2A	795	654	807	788	853	876	811
3A	335	244	323	314	323	348	315
MAV	664	545	701	628	729	743	691
Total AADT	**10,666**	**9,808**	**11,329**	**10,009**	**10,730**	**11,467**	**10,877**
PCU#	**16,757**	**15,142**	**17,637**	**15,857**	**17,127**	**18,053**	**17,090**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV, October-21 has been excluded for the AADT determination of goods vehicles

Table 6.4: Monthly MADT and Base Year FY22 AADT estimation TP3 Salaipudhur

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	6,810	6,285	7,235	6,315	6,703	7,021	6,863
LCV	727	616	720	668	725	781	705
Bus	795	800	836	767	799	831	816
2A	673	581	704	684	747	762	711
3A	278	210	267	271	305	331	283
MAV	489	398	487	463	521	533	494
Total AADT	**9,774**	**8,891**	**10,252**	**9,172**	**9,803**	**10,261**	**9,871**
PCU#	**14,761**	**13,302**	**15,353**	**14,022**	**15,073**	**15,734**	**14,987**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV , *Rigid Trailer PCU factor used for MAV, October-21 has been excluded for the AADT determination of goods vehicles

Table 6.5: Monthly MADT and Base Year FY22 AADT estimation TP4 Nanguneri

Vehicle Type	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar -22	FY22 Adopted AADT (FY22*)
CJV	8,545	8,043	9,607	7,913	8,624	8,750	8,776
LCV	762	647	769	713	792	810	749
Bus	1,011	1,011	1,098	969	1,058	1,108	1,062
2A	639	572	648	618	655	676	650
3A	331	282	343	365	387	369	351
MAV	495	402	497	474	517	512	491
Total AADT	**11,785**	**10,959**	**12,965**	**11,056**	**12,035**	**12,229**	**12,078**
PCU#	**17,273**	**15,942**	**18,676**	**16,414**	**17,825**	**18,128**	**17,716**

Source: Steer Analysis, #Rigid Trailer PCU factor used for MAV, *Rigid Trailer PCU factor used for MAV, October-21 has been excluded for the AADT determination of goods vehicles

Analysis of potential network/developmental impacts

6.8 This section details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed in previous Chapters, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

Six-laning LOS improvement

6.9 As per the concession agreement, as soon as the traffic on the Asset crosses 40,000 PCU's, the Asset is eligible for capacity augmentation. The PCU levels need to be maintained above the 40,000 levels for four consecutive years and one year will be earmarked for DPR preparation. After this period, a three-year period is factored in for construction, during which 75% toll rate is maintained. After the construction is over, the toll rates will be calculated as normal, as they should have been in that year.

6.10 On the Assets, it is expected based on our forecasts that traffic volumes will go beyond the 40,000 PCUs mark in FY23 for the MK1 Asset while for MK4 Asset it is crossing the 40,000 PCUs by FY37, thus breaching the Level of Service requirements set out in the concession agreement. Hence, to calculate the impact of lane augmentation on the Asset we have employed a GJC based approach.

6.11 A comparison of generalised journey costs (GJC) provides how different elements of cost and time affect traffic. This comparison was done for both light and heavy vehicles. Lower GJCs correspond to higher induced traffic. Based on Steer's studies and research in India, we have found that for every 1% reduction in the GJCs, the traffic increases by a factor of 0.3. We then applied the difference of GJCs to the elasticity of 0.3 to get the net influence on the traffic.

6.12 The improvement in travel costs or GJC is translated into the impact on that share of local + IAOI OD movements using a linear inverse relationship. Therefore, the GJC influence is applied on the corresponding shares of traffic, which were extracted from OD data.

6.13 The table below shows the extent of the LOS impact and the expected timelines of the impact on each of the Assets.

Table 6.6: Impact of LOS improvement due to six-laning (capacity augmentation)

	TP1 Kappalur	TP4 Nanguneri
Vehicle category	**FY31**	**FY45**
CJV	2.6%	2.9%
Mini LCV	0.5%	0.7%
Buses	0.5%	0.7%
LCV	0.5%	0.7%
2A	1.3%	1.9%
3A	1.5%	2.6%
MAV	1.2%	2.7%

Source: Steer analysis

NH 744 upgrade: Madurai Kollam

6.14 The NH 744 route between Madurai (Tirumangalam) and Kollam, through Rajapalayam, is a competitive alternate for road users having Courtallam and Kollam district (Kerala) as

destinations. Currently two-lane, un-tolled and in fairly good condition, this alternate is the preferred choice compared to the Asset, especially for light vehicles like cars. A small proportion of heavy vehicles of this particular traffic market continue to prefer using the Asset.

6.15 However, the Tirumangalam-Kollam highway of about 230 km is being planned for upgrade to four lanes. Included as part of the Union Budget FY22, land acquisition on the 72-km stretch (including a greenfield section of 28 km) of Tirumangalam-Rajapalyam is reportedly in an advanced stage.[14] The tenders are expected to be out soon. Upgrade of this road may improve levels of service, while at the same time increasing toll costs for users of the alternate road. Overall, based on our GJC comparison analysis using a logit model and the expected completion of the four-laning, we estimate a small negative impact of 50% of the 3A and MAV traffic plying past the two toll plazas – Etturvattam and Salaipudhur – of the Asset that may be bypassed due to this upgrade.

Table 6.7: NH744 upgrade: Madurai Kollam

	TP2-3 Etturvattam and Salaipudhur		
Vehicle category	**FY25**	**FY26**	**FY27**
Staging of the impact	**20%**	**40%**	**50%**
3A	-0.5%	-1.0%	-1.2%
MAV	-0.8%	-1.6%	-2.0%

Source: Steer analysis

Four-laning of Trivandrum-Nagercoil NH 66

6.16 The Thiruvananthapuram-Kanyakumari section serves a key intercity urban and consumption-based goods movement for the cities of Kanyakumari, Tuticorin and Tirunelveli. A small share the traffic is also long-distance from north of Tamil Nadu.

6.17 The upgrade of the Thiruvananthapuram-Kanyakumari section of NH 66 is part of the Mumbai-Kanyakumari national highway's four-laning. The part of the highway north of Kerala has already been four-laned. The four-laning of this section just adjacent to the Asset is expected to result in higher levels of service especially relevant for car traffic and may attract additional demand. We estimate an impact of overall 2.5% based on our benchmarks across similar roads in the country and our understanding of the region.

Table 6.8: Four-laning of Trivandrum-Nagercoil

	TP4 Nanguneri	
Vehicle category	**FY23**	**FY24 onwards**
Staging of impact	**50%**	**100%**
CJV	1.25%	2.5%

Source: Steer analysis

[14] https://www.thehindu.com/news/cities/Madurai/widening-of-madurai-rajapalayam-highway-to-be-taken-up-soon/article33716366.ece, accessed on 17 April 2021

Revenue forecasting assumptions

6.18 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e. traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e. the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.19 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY22 data available and listed in the table below:

Table 6.9: Trip factors for the forecast years for TP1 Kappalur

Vehicle category	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	50	45	45	45	45	45	45	45
Local Commercial	1	1	1	1	1	1	1	1
Local Personal	20	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

Table 6.10: Trip factors for the forecast years for TP2 Etturvattam

Vehicle category	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	59	45	45	45	45	45	45	45
Local Commercial	1	1	1	1	1	1	1	1
Local Personal	15	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

Table 6.11: Trip factors for the forecast years for TP3 Salaipudhur

Vehicle category	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	50	45	39	45	45	45	45	45

Vehicle category	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Local Commercial	1	1	1	1	1	1	1	1
Local Personal	18	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

Table 6.12: Trip factors for the forecast years for TP4 Nanguneri

Vehicle category	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2	2
Monthly	45	45	45	45	45	45	45	45
Local Commercial	1	1	1	1	1	1	1	1
Local Personal	15	20	20	20	20	20	20	20
Exemptions	1	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data

Toll segmentation

6.20 We have analysed the historical TMS data split by ticket categories, to understand trends, as shown in Chapter 3. For the traffic and revenue forecast, we believe that the ticket segmentation from Oct-21 to Mar-22 is a good representative of the segmentation for the Asset. As per the historical analysis we have also observed that the ticket segmentation of the Asset has been stabilised over the Q3FY22 and Q4FY22. We believe with FASTag penetration stabilising and reaching upto 100% in MAVs and minimal impact of COVID19 during these months, Oct-Mar FY22 segmentation provide us with stable toll segmentation which can be used for the forecast years.

6.21 The table below provides the toll segmentation assumed for the period of forecast.

Table 6.13: Toll segmentation for FY22, TP1 Kappalur

Ticket type	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	32%	32%	6%	35%	30%	58%	82%	89%
Return	47%	47%	19%	50%	54%	32%	17%	9%
Monthly	0%	2%	12%	0%	0%	0%	0%	0%
Local commercial	2%	0%	6%	6%	10%	5%	1%	0%
Local personal	2%	2%	0%	0%	0%	0%	0%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%
Exemptions	17%	17%	57%	9%	6%	5%	1%	2%

Source: Steer analysis of Client TMS data

Table 6.14: Toll segmentation for FY22, TP2 Etturvattam

Ticket type	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	48%	48%	10%	43%	31%	63%	61%	52%
Return	44%	44%	34%	52%	65%	34%	34%	47%
Monthly	0%	0%	18%	0%	0%	0%	0%	0%
Local commercial	1%	1%	5%	3%	4%	0%	4%	0%
Local personal	3%	3%	0%	0%	0%	0%	0%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%
Exemptions	5%	5%	33%	1%	0%	3%	1%	1%

Source: Steer analysis of Client TMS data

Table 6.15: Toll segmentation for FY22, TP3 Salaipudhur

Ticket type	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	45%	45%	11%	41%	28%	53%	68%	49%
Return	46%	46%	37%	56%	68%	37%	29%	51%
Monthly	0%	0%	20%	0%	0%	0%	0%	0%
Local commercial	1%	1%	1%	2%	3%	5%	2%	0%
Local personal	1%	1%	0%	0%	0%	0%	0%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%
Exemptions	7%	7%	33%	2%	1%	5%	2%	0%

Source: Steer analysis of Client TMS data

Table 6.16: Toll segmentation for FY22, TP4 Nanguneri

Ticket type	CJV	Mini LCV	Bus	LCV	2A	3A	MAV	OSV
Single	31%	31%	7%	29%	24%	42%	47%	36%
Return	57%	57%	24%	58%	72%	53%	52%	64%
Monthly	0%	0%	24%	0%	0%	0%	0%	0%
Local commercial	3%	3%	3%	9%	4%	5%	0%	0%
Local personal	4%	4%	0%	0%	0%	0%	0%	0%
Violations	0%	0%	0%	0%	0%	0%	0%	0%
Exemptions	4%	4%	41%	4%	0%	0%	0%	0%

Source: Steer analysis of Client TMS data

Toll evolution

6.22 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.23 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.17: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.27%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: Shared by client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Revenue reconciliation

6.24 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue on a monthly level for the Asset. To reconcile we have used the segmentation Oct-Mar FY22 average, MADT of the month and compared it with the reported revenue for that month. The exercise was undertaken for Feb and Mar 2022. The comparison, as shown in the table below, depicts the modelled revenue vs the reported revenue difference, and the difference lies within 0.8%, this gives us the confidence in the assumptions around segmentation and trip factors for future forecast purposes.

Table 6.18: FY22 Revenue reconciliation summary (INR Lakhs)

Asset	Modelled Feb-22	Actual Feb-22	Difference (%)	Modelled Mar-22	Actual Mar-22	Difference (%)
MK-1	639	633	0.8%	736	739	(0.3%)
MK-2	373	373	0.1%	434	432	0.6%
MK-3	391	392	(0.2%)	452	451	0.3%
MK-4	383	381	0.4%	429	427	0.3%

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.25 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table

below presents the AADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix C presents the AADT and revenues for the forecast period.

Table 6.19: Traffic forecast (With Impacts) for TP1 Kappalur

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	15,667	23,442	34,982	68,026	116,347
Mini LCV	2,053	2,669	3,423	5,274	7,471
Bus	2,923	3,980	4,605	5,908	7,221
LCV	1,528	1,987	2,548	3,926	5,562
2A	1,264	1,585	1,979	2,869	3,871
3A	567	636	717	865	1,006
MAV	871	1,052	1,268	1,730	2,221
AADT	**24,873**	**35,351**	**49,521**	**88,598**	**143,698**
PCU's	**37,165**	**51,184**	**68,336**	**113,856**	**175,824**

Source: Steer analysis

Table 6.20: Traffic growth CAGR (%) for TP1 Kappalur

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	8.4%	8.3%	6.9%	7.2%
Mini LCV	5.4%	5.1%	4.4%	4.6%
Bus	6.4%	3.0%	2.5%	3.2%
LCV	5.4%	5.1%	4.4%	4.6%
2A	4.6%	4.5%	3.8%	3.9%
3A	2.3%	2.4%	1.9%	2.0%
MAV	3.9%	3.8%	3.2%	3.3%
AADT	**7.3%**	**7.0%**	**6.0%**	**6.2%**
PCU's	**6.6%**	**6.0%**	**5.2%**	**5.5%**

Source: Steer analysis

Table 6.21: Revenue forecast (With Impacts) for TP1 Kappalur (INR Cr)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	33	68	128	385	992
Mini LCV	4	8	13	30	64
Bus	10	18	26	51	94
LCV	6	10	16	40	84
2A	10	17	27	60	122
3A	5	8	12	22	39
MAV	14	22	34	72	138
Total Revenue	**82**	**151**	**256**	**661**	**1,533**

Source: Steer analysis

Table 6.22: Revenue growth CAGR (%) for TP1 Kappalur

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	15.6%	13.5%	11.6%	12.4%
Mini LCV	12.4%	10.1%	9.1%	9.7%
Bus	13.0%	7.9%	7.1%	8.2%
LCV	12.2%	10.1%	9.2%	9.7%
2A	11.1%	9.6%	8.5%	9.0%
3A	8.7%	7.3%	6.5%	7.0%
MAV	10.4%	8.8%	7.8%	8.3%
Total revenue	**13.1%**	**11.1%**	**10.0%**	**10.6%**

Source: Steer analysis

Table 6.23: Traffic forecast (With Impacts) for TP2 Etturvattam

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	6,580	9,536	13,456	24,810	40,643
Mini LCV	705	917	1,170	1,802	2,553
Bus	980	1,291	1,485	1,906	2,329
LCV	793	1,031	1,316	2,027	2,872
2A	811	1,017	1,254	1,818	2,453
3A	315	349	388	468	544
MAV	691	818	975	1,330	1,708
AADT	**10,877**	**14,958**	**20,044**	**34,161**	**53,101**
PCU's	**17,090**	**22,683**	**29,216**	**46,641**	**69,148**

Source: Steer analysis

Table 6.24: Traffic growth CAGR (%) TP2 Etturvattam

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	7.7%	7.1%	6.3%	6.5%
Mini LCV	5.4%	5.0%	4.4%	4.5%
Bus	5.7%	2.9%	2.5%	3.0%
LCV	5.4%	5.0%	4.4%	4.5%
2A	4.6%	4.3%	3.8%	3.9%
3A	2.1%	2.1%	1.9%	1.9%
MAV	3.4%	3.6%	3.2%	3.2%
AADT	6.6%	6.0%	5.5%	5.6%
PCU's	5.8%	5.2%	4.8%	4.9%

Source: Steer analysis

Table 6.25: Revenue forecast (with impacts) for TP2 Etturvattam (INR Cr)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	17	33	59	170	414
Mini LCV	2	3	5	12	26
Bus	5	9	14	27	49
LCV	3	6	10	23	49
2A	7	12	19	42	84
3A	3	5	7	13	22
MAV	10	16	25	52	101
Total Revenue	**48**	**84**	**137**	**339**	**745**

Source: Steer analysis

Table 6.26: Revenue growth CAGR (%) for TP2 Etturvattam

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	14.4%	12.2%	11.2%	11.7%
Mini LCV	11.9%	10.0%	9.3%	9.6%
Bus	12.3%	7.8%	7.1%	8.1%
LCV	12.1%	9.9%	9.2%	9.7%
2A	11.2%	9.3%	8.5%	9.0%
3A	8.6%	7.0%	6.5%	6.9%
MAV	9.9%	8.6%	7.8%	8.2%
Total revenue	**12.1%**	**10.1%**	**9.5%**	**9.9%**

Source: Steer analysis

Table 6.27: Traffic forecast (With Impacts) for TP3 Salaipudhur

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	6,135	8,890	12,545	23,130	37,890
Mini LCV	728	947	1,208	1,861	2,637
Bus	816	1,074	1,236	1,586	1,939
Bus	705	916	1,169	1,801	2,551
LCV	711	891	1,098	1,593	2,149
3A	283	313	348	420	488
MAV	494	584	696	949	1,219
AADT	**9,871**	**13,615**	**18,301**	**31,340**	**48,873**
PCU's	**14,987**	**19,984**	**25,865**	**41,640**	**62,127**

Source: Steer analysis

Table 6.28: Traffic growth CAGR (%) for TP3 Salaipudhur

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	7.7%	7.1%	6.3%	6.5%
Mini LCV	5.4%	5.0%	4.4%	4.5%
Bus	5.7%	2.9%	2.5%	3.0%
LCV	5.4%	5.0%	4.4%	4.5%
2A	4.6%	4.3%	3.8%	3.9%
3A	2.1%	2.1%	1.9%	1.9%
MAV	3.4%	3.6%	3.2%	3.2%
AADT	6.6%	6.1%	5.5%	5.7%
PCU's	**5.9%**	**5.3%**	**4.9%**	**5.0%**

Source: Steer analysis

Table 6.29: Revenue forecast (with impacts) for TP3 Salaipudhur (INR Cr)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	19	37	66	189	463
Mini LCV	2	4	6	15	32
Bus	6	10	15	30	55
LCV	4	6	10	25	53
2A	7	13	20	44	89
3A	3	5	7	13	23
MAV	9	14	22	46	89
Total Revenue	**50**	**89**	**146**	**363**	**804**

Source: Steer analysis

Table 6.30: Revenue growth CAGR (%) for TP3 Salaipudhur

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	14.5%	12.5%	11.1%	11.7%
Mini LCV	12.0%	10.2%	9.1%	9.7%
Bus	12.3%	7.8%	7.1%	8.1%
LCV	12.0%	10.0%	9.1%	9.6%
2A	11.2%	9.3%	8.5%	9.0%
3A	8.5%	7.0%	6.5%	6.9%
MAV	10.0%	8.5%	7.8%	8.2%
Total revenue	**12.3%**	**10.3%**	**9.5%**	**10.0%**

Source: Steer analysis

Table 6.31: Traffic forecast (With Impacts) for TP4 Nanguneri

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	7,906	11,743	16,571	30,552	51,478
Mini LCV	870	1,131	1,443	2,223	3,171
Bus	1,062	1,446	1,664	2,136	2,629
LCV	749	973	1,242	1,913	2,729
2A	650	814	1,004	1,456	2,002
3A	351	394	438	528	630
MAV	491	593	706	964	1,271
AADT	**12,078**	**17,094**	**23,068**	**39,771**	**63,909**
PCU's	**17,716**	**24,263**	**31,539**	**51,201**	**78,741**

Source: Steer analysis

Table 6.32: Traffic growth CAGR (%) for TP4 Nanguneri

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	8.2%	7.1%	6.3%	6.7%
Mini LCV	5.4%	5.0%	4.4%	4.6%
Bus	6.4%	2.9%	2.5%	3.2%
LCV	5.4%	5.0%	4.4%	4.6%
2A	4.6%	4.3%	3.8%	4.0%
3A	2.3%	2.1%	1.9%	2.0%
MAV	3.9%	3.6%	3.2%	3.3%
AADT	**7.2%**	**6.2%**	**5.6%**	**5.9%**
PCU's	**6.5%**	**5.4%**	**5.0%**	**5.3%**

Source: Steer analysis

Table 6.33: Revenue forecast (with impacts) for TP4 Nanguneri (INR Cr)

Vehicle Type	FY22	FY27	FY32	FY42	FY51
CJV	21	41	74	160	536
Mini LCV	2	4	6	12	33
Bus	5	10	15	22	54
LCV	3	6	9	16	46
2A	6	10	16	27	74
3A	4	6	8	11	27
MAV	8	13	19	30	80
Total Revenue	**49**	**89**	**147**	**278**	**850**

Source: Steer analysis

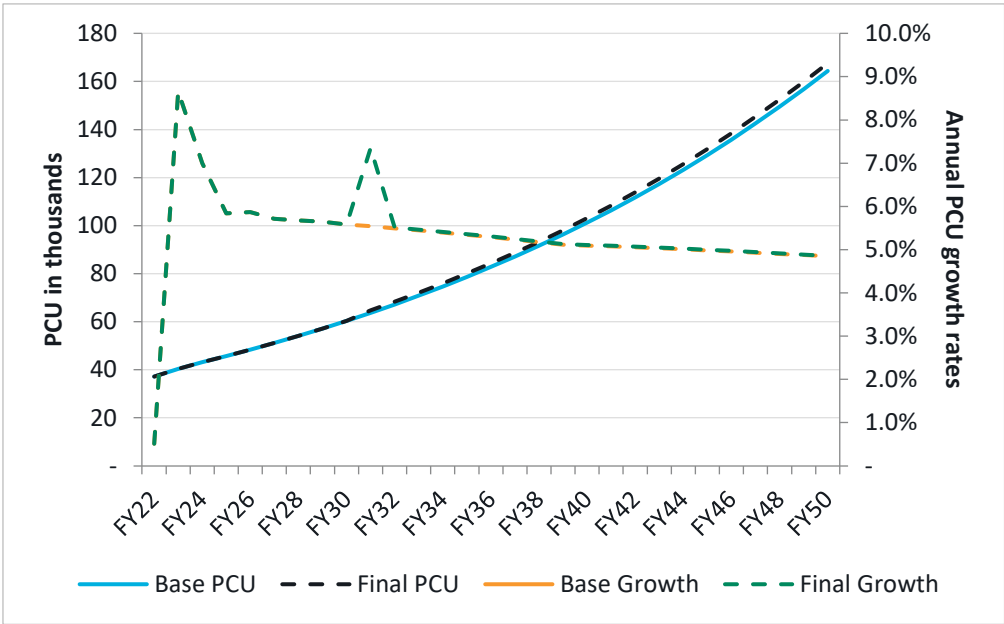
Table 6.34: Revenue growth CAGR (%) for TP4 Nanguneri

Vehicle Type	FY22-FY27	FY27-FY32	FY32-FY42	FY22-FY51
CJV	14.8%	12.4%	8.0%	11.9%
Mini LCV	11.8%	10.2%	6.1%	9.7%
Bus	13.1%	7.7%	4.1%	8.2%
LCV	12.3%	10.0%	6.0%	9.7%
2A	11.3%	9.2%	5.4%	9.0%
3A	8.8%	7.0%	3.5%	7.0%
MAV	10.4%	8.5%	4.8%	8.4%
Total revenue	**12.8%**	**10.5%**	**6.6%**	**10.3%**

Source: Steer analysis

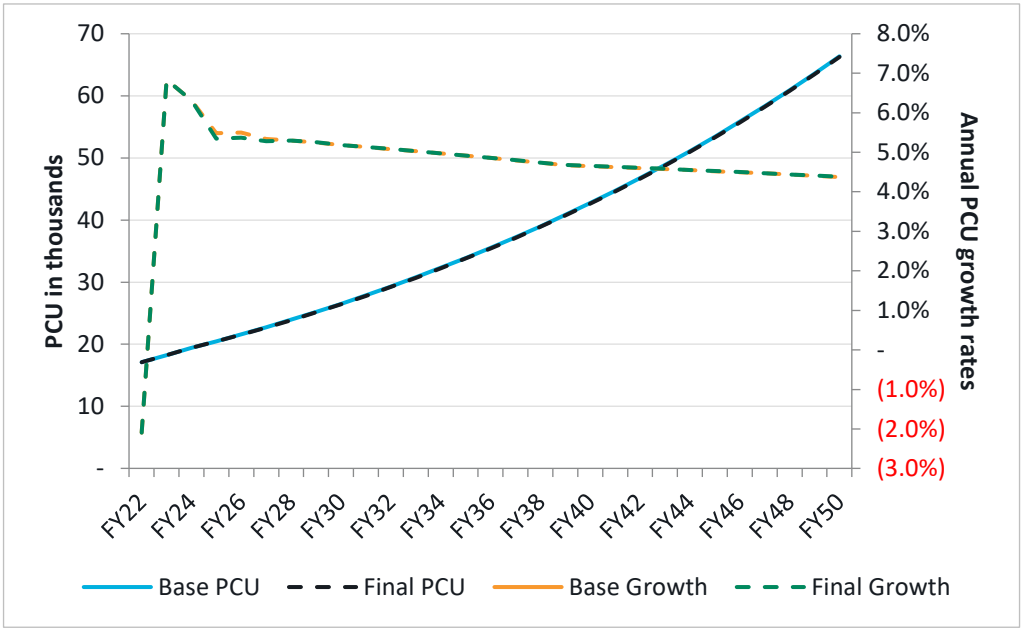
6.26 As presented in the tables above, traffic CAGRs (PCUs) for the traffic forecast (with impacts) on the Asset over the concession period is around 5% and corresponding revenue CAGR is around 10% over all the Assets. This growth is majorly driven by CJVs, as discussed in the historical section, this Asset has a dominant share of CJVs because the Assets lie on the inter-urban corridor. It is expected to grow strongly with a presence of the well-established road network with stabilised travel patterns and the growth of the Buses and CJVs will be driven by the inter-urban relationships and the presence of tourism hotspots present in the vicinity of the Assets. While a steady growth can also be seen in goods vehicles as per the forecasts, as it is interdependent on the growth of regional economy which is based on the presence of Cement Industries, wind power farms, growth of the port city of Tuticorin, industrial estates (SIDCO) and the movement of Fast-Moving Consumer Goods (FMCG) and groceries on the Madurai-Kanyakumari corridor.

Figure 6.1: Traffic and growth rates for forecast PCUs - Background and final, TP1 Kappalur



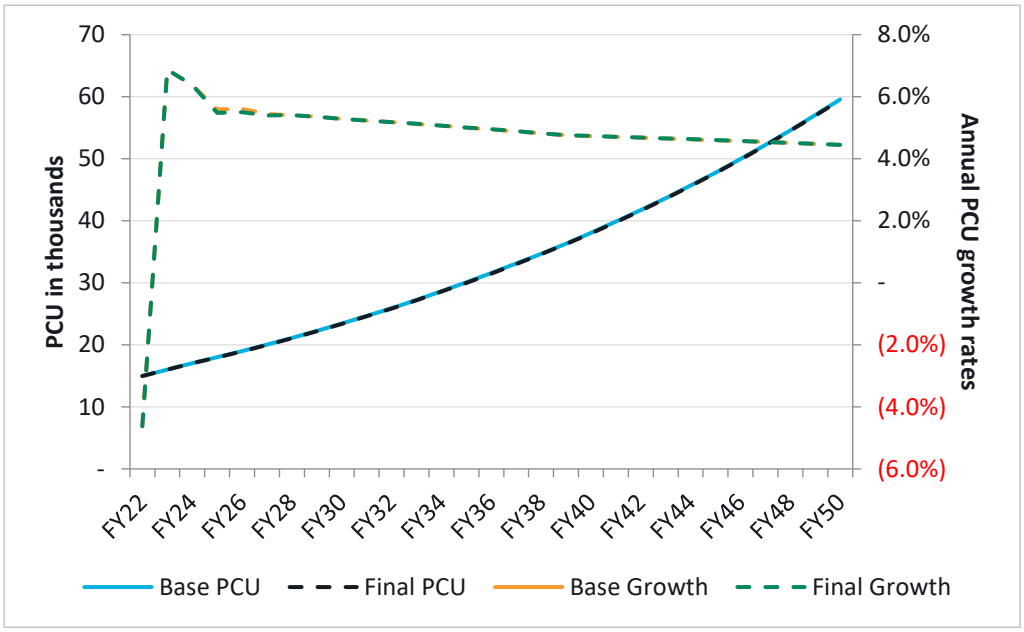
Source: Steer analysis

Figure 6.2: Traffic and growth rates for forecast PCUs - Background and final, TP2 Etturvattam



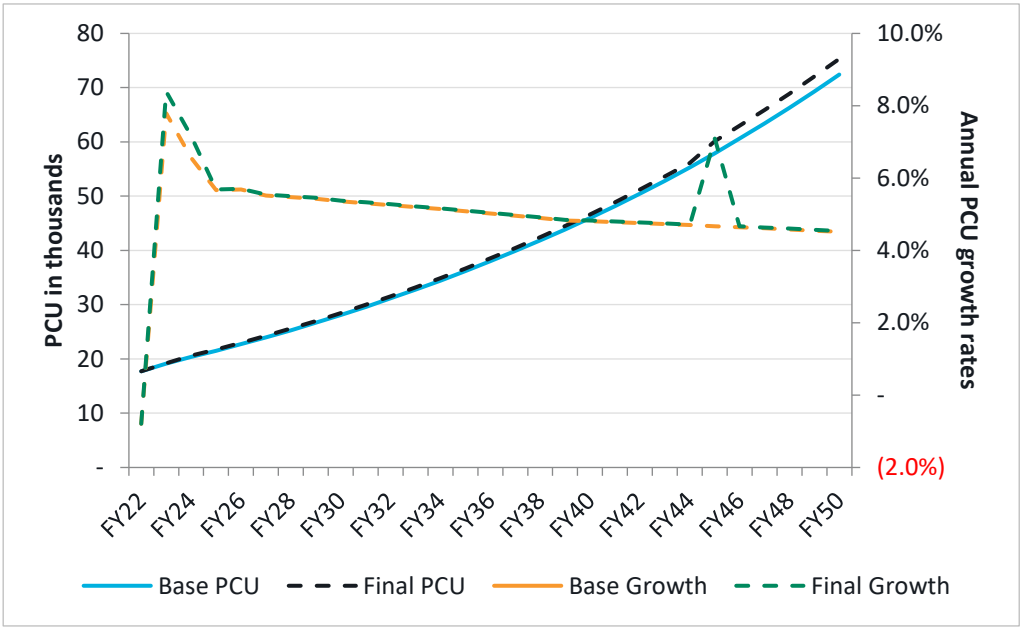
Source: Steer analysis

Figure 6.3: Traffic and growth rates for forecast PCUs - Background and final, TP3 Salaipudhur



Source: Steer analysis

Figure 6.4: Traffic and growth rates for forecast PCUs - Background and final, TP4 Nanguneri



Source: Steer analysis

Upside and Downside Cases

6.27 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.28 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.29 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.35: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
MK Assets	GDP/GSDP	+1% every year	-1% every year
MK Assets	WPI	+1% every year	-1% every year
MK Assets	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.30 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside

(optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.31 The upside case impacts included in forecasts are summarised in below:

Table 6.36: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning)	NH-744 Upgrade			4-L of Trivandrum Nagercoil	
Year	**FY31 Onwards**					
TP-1	CJV:3.3%, Bus/LCV:0.6% 2A:1.6%, 3A:1.8%, MAV:1.5%					
Year		**FY25**	**FY26**	**FY27 onwards**		
TP-2		3A: -0.4% MAV: -0.6%	3A: -0.7% MAV: -1.2%	3A: -0.9% MAV: -1.5%		
Year		**FY25**	**FY26**	**FY27 onwards**		
TP-3		3A: -0.4% MAV: -0.6%	3A: -0.7% MAV: -1.2%	3A: -0.9% MAV: -1.5%		
Year	**FY42 Onwards**				**FY23**	**FY24 onwards**
TP-4	CJV:3.7%, Bus/LCV:0.9% 2A:2.4%, 3A:3.2%, MAV:3.4%				CJV: 1.6%	CJV: 3.1%

Source: Steer analysis of OD data, and publicly available information

Impacts-Downside Case

6.32 The downside case impacts included in forecasts are summarised in below:

Table 6.37: Summary of impacts on the Assets

Impact	LoS Improvement (6 Laning)	NH-744 Upgrade			4-L of Trivandrum Nagercoil	
Year	**FY32 Onwards**					
TP-1	CJV:2.0%, LCV/Bus:0.4% 2A:1.0%, 3A:1.1%, MAV:0.9%					
Year		**FY25**	**FY26**	**FY27 onwards**		
TP-2		3A: -0.6% MAV: -1.0%	3A: -1.2% MAV: -2.0%	3A: -1.5% MAV: -2.5%		
Year		**FY25**	**FY26**	**FY27 onwards**		
TP-3		3A: -0.6% MAV: -1.0%	3A: -1.2% MAV: -2.0%	3A: -1.5% MAV: -2.5%		
Year	**FY42 Onwards**				**FY23**	**FY24 onwards**

Impact	LoS Improvement (6 Laning)	NH-744 Upgrade	4-L of Trivandrum Nagercoil	
TP-4	CJV:2.2%, LCV/Bus:0.5%, 2A:1.4%, 3A:1.9%, MAV:2.0%		CJV: 0.9%	CJV: 1.9%

Source: Steer analysis of OD data, and publicly available information

6.33 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.34 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.35 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.38: Traffic forecast (With Upside Impacts) for TP1: Kappalur

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	15,667	17,297	25,730	42,319	98,032	195,279
Mini LCV	2,053	2,190	2,839	3,871	6,694	10,483
Bus	2,923	3,431	4,176	5,011	6,877	8,910
LCV	1,528	1,631	2,114	2,882	4,983	7,804
2A	1,264	1,337	1,671	2,205	3,533	5,196
3A	567	583	653	760	964	1,172
MAV	871	912	1,100	1,389	2,060	2,844
AADT	**24,873**	**27,381**	**38,285**	**58,437**	**123,141**	**231,688**
PCU's	**37,165**	**41,013**	**54,894**	**79,050**	**153,155**	**272,740**

Source: Steer analysis

Table 6.39: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Kappalur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	10.4%	10.4%	10.5%	8.8%	9.0%
Mini LCV	6.7%	6.7%	6.4%	5.6%	5.8%
Bus	17.4%	5.0%	3.7%	3.2%	3.5%
LCV	6.7%	6.7%	6.4%	5.6%	5.8%
2A	5.7%	5.7%	5.7%	4.8%	5.0%
3A	2.9%	2.9%	3.1%	2.4%	2.5%
MAV	4.8%	4.8%	4.8%	4.0%	4.1%
AADT	**10.1%**	**8.7%**	**8.8%**	**7.7%**	**7.9%**
PCU's	**10.4%**	**7.6%**	**7.6%**	**6.8%**	**7.0%**

Source: Steer analysis

Table 6.40: Revenue forecast (With Upside Impacts) for TP1: Kappalur (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	33	41	77	166	649	2,097
Mini LCV	4	5	9	15	44	113
Bus	10	12	19	30	69	146
LCV	6	7	11	20	58	148
2A	10	12	18	32	86	206
3A	5	6	9	13	29	57
MAV	14	16	24	40	99	223
Total Revenue	**82**	**99**	**167**	**316**	**1,035**	**2,990**

Source: Steer analysis

Table 6.41: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Kappalur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	23.5%	17.4%	16.5%	14.6%	15.1%
Mini LCV	19.4%	13.4%	12.2%	11.3%	11.6%
Bus	30.3%	11.2%	9.5%	8.8%	9.2%
LCV	18.9%	13.1%	12.3%	11.3%	11.6%
2A	17.4%	11.9%	11.6%	10.4%	10.8%
3A	13.1%	9.3%	8.8%	7.9%	8.2%
MAV	16.4%	11.0%	10.6%	9.6%	9.9%
Total Revenue	**21.1%**	**14.1%**	**13.6%**	**12.6%**	**12.9%**

Source: Steer analysis

Table 6.42: Traffic forecast (With Upside Impacts) for TP2: Etturvattam

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6,580	7,209	10,393	15,950	34,562	65,166
Mini LCV	705	752	975	1,321	2,284	3,577
Bus	980	1,108	1,349	1,608	2,207	2,860
LCV	793	846	1,097	1,486	2,570	4,024
2A	811	858	1,073	1,393	2,232	3,282
3A	315	324	360	410	521	633
MAV	691	724	860	1,070	1,588	2,192
AADT	**10,877**	**11,822**	**16,106**	**23,239**	**45,963**	**81,735**
PCU's	**17,090**	**18,504**	**24,211**	**33,287**	**60,847**	**102,379**

Source: Steer analysis

Table 6.43: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Etturvattam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	9.5%	9.6%	8.9%	8.0%	8.2%
Mini LCV	6.7%	6.7%	6.3%	5.6%	5.7%
Bus	13.0%	5.0%	3.6%	3.2%	3.4%
LCV	6.7%	6.7%	6.3%	5.6%	5.7%
2A	5.7%	5.7%	5.4%	4.8%	4.9%
3A	2.9%	2.6%	2.7%	2.4%	2.4%
MAV	4.8%	4.4%	4.5%	4.0%	4.0%
AADT	**8.7%**	**8.0%**	**7.6%**	**7.1%**	**7.1%**
PCU's	**8.3%**	**7.0%**	**6.6%**	**6.2%**	**6.3%**

Source: Steer analysis

Table 6.44: Revenue forecast (With Upside Impacts) for TP2: Etturvattam (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	17	20	37	74	273	836
Mini LCV	2	2	3	6	18	46
Bus	5	6	10	16	36	76
LCV	3	4	7	12	34	86
2A	7	8	13	22	59	143
3A	3	4	5	8	16	32
MAV	10	12	18	29	72	163
Total Revenue	**48**	**57**	**93**	**166**	**509**	**1,382**

Source: Steer analysis

Table 6.45: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Etturvattam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	20.5%	16.4%	14.8%	13.9%	14.2%
Mini LCV	17.4%	13.3%	12.0%	11.3%	11.6%
Bus	24.8%	11.5%	9.3%	8.8%	9.2%
LCV	18.8%	13.0%	12.2%	11.3%	11.6%
2A	16.7%	12.2%	11.2%	10.4%	10.8%
3A	14.1%	8.7%	8.4%	7.9%	8.1%
MAV	16.3%	10.6%	10.3%	9.6%	9.8%
Total Revenue	**18.9%**	**13.3%**	**12.3%**	**11.8%**	**12.1%**

Source: Steer analysis

Table 6.46: Traffic forecast (With Upside Impacts) for TP3: Salaipudhur

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6,135	6,721	9,689	14,869	32,221	60,753
Mini LCV	728	777	1,007	1,365	2,359	3,695
Bus	816	922	1,123	1,339	1,837	2,380
LCV	705	752	975	1,320	2,283	3,575
2A	711	751	940	1,220	1,955	2,875
3A	283	291	323	368	468	568
MAV	494	517	614	764	1,133	1,565
AADT	**9,871**	**10,731**	**14,670**	**21,246**	**42,256**	**75,412**
PCU's	**14,987**	**16,235**	**21,351**	**29,533**	**54,544**	**92,475**

Source: Steer analysis

Table 6.47: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP3: Salaipudhur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	9.5%	9.6%	8.9%	8.0%	8.2%
Mini LCV	6.7%	6.7%	6.3%	5.6%	5.7%
Bus	13.0%	5.0%	3.6%	3.2%	3.4%
LCV	6.7%	6.7%	6.3%	5.6%	5.7%
2A	5.7%	5.7%	5.4%	4.8%	4.9%
3A	2.9%	2.6%	2.7%	2.4%	2.4%
MAV	4.8%	4.4%	4.5%	4.0%	4.0%
AADT	**8.7%**	**8.1%**	**7.7%**	**7.1%**	**7.2%**
PCU's	**8.3%**	**7.1%**	**6.7%**	**6.3%**	**6.4%**

Source: Steer analysis

Table 6.48: Revenue forecast (With Upside Impacts) for TP3: Salaipudhur (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	19	23	41	83	305	933
Mini LCV	2	3	4	8	22	57
Bus	6	7	11	17	40	85
LCV	4	4	7	12	36	93
2A	7	9	14	23	63	150
3A	3	4	5	8	17	34
MAV	9	10	16	26	64	144
Total Revenue	**50**	**60**	**98**	**177**	**548**	**1,496**

Source: Steer analysis

Table 6.49: Revenue growth (With Upside Impacts) CAGR (%) for TP3: Salaipudhur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	21.6%	16.1%	14.9%	13.9%	14.2%
Mini LCV	18.5%	13.0%	12.1%	11.4%	11.6%
Bus	24.8%	11.4%	9.4%	8.8%	9.2%
LCV	16.7%	13.3%	12.2%	11.3%	11.6%
2A	16.5%	12.2%	11.2%	10.5%	10.8%
3A	13.5%	8.9%	8.3%	7.9%	8.1%
MAV	16.1%	10.6%	10.3%	9.6%	9.8%
Total Revenue	**19.2%**	**13.3%**	**12.5%**	**12.0%**	**12.2%**

Source: Steer analysis

Table 6.50: Traffic forecast (With Upside Impacts) for TP4: Nanguneri

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	7,906	8,796	12,876	19,761	44,339	83,602
Mini LCV	870	928	1,203	1,630	2,842	4,451
Bus	1,062	1,246	1,517	1,809	2,504	3,245
LCV	749	799	1,035	1,403	2,447	3,832
2A	650	687	859	1,115	1,830	2,692
3A	351	361	405	462	605	735
MAV	491	514	620	772	1,183	1,633
AADT	**12,078**	**13,332**	**18,515**	**26,951**	**55,750**	**100,190**
PCU's	**17,716**	**19,512**	**26,032**	**36,214**	**69,595**	**119,236**

Source: Steer analysis

Table 6.51: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP4: Nanguneri

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	11.3%	10.0%	8.9%	8.4%	8.4%
Mini LCV	6.7%	6.7%	6.3%	5.7%	5.8%
Bus	17.4%	5.0%	3.6%	3.3%	3.5%
LCV	6.7%	6.7%	6.3%	5.7%	5.8%
2A	5.7%	5.7%	5.4%	5.1%	5.0%
3A	2.9%	2.9%	2.7%	2.7%	2.6%
MAV	4.8%	4.8%	4.5%	4.4%	4.2%
AADT	**10.4%**	**8.6%**	**7.8%**	**7.5%**	**7.5%**
PCU's	**10.1%**	**7.5%**	**6.8%**	**6.8%**	**6.7%**

Source: Steer analysis

Table 6.52: Revenue forecast (With Upside Impacts) for TP4: Nanguneri (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	21	25	47	94	358	1,095
Mini LCV	2	3	4	8	23	58
Bus	5	7	11	17	40	84
LCV	3	4	6	11	32	82
2A	6	7	11	19	52	125
3A	4	4	6	9	20	39
MAV	8	9	14	22	57	129
Total Revenue	**49**	**59**	**99**	**179**	**582**	**1,612**

Source: Steer analysis

Table 6.53: Revenue growth (With Upside Impacts) CAGR (%) for TP4: Nanguneri

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	23.1%	16.3%	15.0%	14.3%	14.4%
Mini LCV	18.0%	12.8%	12.2%	11.5%	11.6%
Bus	29.9%	11.4%	9.3%	8.9%	9.2%
LCV	18.2%	13.1%	12.3%	11.4%	11.7%
2A	17.0%	12.1%	11.2%	10.7%	10.8%
3A	13.5%	9.2%	8.3%	8.3%	8.3%
MAV	16.2%	11.1%	10.2%	10.0%	10.0%
Total Revenue	**20.8%**	**13.7%**	**12.7%**	**12.5%**	**12.5%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.36 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.37 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.54: Traffic forecast (With Downside Impacts) for TP1: Kappalur

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	15,667	16,693	21,538	29,413	48,870	72,933
Mini LCV	2,053	2,140	2,525	3,063	4,256	5,516
Bus	2,923	3,314	3,800	4,255	5,142	5,968
LCV	1,528	1,593	1,879	2,280	3,169	4,106
2A	1,264	1,310	1,510	1,794	2,380	2,974
3A	567	577	620	681	785	878
MAV	871	897	1,010	1,168	1,479	1,781
AADT	**24,873**	**26,523**	**32,883**	**42,654**	**66,081**	**94,155**

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
PCU's	**37,165**	**39,801**	**48,026**	**59,961**	**87,707**	**119,975**

Source: Steer analysis

Table 6.55: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Kappalur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	6.6%	6.6%	6.4%	5.2%	5.4%
Mini LCV	4.2%	4.2%	3.9%	3.3%	3.4%
Bus	13.4%	3.5%	2.3%	1.9%	2.1%
LCV	4.2%	4.2%	3.9%	3.3%	3.4%
2A	3.6%	3.6%	3.5%	2.9%	3.0%
3A	1.8%	1.8%	1.9%	1.4%	1.5%
MAV	3.0%	3.0%	2.9%	2.4%	2.5%
AADT	**6.6%**	**5.5%**	**5.3%**	**4.5%**	**4.6%**
PCU's	**7.1%**	**4.8%**	**4.5%**	**3.9%**	**4.0%**

Source: Steer analysis

Table 6.56: Revenue forecast (With Downside Impacts) for TP1: Kappalur (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	33	39	60	101	240	497
Mini LCV	4	5	7	10	21	38
Bus	10	12	16	22	39	62
LCV	6	7	9	14	28	50
2A	10	11	16	23	43	75
3A	5	6	8	11	18	27
MAV	14	15	21	29	53	89
Total Revenue	**82**	**96**	**137**	**210**	**442**	**837**

Source: Steer analysis

Table 6.57: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Kappalur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	19.2%	11.3%	10.8%	9.1%	9.5%
Mini LCV	16.6%	8.8%	8.2%	7.2%	7.4%
Bus	24.6%	8.3%	6.4%	5.7%	6.1%
LCV	14.9%	9.1%	8.3%	7.2%	7.5%
2A	13.7%	8.5%	7.6%	6.7%	7.0%
3A	11.5%	6.6%	6.0%	5.2%	5.5%
MAV	13.3%	7.9%	7.1%	6.2%	6.5%
Total Revenue	**17.2%**	**9.5%**	**8.8%**	**7.7%**	**8.1%**

Source: Steer analysis

Table 6.58: Traffic forecast (With Downside Impacts) for TP2: Etturvattam

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6,580	6,976	8,819	11,536	18,397	26,581
Mini LCV	705	735	867	1,048	1,456	1,887
Bus	980	1,079	1,237	1,380	1,667	1,935
LCV	793	827	975	1,179	1,638	2,123
2A	811	841	969	1,141	1,513	1,891
3A	315	321	339	368	425	475
MAV	691	712	782	896	1,134	1,366
AADT	**10,877**	**11,490**	**13,989**	**17,547**	**26,231**	**36,257**
PCU's	**17,090**	**18,034**	**21,379**	**25,990**	**36,890**	**49,087**

Source: Steer analysis

Table 6.59: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Etturvattam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	6.0%	6.0%	5.5%	4.8%	4.9%
Mini LCV	4.2%	4.2%	3.9%	3.3%	3.4%
Bus	10.0%	3.5%	2.2%	1.9%	2.1%
LCV	4.2%	4.2%	3.9%	3.3%	3.4%
2A	3.6%	3.6%	3.3%	2.9%	2.9%
3A	1.8%	1.4%	1.7%	1.4%	1.4%
MAV	3.0%	2.4%	2.8%	2.4%	2.4%
AADT	**5.6%**	**5.0%**	**4.6%**	**4.1%**	**4.2%**
PCU's	**5.5%**	**4.3%**	**4.0%**	**3.6%**	**3.6%**

Source: Steer analysis

Table 6.60: Revenue forecast (With Downside Impacts) for TP2: Etturvattam (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	17	20	30	47	109	218
Mini LCV	2	2	3	4	9	15
Bus	5	6	9	12	20	33
LCV	3	4	5	8	16	29
2A	7	8	11	16	30	52
3A	3	4	5	6	10	15
MAV	10	12	15	21	39	64
Total Revenue	**48**	**55**	**78**	**114**	**233**	**427**

Source: Steer analysis

Table 6.61: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Etturvattam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	16.6%	11.3%	9.3%	8.8%	9.0%
Mini LCV	14.7%	9.4%	7.6%	7.3%	7.4%
Bus	20.2%	8.5%	6.4%	5.6%	6.1%
LCV	12.9%	9.3%	8.1%	7.2%	7.5%
2A	12.9%	8.6%	7.6%	6.6%	7.0%
3A	11.5%	6.2%	5.8%	5.2%	5.4%
MAV	13.1%	7.2%	6.9%	6.2%	6.3%
Total Revenue	**15.0%**	**9.2%**	**7.9%**	**7.4%**	**7.6%**

Source: Steer analysis

Table 6.62: Traffic forecast (With Downside Impacts) for TP3: Salaipudhur

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	6,135	6,504	8,222	10,755	17,151	24,781
Mini LCV	728	759	896	1,082	1,504	1,949
Bus	816	898	1,030	1,148	1,388	1,611
LCV	705	734	867	1,047	1,455	1,886
2A	711	736	849	999	1,325	1,656
3A	283	288	305	331	381	426
MAV	494	508	558	639	810	975
AADT	**9,871**	**10,428**	**12,725**	**16,002**	**24,015**	**33,284**
PCU's	**14,987**	**15,818**	**18,819**	**22,964**	**32,809**	**43,874**

Source: Steer analysis

Table 6.63: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP3: Salaipudhur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	6.0%	6.0%	5.5%	4.8%	4.9%
Mini LCV	4.2%	4.2%	3.9%	3.3%	3.4%
Bus	10.0%	3.5%	2.2%	1.9%	2.1%
LCV	4.2%	4.2%	3.9%	3.3%	3.4%
2A	3.6%	3.6%	3.3%	2.9%	2.9%
3A	1.8%	1.4%	1.7%	1.4%	1.4%
MAV	3.0%	2.4%	2.8%	2.4%	2.4%
AADT	**5.6%**	**5.1%**	**4.7%**	**4.1%**	**4.2%**
PCU's	**5.5%**	**4.4%**	**4.1%**	**3.6%**	**3.7%**

Source: Steer analysis

Table 6.64: Revenue forecast (With Downside Impacts) for TP3: Salaipudhur (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	19	22	33	53	121	242
Mini LCV	2	3	4	5	11	19
Bus	6	7	10	13	23	37
LCV	4	4	6	9	17	31
2A	7	8	12	17	32	55
3A	3	4	5	6	10	16
MAV	9	10	13	19	34	57
Total Revenue	**50**	**58**	**82**	**122**	**248**	**457**

Source: Steer analysis

Table 6.65: Revenue growth (With Downside Impacts) CAGR (%) for TP3: Salaipudhur

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	16.2%	11.3%	9.8%	8.6%	9.0%
Mini LCV	14.2%	9.4%	8.1%	7.1%	7.5%
Bus	20.5%	8.4%	6.4%	5.7%	6.1%
LCV	13.9%	8.9%	8.1%	7.2%	7.4%
2A	13.6%	8.5%	7.5%	6.7%	6.9%
3A	12.0%	6.2%	5.8%	5.2%	5.4%
MAV	13.2%	7.1%	7.0%	6.2%	6.3%
Total Revenue	**15.2%**	**9.2%**	**8.2%**	**7.4%**	**7.7%**

Source: Steer analysis

Table 6.66: Traffic forecast (With Downside Impacts) for TP4: Nanguneri

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	7,906	8,460	10,794	14,119	22,517	33,234
Mini LCV	870	906	1,069	1,293	1,796	2,340
Bus	1,062	1,204	1,381	1,540	1,861	2,171
LCV	749	780	921	1,113	1,546	2,014
2A	650	673	776	913	1,212	1,536
3A	351	358	384	417	481	548
MAV	491	506	569	652	826	1,015
AADT	**12,078**	**12,887**	**15,894**	**20,047**	**30,239**	**42,858**
PCU's	**17,716**	**18,918**	**22,756**	**27,856**	**40,034**	**54,729**

Source: Steer analysis

Table 6.67: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP4: Nanguneri

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	7.0%	6.3%	5.5%	4.8%	5.0%
Mini LCV	4.2%	4.2%	3.9%	3.3%	3.4%
Bus	13.4%	3.5%	2.2%	1.9%	2.1%
LCV	4.2%	4.2%	3.9%	3.3%	3.4%
2A	3.6%	3.6%	3.3%	2.9%	3.0%
3A	1.8%	1.8%	1.7%	1.4%	1.5%
MAV	3.0%	3.0%	2.8%	2.4%	2.5%
AADT	**6.7%**	**5.4%**	**4.8%**	**4.2%**	**4.4%**
PCU's	**6.8%**	**4.7%**	**4.1%**	**3.7%**	**3.9%**

Source: Steer analysis

Table 6.68: Revenue forecast (With Downside Impacts) for TP4: Nanguneri (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY42	FY51
CJV	21	24	37	59	136	278
Mini LCV	2	3	4	5	11	20
Bus	5	7	9	13	22	36
LCV	3	4	5	8	15	27
2A	6	7	9	14	26	45
3A	4	4	5	7	12	19
MAV	8	9	12	16	30	51
Total Revenue	**49**	**57**	**82**	**122**	**251**	**475**

Source: Steer analysis

Table 6.69: Revenue growth (With Downside Impacts) CAGR (%) for TP4: Nanguneri

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY42	FY23-FY51
CJV	16.0%	11.6%	9.7%	8.6%	9.1%
Mini LCV	13.0%	9.5%	8.0%	7.2%	7.5%
Bus	24.2%	8.4%	6.4%	5.7%	6.1%
LCV	15.5%	9.2%	7.9%	7.2%	7.5%
2A	13.4%	8.5%	7.6%	6.7%	7.0%
3A	11.4%	6.6%	5.8%	5.2%	5.5%
MAV	13.1%	7.9%	6.9%	6.2%	6.5%
Total Revenue	**15.6%**	**9.7%**	**8.3%**	**7.5%**	**7.9%**

Source: Steer analysis

Target revenues and modification of concession period

6.38 As per the concession agreement, the target revenue for individual toll plazas should be as shown in the table below for the first calculation of target revenue and the second calculation of target revenue in March 2030 and March 2040 respectively. The traffic sampling will be undertaken for a continuous period of 7 days during anytime within 15 days prior to the date on the specified year, previous year and following year. The average thereof will be deemed as 'actual revenue.' If the target revenue for any section falls short or exceeds by 2.5%, the concession period shall be deemed to be modified using the laid-out conditions in the concession agreement. The table below presents the summary of the analysis.

Table 6.70: Target Revenues for Extension 1

Asset	Target Month	Target Revenue Cr	Estimated Revenue			Average Revenue	Variation (%)
			2029	2030	2031		
TP1	Mar-30	12.2	11.3	12.0	19.8	14.4	17.9%
TP2	Mar-30	9.9	8.9	9.7	10.7	9.8	(1.2%)
TP3	Mar-30	9.8	9.4	10.4	11.3	10.4	5.2%
TP4	Mar-30	12.0	9.4	10.3	11.4	10.4	(13.3%)

Source: Steer analysis

Table 6.71: Target Revenues for Extension 2

Asset	Target Month	Target Revenue Cr	Estimated Revenue			Average Revenue	Variation (%)
			2039	2040	2041		
TP1	Mar-40	22.8	42.7	46.5	51.2	46.8	105.4%
TP2	Mar-40	22.7	22.2	24.3	26.6	24.3	7.2%
TP3	Mar-40	22.7	23.7	25.9	28.2	25.9	14.1%
TP4	Mar-40	28.2	24.0	26.3	28.9	26.4	(6.5%)

Source: Steer analysis

6.39 We have used the average AADT forecast for target year, previous year and following year as a proxy for 'actual traffic.' We have forecast seasonality of March month to adjust for seasonal trends and arrive at March traffic from AADT traffic, which is then segmented according to the forecast toll segmentation and trip factors and multiplied with respective estimated toll rates to get to a monthly revenue collection.

6.40 As seen from the table above, the target revenue forecast for the TP1 and the estimated target revenue, difference lies above the threshold value of 30% at second target date. As per the concession agreement, for every 1% excess target revenue, the concession period shall be decreased by 1.5%, with a capping at 20%. Therefore, for the excess traffic on the toll plazas, the concession period, originally 30 years, is expected to be decreased by 5 years from FY51, potentially reducing the last date of concession to FY46 for TP1. For TP2-4 there is no change in concession period expected as the difference in estimated and target revenues lie within the threshold range as stipulated by the concession agreement.

Summary outlook

6.41 Overall, passenger traffic on the Asset is largely inter-urban driven by business, tourism and leisure travel between the cities of Madurai, Tirunelveli, Nagercoil and Thiruvananthapuram, and towns in the southern Tamil Nadu (TN) region. Goods traffic serve the regional industries of wind power and cement, apart from consumption-based movements feeding demand from urban areas. While wind farms are concentrated in the Tirunelveli and Kanyakumari regions, two large operational cement plants are located on the Asset between Virudhunagar and Tirunelveli. The Chennai-Kanykumari section of the East Coast Industrial Corridor is planned with nodes in Madurai and Tuticorin and expected to directly support growth in the region and traffic on the Asset.

6.42 Located in the urbanised and industrialised state of TN, the four-lane Asset highway is part of a well-established road network with stable travel patterns and potential for steady growth. While the Asset is the primary connection between northern TN and locations north of the state at one end, and the southern TN region, the parallel Tuticorin-Madurai (NH 38) highway to the east of the Asset caters to Tuticorin port traffic, particularly connecting it with the northern TN hinterland. The Asset is also the primary route for inter-urban travel in the southern TN region – both within the State and with the Thiruvananthapuram district of Kerala. The parallel NH 744 Tirumangalam-Kollam highway connects Madurai and northern Tamil Nadu with Courtallam falls near Tirunelveli and Kollam and neighbouring districts in Kerala.

6.43 Consequent to the expected steady growth on the Asset, TP1 Kappalur and TP4 Nanguneri closer to the cities of Madurai and Tirunelveli are expected to cross capacity for four-lane roads during the concession period. With six-lane upgrades for these sections by FY30 and FY45 respectively, the Asset is expected to offer additional capacity and therefore see an improvement in level of service, leading to a considerable additional travel demand. Upgrade of the feeder section between Nagercoil/Kanyakumari and Thiruvananthapuram of the NH 66 highway is expected to again lead to improved levels of service for inter-urban travel and induce more car trips. Upgrade and tolling of the alternate NH 744 highway may lead to a small negative diversion impact for heavy vehicles currently using the Asset.

6.44 Though traffic across toll roads in India were temporarily affected during the country due to the COVID-19 lockdowns, we have observed significant and higher-than-expected recovery in traffic demand across both passenger and goods vehicle types in FY21 and the similar trends has sustained over FY22 with a minor dip in traffic in Q1FY22 and Q4FY22 amid COVID-19 waves. Considering the above positive outlook of the Asset with a stable and well-established road network, strong urban consumption demand and regional industry, the forecasts overall translate to traffic growth rates of 5.5%, 4.9%, 5.0% and 5.3% CAGR at PCU levels at TP1, TP2, TP3 and TP4 respectively, during the FY22-51 period. At TP1 Kappalur, the total AADT, starting at above 37,000 in FY22, is estimated to cross 175,000 in the final year of concession FY51. Revenue forecasts are expected to start growing at an estimated over 10% in the FY22-51 period.

6.45 We expect that the implementation of mandatory FASTag-based tolling has already demonstrated and will continue improving the operational efficiency and overall compliance levels on the Asset and overall corridor as a whole which should result in an improved level of service for all users.

6.46 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be risks associated with assumptions and the forecasts using them as summarised below.

6.47 With regards to the long-term background growth, we see the following risks:

- It was observed in FY21 that a very a strong recovery of traffic took place once the nationwide lockdown was relaxed. This included pent up demand from the lockdown period giving a major boost to traffic in FY21. It can be seen from the FY22 traffic data that the traffic is following the similar trends as seen in the Q3 and Q4FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure has seen a comeback in the second part of FY22 resulting in increased activity in the corridor and these.

6.48 With regards to impacts, we see the following risks:

- Delay in the completion of upgrade on the Tirumangalam-Kollam highway (NH 744) may be a positive risk for the Asset.
- Delay in completion of four-laning of the Kanykumari-Thiruvananthapuram section of NH 66 highway or six-laning of the Asset may delay the estimated positive induced demand on Asset.

6.49 Overall, we see a positive outlook for the Asset given the well-established road network and driven by inter-urban business, leisure and tourism travel in cars and buses, along with the regional economies of wind power, cement, industrial estates and consumption-based goods driving stable and steady growth of heavy vehicle traffic. The underlying growth drivers of the corridor are therefore strong and are expected to deliver sustained growth.

Appendices

A Top 10 OD Pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Kappalur

Table A.1: CJV, Bus and Mini Bus top 10 OD pair shares at TP1 Kappalur

	OD Pair	Share
1.	Madurai-Tirumangalam	24%
2.	Madurai-Tirunelveli	7%
3.	Madurai-Virudunagar	5%
4.	Madurai-Sivakasi	5%
5.	Madurai-Rajapalayam	4%
6.	Tirumangalam-Tiruchirappalli	4%
7.	Madurai-Tenkasi	4%
8.	Madurai-Kanyakumari	3%
9.	Madurai-Kovilpatti	2%
10.	Tirunelveli-Chennai	2%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Kappalur

	OD Pair	Share
1.	Madurai-Tirunelveli	5%
2.	Madurai-Tirumangalam	5%
3.	Madurai-Virudunagar	5%
4.	Tirunelveli-Chennai	3%
5.	Madurai-Tenkasi	3%
6.	Madurai-Rajapalayam	3%
7.	Chennai-Kanyakumari	3%
8.	Madurai-Kanyakumari	2%
9.	Madurai-Sivakasi	2%
10.	Kappalur-Tirumangalam	2%

Source: Steer analysis of OD data

TP2 Etturvattam

Table A.3: CJV, Bus and Mini Bus top 10 OD pair shares at TP2 Etturvattam

	OD Pair	Share
1.	Madurai-Tirunelveli	19%
2.	Madurai-Kovilpatti	7%
3.	Tirunelveli-Chennai	6%
4.	Madurai-Kanyakumari	6%
5.	Tirunelveli-Coimbatore	5%
6.	Madurai-Sattur	4%
7.	Chennai-Kanyakumari	4%
8.	Virudunagar-Sattur	3%
9.	Tirunelveli-Tiruchirappalli	2%
10.	Virudunagar-Kovilpatti	2%

Source: Steer analysis of OD data

Table A.4: MAV and OSV top 10 OD pair shares at TP2 Etturvattam

	OD Pair	Share
1.	Madurai-Tirunelveli	8%
2.	Dindigul-Tenkasi	5%
3.	Tirunelveli-Chennai	4%
4.	Dindigul-Kanyakumari	4%
5.	Tirunelveli-Dindigul	3%
6.	Tirunelveli-Tiruppur	2%
7.	Kovilpatti-Dindigul	2%
8.	Chennai-Kanyakumari	2%
9.	Madurai-Thiruvananthapuram	2%
10.	Madurai-Kanyakumari	2%

Source: Steer analysis of OD data

TP3 Salaipudhur

Table A.5: CJV, Bus and Mini Bus top 10 OD pair shares at TP3 Salaipudhur

	OD Pair	Share
1.	Madurai-Tirunelveli	20%
2.	Kovilpatti-Tirunelveli	10%
3.	Madurai-Kanyakumari	8%
4.	Tirunelveli-Chennai	6%
5.	Chennai-Kanyakumari	5%
6.	Kovilpatti-Kayathar	3%
7.	Tirunelveli-Coimbatore	2%
8.	Sattur-Tirunelveli	2%
9.	Madurai-Kayathar	2%
10.	Tirunelveli-Tiruchirappalli	2%

Source: Steer analysis of OD data

Table A.6: MAV and OSV top 10 OD pair shares at TP3 Salaipudhur

	OD Pair	Share
1.	Tirunelveli-Chennai	6%
2.	Madurai-Tirunelveli	6%
3.	Dindigul-Kanyakumari	5%
4.	Chennai-Kanyakumari	5%
5.	Madurai-Kanyakumari	4%
6.	Tirunelveli-Dindigul	4%
7.	Tirunelveli-Karnataka	3%
8.	Ariyalur-Kanyakumari	2%
9.	Kovilpatti-Tirunelveli	2%
10.	Virudunagar-Tirunelveli	2%

Source: Steer analysis of OD data

TP4 Nanguneri

Table A.7: CJV, Bus and Mini Bus top 10 OD pair shares at TP4 Nanguneri

	OD Pair	Share
1.	Tirunelveli-Kanyakumari	31%
2.	Madurai-Kanyakumari	8%
3.	Tuticorin (Thoothukudi)-Kanyakumari	6%
4.	Tirunelveli-Vallioor	5%
5.	Chennai-Kanyakumari	5%
6.	Tirunelveli-Tirunelveli	5%
7.	Tirunelveli-Nanguneri	2%
8.	Tirunelveli-Kanniyakumari	2%
9.	Tirunelveli-Thiruvananthapuram	2%
10.	Madurai-Thiruvananthapuram	1%

Source: Steer analysis of OD data

Table A.8: MAV and OSV top 10 OD pair shares at TP4 Nanguneri

	OD Pair	Share
1.	Tirunelveli-Kanyakumari	15%
2.	Tuticorin (Thoothukudi)-Kanyakumari	9%
3.	Madurai-Kanyakumari	9%
4.	Chennai-Kanyakumari	6%
5.	Tirunelveli-Vallioor	3%
6.	Tuticorin (Thoothukudi)-Thiruvananthapuram	2%
7.	Tirunelveli-Kanniyakumari	2%
8.	Madurai-Thiruvananthapuram	2%
9.	Kovilpatti-Kanyakumari	2%
10.	Tirunelveli-Thiruvananthapuram	2%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

This section presents the detailed traffic forecasts for the forecast period until FY50, year of expected close of the concession. The following two tables show the AADT and traffic growth, respectively.

Table B.1: Traffic Forecast (with impacts) over horizon years at TP1 Kappalur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	15,667	2,053	2,923	1,528	1,264	567	871	**24,873**	**37,165**
FY23	16,978	2,164	3,372	1,611	1,322	580	904	**26,931**	**40,382**
FY24	18,422	2,282	3,635	1,699	1,384	594	939	**28,955**	**43,209**
FY25	19,986	2,406	3,748	1,791	1,449	608	976	**30,964**	**45,732**
FY26	21,675	2,537	3,865	1,888	1,516	622	1,014	**33,116**	**48,417**
FY27	23,442	2,669	3,980	1,987	1,585	636	1,052	**35,351**	**51,184**
FY28	25,325	2,807	4,098	2,090	1,655	650	1,091	**37,714**	**54,091**
FY29	27,329	2,950	4,217	2,196	1,727	664	1,130	**40,212**	**57,145**
FY30	29,450	3,097	4,337	2,305	1,800	678	1,170	**42,838**	**60,334**
FY31	32,536	3,265	4,481	2,431	1,900	703	1,226	**46,541**	**64,766**
FY32	34,982	3,423	4,605	2,548	1,979	717	1,268	**49,521**	**68,336**
FY33	37,569	3,586	4,730	2,669	2,059	732	1,311	**52,655**	**72,070**
FY34	40,301	3,753	4,856	2,794	2,142	746	1,355	**55,946**	**75,972**
FY35	43,182	3,925	4,983	2,922	2,226	761	1,399	**59,399**	**80,045**
FY36	46,216	4,103	5,112	3,054	2,312	776	1,444	**63,017**	**84,292**
FY37	49,407	4,284	5,241	3,189	2,400	791	1,490	**66,803**	**88,716**
FY38	52,758	4,471	5,372	3,328	2,490	805	1,536	**70,760**	**93,319**
FY39	56,271	4,662	5,503	3,471	2,581	820	1,583	**74,891**	**98,104**
FY40	59,981	4,860	5,636	3,618	2,675	835	1,631	**79,235**	**103,117**
FY41	63,897	5,063	5,771	3,769	2,771	850	1,680	**83,801**	**108,364**
FY42	68,026	5,274	5,908	3,926	2,869	865	1,730	**88,598**	**113,856**
FY43	72,379	5,490	6,047	4,087	2,970	880	1,780	**93,634**	**119,600**
FY44	76,962	5,714	6,187	4,253	3,074	896	1,832	**98,918**	**125,606**
FY45	81,786	5,943	6,330	4,425	3,180	911	1,885	**104,460**	**131,883**
FY46	86,859	6,180	6,474	4,601	3,289	927	1,938	**110,267**	**138,439**
FY47	92,190	6,424	6,620	4,782	3,400	942	1,993	**116,350**	**145,285**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY48	97,788	6,674	6,767	4,969	3,513	958	2,048	**122,717**	**152,428**
FY49	103,662	6,932	6,916	5,160	3,629	974	2,105	**129,378**	**159,878**
FY50	109,821	7,196	7,067	5,357	3,748	990	2,162	**136,342**	**167,644**
FY51	116,347	7,471	7,221	5,562	3,871	1,006	2,221	**143,698**	**175,824**

Source: Steer analysis

Table B.2: Forecasts (with impacts) for AADT growth rates (%) at TP1 Kappalur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	3.5%	3.5%	8.4%	(35.5%)	3.1%	(4.9%)	5.2%	**0.1%**	**0.5%**
FY23	8.4%	5.4%	15.4%	5.4%	4.6%	2.3%	3.8%	**8.3%**	**8.7%**
FY24	8.5%	5.5%	7.8%	5.5%	4.7%	2.3%	3.9%	**7.5%**	**7.0%**
FY25	8.5%	5.5%	3.1%	5.5%	4.7%	2.3%	3.9%	**6.9%**	**5.8%**
FY26	8.5%	5.4%	3.1%	5.4%	4.7%	2.3%	3.9%	**7.0%**	**5.9%**
FY27	8.2%	5.2%	3.0%	5.2%	4.5%	2.2%	3.7%	**6.7%**	**5.7%**
FY28	8.0%	5.2%	2.9%	5.2%	4.4%	2.2%	3.7%	**6.7%**	**5.7%**
FY29	7.9%	5.1%	2.9%	5.1%	4.4%	2.2%	3.6%	**6.6%**	**5.6%**
FY30	7.8%	5.0%	2.8%	5.0%	4.3%	2.1%	3.6%	**6.5%**	**5.6%**
FY31	10.5%	5.4%	3.3%	5.4%	5.5%	3.6%	4.7%	**8.6%**	**7.3%**
FY32	7.5%	4.8%	2.8%	4.8%	4.1%	2.1%	3.4%	**6.4%**	**5.5%**
FY33	7.4%	4.7%	2.7%	4.7%	4.1%	2.0%	3.4%	**6.3%**	**5.5%**
FY34	7.3%	4.7%	2.7%	4.7%	4.0%	2.0%	3.3%	**6.3%**	**5.4%**
FY35	7.1%	4.6%	2.6%	4.6%	3.9%	2.0%	3.3%	**6.2%**	**5.4%**
FY36	7.0%	4.5%	2.6%	4.5%	3.9%	1.9%	3.2%	**6.1%**	**5.3%**
FY37	6.9%	4.4%	2.5%	4.4%	3.8%	1.9%	3.2%	**6.0%**	**5.2%**
FY38	6.8%	4.4%	2.5%	4.4%	3.7%	1.9%	3.1%	**5.9%**	**5.2%**
FY39	6.7%	4.3%	2.4%	4.3%	3.7%	1.8%	3.1%	**5.8%**	**5.1%**
FY40	6.6%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.8%**	**5.1%**
FY41	6.5%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.8%**	**5.1%**
FY42	6.5%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.7%**	**5.1%**
FY43	6.4%	4.1%	2.3%	4.1%	3.5%	1.8%	2.9%	**5.7%**	**5.0%**
FY44	6.3%	4.1%	2.3%	4.1%	3.5%	1.7%	2.9%	**5.6%**	**5.0%**
FY45	6.3%	4.0%	2.3%	4.0%	3.5%	1.7%	2.9%	**5.6%**	**5.0%**
FY46	6.2%	4.0%	2.3%	4.0%	3.4%	1.7%	2.8%	**5.6%**	**5.0%**
FY47	6.1%	3.9%	2.3%	3.9%	3.4%	1.7%	2.8%	**5.5%**	**4.9%**
FY48	6.1%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.5%**	**4.9%**
FY49	6.0%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.4%**	**4.9%**
FY50	5.9%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**5.4%**	**4.9%**
FY51	5.9%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**5.4%**	**4.9%**

Source: Steer analysis

Table B.3: Traffic Forecast(with impacts) over horizon years at TP2 Etturvattam

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	6,580	705	980	793	811	315	691	**10,877**	**17,090**
FY23	7,086	743	1,093	836	849	322	718	**11,647**	**18,258**
FY24	7,639	784	1,179	882	889	330	746	**12,447**	**19,411**
FY25	8,234	826	1,215	930	930	336	769	**13,239**	**20,449**
FY26	8,872	871	1,253	980	973	342	792	**14,083**	**21,546**
FY27	9,536	917	1,291	1,031	1,017	349	818	**14,958**	**22,683**
FY28	10,238	964	1,329	1,085	1,062	356	848	**15,882**	**23,885**
FY29	10,982	1,013	1,367	1,140	1,108	364	879	**16,853**	**25,140**
FY30	11,764	1,064	1,406	1,196	1,156	372	910	**17,868**	**26,444**
FY31	12,588	1,116	1,445	1,255	1,204	380	942	**18,931**	**27,802**
FY32	13,456	1,170	1,485	1,316	1,254	388	975	**20,044**	**29,216**
FY33	14,369	1,225	1,526	1,378	1,305	396	1,008	**21,207**	**30,685**
FY34	15,328	1,282	1,566	1,443	1,357	404	1,042	**22,422**	**32,212**
FY35	16,333	1,341	1,607	1,509	1,411	411	1,076	**23,689**	**33,796**
FY36	17,386	1,402	1,649	1,577	1,465	419	1,110	**25,009**	**35,439**
FY37	18,488	1,464	1,691	1,647	1,521	427	1,145	**26,383**	**37,140**
FY38	19,638	1,528	1,733	1,719	1,578	435	1,181	**27,811**	**38,900**
FY39	20,838	1,593	1,775	1,792	1,636	443	1,217	**29,294**	**40,720**
FY40	22,098	1,661	1,818	1,868	1,695	451	1,254	**30,845**	**42,615**
FY41	23,422	1,730	1,862	1,946	1,756	459	1,292	**32,466**	**44,588**
FY42	24,810	1,802	1,906	2,027	1,818	468	1,330	**34,161**	**46,641**
FY43	26,267	1,876	1,951	2,110	1,882	476	1,369	**35,931**	**48,777**
FY44	27,793	1,952	1,996	2,196	1,948	484	1,409	**37,778**	**50,998**
FY45	29,391	2,031	2,042	2,285	2,015	493	1,449	**39,705**	**53,306**
FY46	31,063	2,112	2,088	2,376	2,084	501	1,490	**41,714**	**55,703**
FY47	32,812	2,195	2,135	2,469	2,154	509	1,532	**43,808**	**58,193**
FY48	34,640	2,281	2,183	2,565	2,226	518	1,575	**45,988**	**60,777**
FY49	36,549	2,369	2,231	2,664	2,300	526	1,618	**48,258**	**63,457**
FY50	38,542	2,459	2,280	2,766	2,375	535	1,663	**50,619**	**66,236**
FY51	40,643	2,553	2,329	2,872	2,453	544	1,708	**53,101**	**69,148**

Source: Steer analysis

Table B.4: Forecasts (with impacts) for AADT growth rates (%) at TP2 Etturvattam

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	(6.0%)	(6.0%)	6.9%	(25.5%)	6.3%	(2.4%)	9.4%	**(5.0%)**	**(2.1%)**
FY23	7.7%	5.4%	11.5%	5.4%	4.6%	2.3%	3.8%	**7.1%**	**6.8%**
FY24	7.8%	5.5%	7.8%	5.5%	4.7%	2.3%	3.9%	**6.9%**	**6.3%**
FY25	7.8%	5.5%	3.1%	5.5%	4.7%	1.8%	3.0%	**6.4%**	**5.3%**
FY26	7.8%	5.4%	3.1%	5.4%	4.7%	1.8%	3.0%	**6.4%**	**5.4%**
FY27	7.5%	5.2%	3.0%	5.2%	4.5%	2.0%	3.3%	**6.2%**	**5.3%**
FY28	7.4%	5.2%	2.9%	5.2%	4.4%	2.2%	3.7%	**6.2%**	**5.3%**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY29	7.3%	5.1%	2.9%	5.1%	4.4%	2.2%	3.6%	**6.1%**	**5.3%**
FY30	7.1%	5.0%	2.8%	5.0%	4.3%	2.1%	3.6%	**6.0%**	**5.2%**
FY31	7.0%	4.9%	2.8%	4.9%	4.2%	2.1%	3.5%	**6.0%**	**5.1%**
FY32	6.9%	4.8%	2.8%	4.8%	4.1%	2.1%	3.4%	**5.9%**	**5.1%**
FY33	6.8%	4.7%	2.7%	4.7%	4.1%	2.0%	3.4%	**5.8%**	**5.0%**
FY34	6.7%	4.7%	2.7%	4.7%	4.0%	2.0%	3.3%	**5.7%**	**5.0%**
FY35	6.6%	4.6%	2.6%	4.6%	3.9%	2.0%	3.3%	**5.7%**	**4.9%**
FY36	6.4%	4.5%	2.6%	4.5%	3.9%	1.9%	3.2%	**5.6%**	**4.9%**
FY37	6.3%	4.4%	2.5%	4.4%	3.8%	1.9%	3.2%	**5.5%**	**4.8%**
FY38	6.2%	4.4%	2.5%	4.4%	3.7%	1.9%	3.1%	**5.4%**	**4.7%**
FY39	6.1%	4.3%	2.4%	4.3%	3.7%	1.8%	3.1%	**5.3%**	**4.7%**
FY40	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.7%**
FY41	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.6%**
FY42	5.9%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.2%**	**4.6%**
FY43	5.9%	4.1%	2.3%	4.1%	3.5%	1.8%	2.9%	**5.2%**	**4.6%**
FY44	5.8%	4.1%	2.3%	4.1%	3.5%	1.7%	2.9%	**5.1%**	**4.6%**
FY45	5.8%	4.0%	2.3%	4.0%	3.5%	1.7%	2.9%	**5.1%**	**4.5%**
FY46	5.7%	4.0%	2.3%	4.0%	3.4%	1.7%	2.8%	**5.1%**	**4.5%**
FY47	5.6%	3.9%	2.3%	3.9%	3.4%	1.7%	2.8%	**5.0%**	**4.5%**
FY48	5.6%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.0%**	**4.4%**
FY49	5.5%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**4.9%**	**4.4%**
FY50	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**4.9%**	**4.4%**
FY51	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**4.9%**	**4.4%**

Source: Steer analysis

Table B.5: Traffic Forecast(with impacts) over horizon years at TP3 Salaipudhur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	6,135	728	816	705	711	283	494	**9,871**	**14,987**
FY23	6,606	767	910	743	743	289	513	**10,572**	**16,017**
FY24	7,121	809	981	783	778	296	533	**11,302**	**17,039**
FY25	7,676	854	1,012	826	815	301	549	**12,032**	**17,973**
FY26	8,271	900	1,043	871	853	307	565	**12,810**	**18,961**
FY27	8,890	947	1,074	916	891	313	584	**13,615**	**19,984**
FY28	9,545	996	1,106	964	930	320	606	**14,466**	**21,064**
FY29	10,238	1,046	1,138	1,013	971	327	628	**15,360**	**22,193**
FY30	10,967	1,099	1,170	1,063	1,012	334	650	**16,295**	**23,366**
FY31	11,736	1,152	1,203	1,115	1,055	341	673	**17,275**	**24,590**
FY32	12,545	1,208	1,236	1,169	1,098	348	696	**18,301**	**25,865**
FY33	13,396	1,266	1,270	1,224	1,143	355	720	**19,374**	**27,191**
FY34	14,290	1,325	1,304	1,282	1,189	362	744	**20,495**	**28,569**
FY35	15,227	1,385	1,338	1,340	1,236	369	768	**21,664**	**30,001**
FY36	16,209	1,448	1,373	1,401	1,283	376	793	**22,883**	**31,486**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY37	17,236	1,512	1,407	1,463	1,332	384	818	**24,152**	**33,026**
FY38	18,308	1,578	1,442	1,527	1,382	391	843	**25,471**	**34,620**
FY39	19,426	1,645	1,478	1,592	1,433	398	869	**26,841**	**36,268**
FY40	20,601	1,715	1,513	1,660	1,485	405	895	**28,275**	**37,986**
FY41	21,835	1,787	1,550	1,729	1,538	412	922	**29,774**	**39,776**
FY42	23,130	1,861	1,586	1,801	1,593	420	949	**31,340**	**41,640**
FY43	24,488	1,938	1,624	1,875	1,649	427	977	**32,977**	**43,580**
FY44	25,910	2,017	1,661	1,951	1,706	435	1,006	**34,686**	**45,598**
FY45	27,400	2,098	1,700	2,030	1,765	442	1,035	**36,469**	**47,696**
FY46	28,959	2,181	1,738	2,111	1,825	450	1,064	**38,329**	**49,877**
FY47	30,590	2,267	1,777	2,194	1,887	457	1,094	**40,267**	**52,143**
FY48	32,294	2,356	1,817	2,279	1,950	465	1,124	**42,286**	**54,496**
FY49	34,074	2,447	1,857	2,367	2,015	473	1,155	**44,387**	**56,938**
FY50	35,931	2,540	1,898	2,457	2,081	480	1,187	**46,574**	**59,472**
FY51	37,890	2,637	1,939	2,551	2,149	488	1,219	**48,873**	**62,127**

Source: Steer analysis

Table B.6: Forecasts (with impacts) for AADT growth rates (%) at TP3 Salaipudhur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	(7.8%)	(7.8%)	0.2%	(7.2%)	(1.5%)	(14.4%)	7.2%	**(6.3%)**	**(4.6%)**
FY23	7.7%	5.4%	11.5%	5.4%	4.6%	2.3%	3.8%	**7.1%**	**6.9%**
FY24	7.8%	5.5%	7.8%	5.5%	4.7%	2.3%	3.9%	**6.9%**	**6.4%**
FY25	7.8%	5.5%	3.1%	5.5%	4.7%	1.8%	3.0%	**6.5%**	**5.5%**
FY26	7.8%	5.4%	3.1%	5.4%	4.7%	1.8%	3.0%	**6.5%**	**5.5%**
FY27	7.5%	5.2%	3.0%	5.2%	4.5%	2.0%	3.3%	**6.3%**	**5.4%**
FY28	7.4%	5.2%	2.9%	5.2%	4.4%	2.2%	3.7%	**6.2%**	**5.4%**
FY29	7.3%	5.1%	2.9%	5.1%	4.4%	2.2%	3.6%	**6.2%**	**5.4%**
FY30	7.1%	5.0%	2.8%	5.0%	4.3%	2.1%	3.6%	**6.1%**	**5.3%**
FY31	7.0%	4.9%	2.8%	4.9%	4.2%	2.1%	3.5%	**6.0%**	**5.2%**
FY32	6.9%	4.8%	2.8%	4.8%	4.1%	2.1%	3.4%	**5.9%**	**5.2%**
FY33	6.8%	4.7%	2.7%	4.7%	4.1%	2.0%	3.4%	**5.9%**	**5.1%**
FY34	6.7%	4.7%	2.7%	4.7%	4.0%	2.0%	3.3%	**5.8%**	**5.1%**
FY35	6.6%	4.6%	2.6%	4.6%	3.9%	2.0%	3.3%	**5.7%**	**5.0%**
FY36	6.4%	4.5%	2.6%	4.5%	3.9%	1.9%	3.2%	**5.6%**	**5.0%**
FY37	6.3%	4.4%	2.5%	4.4%	3.8%	1.9%	3.2%	**5.5%**	**4.9%**
FY38	6.2%	4.4%	2.5%	4.4%	3.7%	1.9%	3.1%	**5.5%**	**4.8%**
FY39	6.1%	4.3%	2.4%	4.3%	3.7%	1.8%	3.1%	**5.4%**	**4.8%**
FY40	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.7%**
FY41	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.7%**
FY42	5.9%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.7%**
FY43	5.9%	4.1%	2.3%	4.1%	3.5%	1.8%	2.9%	**5.2%**	**4.7%**
FY44	5.8%	4.1%	2.3%	4.1%	3.5%	1.7%	2.9%	**5.2%**	**4.6%**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY45	5.8%	4.0%	2.3%	4.0%	3.5%	1.7%	2.9%	**5.1%**	**4.6%**
FY46	5.7%	4.0%	2.3%	4.0%	3.4%	1.7%	2.8%	**5.1%**	**4.6%**
FY47	5.6%	3.9%	2.3%	3.9%	3.4%	1.7%	2.8%	**5.1%**	**4.5%**
FY48	5.6%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.0%**	**4.5%**
FY49	5.5%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.0%**	**4.5%**
FY50	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**4.9%**	**4.4%**
FY51	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**4.9%**	**4.5%**

Source: Steer analysis

Table B.7: Traffic Forecast(with impacts) over horizon years at TP4 Nanguneri

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	7,906	870	1,062	749	650	351	491	**12,078**	**17,716**
FY23	8,620	916	1,225	789	680	359	510	**13,099**	**19,203**
FY24	9,407	967	1,321	832	711	368	529	**14,135**	**20,578**
FY25	10,139	1,019	1,362	877	745	376	550	**15,069**	**21,749**
FY26	10,925	1,075	1,404	925	779	385	571	**16,065**	**22,989**
FY27	11,743	1,131	1,446	973	814	394	593	**17,094**	**24,263**
FY28	12,608	1,189	1,489	1,024	850	403	615	**18,177**	**25,596**
FY29	13,523	1,250	1,532	1,076	887	411	637	**19,316**	**26,992**
FY30	14,486	1,312	1,576	1,129	925	420	660	**20,508**	**28,443**
FY31	15,502	1,376	1,620	1,185	964	429	683	**21,758**	**29,959**
FY32	16,571	1,443	1,664	1,242	1,004	438	706	**23,068**	**31,539**
FY33	17,695	1,511	1,710	1,301	1,045	447	730	**24,438**	**33,184**
FY34	18,876	1,582	1,755	1,362	1,087	456	755	**25,871**	**34,897**
FY35	20,114	1,654	1,801	1,424	1,129	465	779	**27,367**	**36,677**
FY36	21,410	1,729	1,848	1,488	1,173	474	805	**28,927**	**38,525**
FY37	22,767	1,806	1,895	1,554	1,218	483	830	**30,551**	**40,443**
FY38	24,183	1,884	1,942	1,622	1,263	492	856	**32,242**	**42,430**
FY39	25,660	1,965	1,989	1,691	1,310	501	882	**33,998**	**44,487**
FY40	27,212	2,048	2,037	1,763	1,357	510	909	**35,836**	**46,632**
FY41	28,842	2,134	2,086	1,837	1,406	519	936	**37,760**	**48,869**
FY42	30,552	2,223	2,136	1,913	1,456	528	964	**39,771**	**51,201**
FY43	32,346	2,314	2,186	1,992	1,507	537	992	**41,874**	**53,629**
FY44	34,225	2,408	2,237	2,073	1,560	547	1,021	**44,069**	**56,158**
FY45	37,226	2,523	2,304	2,171	1,645	570	1,078	**47,518**	**60,142**
FY46	39,345	2,623	2,357	2,258	1,701	580	1,109	**49,972**	**62,947**
FY47	41,560	2,726	2,410	2,347	1,758	590	1,140	**52,531**	**65,864**
FY48	43,875	2,833	2,463	2,438	1,817	600	1,172	**55,199**	**68,895**
FY49	46,293	2,942	2,518	2,532	1,877	610	1,204	**57,976**	**72,043**
FY50	48,817	3,054	2,573	2,629	1,938	620	1,237	**60,868**	**75,312**
FY51	51,478	3,171	2,629	2,729	2,002	630	1,271	**63,909**	**78,741**

Source: Steer analysis

Table B.8: Forecasts (with impacts) for AADT growth rates (%) at TP4 Nanguneri

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	AADT	PCUs
FY22	5.4%	5.4%	2.2%	(42.6%)	14.0%	(0.7%)	(3.5%)	**(0.2%)**	**(0.8%)**
FY23	9.0%	5.4%	15.4%	5.4%	4.6%	2.3%	3.8%	**8.5%**	**8.4%**
FY24	9.1%	5.5%	7.8%	5.5%	4.7%	2.3%	3.9%	**7.9%**	**7.2%**
FY25	7.8%	5.5%	3.1%	5.5%	4.7%	2.3%	3.9%	**6.6%**	**5.7%**
FY26	7.8%	5.4%	3.1%	5.4%	4.7%	2.3%	3.9%	**6.6%**	**5.7%**
FY27	7.5%	5.2%	3.0%	5.2%	4.5%	2.2%	3.7%	**6.4%**	**5.5%**
FY28	7.4%	5.2%	2.9%	5.2%	4.4%	2.2%	3.7%	**6.3%**	**5.5%**
FY29	7.3%	5.1%	2.9%	5.1%	4.4%	2.2%	3.6%	**6.3%**	**5.5%**
FY30	7.1%	5.0%	2.8%	5.0%	4.3%	2.1%	3.6%	**6.2%**	**5.4%**
FY31	7.0%	4.9%	2.8%	4.9%	4.2%	2.1%	3.5%	**6.1%**	**5.3%**
FY32	6.9%	4.8%	2.8%	4.8%	4.1%	2.1%	3.4%	**6.0%**	**5.3%**
FY33	6.8%	4.7%	2.7%	4.7%	4.1%	2.0%	3.4%	**5.9%**	**5.2%**
FY34	6.7%	4.7%	2.7%	4.7%	4.0%	2.0%	3.3%	**5.9%**	**5.2%**
FY35	6.6%	4.6%	2.6%	4.6%	3.9%	2.0%	3.3%	**5.8%**	**5.1%**
FY36	6.4%	4.5%	2.6%	4.5%	3.9%	1.9%	3.2%	**5.7%**	**5.0%**
FY37	6.3%	4.4%	2.5%	4.4%	3.8%	1.9%	3.2%	**5.6%**	**5.0%**
FY38	6.2%	4.4%	2.5%	4.4%	3.7%	1.9%	3.1%	**5.5%**	**4.9%**
FY39	6.1%	4.3%	2.4%	4.3%	3.7%	1.8%	3.1%	**5.4%**	**4.8%**
FY40	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.4%**	**4.8%**
FY41	6.0%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.4%**	**4.8%**
FY42	5.9%	4.2%	2.4%	4.2%	3.6%	1.8%	3.0%	**5.3%**	**4.8%**
FY43	5.9%	4.1%	2.3%	4.1%	3.5%	1.8%	2.9%	**5.3%**	**4.7%**
FY44	5.8%	4.1%	2.3%	4.1%	3.5%	1.7%	2.9%	**5.2%**	**4.7%**
FY45	8.8%	4.8%	3.0%	4.8%	5.4%	4.3%	5.6%	**7.8%**	**7.1%**
FY46	5.7%	4.0%	2.3%	4.0%	3.4%	1.7%	2.8%	**5.2%**	**4.7%**
FY47	5.6%	3.9%	2.3%	3.9%	3.4%	1.7%	2.8%	**5.1%**	**4.6%**
FY48	5.6%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.1%**	**4.6%**
FY49	5.5%	3.9%	2.2%	3.9%	3.3%	1.7%	2.8%	**5.0%**	**4.6%**
FY50	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**5.0%**	**4.5%**
FY51	5.5%	3.8%	2.2%	3.8%	3.3%	1.6%	2.7%	**5.0%**	**4.6%**

Source: Steer analysis

Revenue Forecasts

Table B.9: Revenue Forecasts (with impacts) for horizon years (INR Crores) at TP1 Kappalur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY22	33.0	4.3	9.5	5.7	10.0	5.5	13.5	**81.6**
FY23	40.0	5.1	12.1	6.7	11.5	6.2	15.5	**97.0**
FY24	46.3	5.7	13.8	7.5	12.7	6.7	17.1	**109.8**
FY25	52.2	6.3	14.9	8.3	14.0	7.2	18.5	**121.4**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY26	59.8	7.0	16.2	9.2	15.4	7.7	20.3	**135.6**
FY27	68.1	7.8	17.6	10.2	16.9	8.3	22.2	**151.1**
FY28	57.3	6.4	14.3	8.4	14.0	6.7	18.3	**125.5**
FY29	61.7	6.7	14.7	8.8	14.6	6.9	18.9	**132.2**
FY30	66.5	7.0	15.1	9.3	15.2	7.0	19.6	**139.6**
FY31	114.2	11.5	23.8	15.0	24.5	11.1	31.3	**231.4**
FY32	128.3	12.6	25.7	16.5	26.8	11.9	33.8	**255.5**
FY33	142.9	13.6	27.5	18.1	29.0	12.6	36.4	**280.2**
FY34	161.7	15.1	29.5	19.7	31.6	13.5	39.5	**310.6**
FY35	179.7	16.3	31.7	21.8	34.3	14.4	42.5	**340.6**
FY36	202.3	18.0	34.1	23.6	37.4	15.3	46.0	**376.7**
FY37	223.0	19.3	36.4	25.9	40.4	16.3	49.6	**410.9**
FY38	251.3	21.3	39.0	28.1	43.8	17.4	53.3	**454.2**
FY39	282.2	23.4	41.7	30.6	47.4	18.5	57.7	**501.4**
FY40	310.6	25.2	44.9	33.4	51.6	19.7	62.1	**547.5**
FY41	346.0	27.4	47.9	36.4	55.8	20.9	66.7	**601.0**
FY42	385.4	29.9	51.2	39.6	60.3	22.3	71.9	**660.6**
FY43	428.2	32.5	54.9	43.3	65.3	23.7	77.4	**725.3**
FY44	480.4	35.7	58.9	47.0	71.0	25.3	83.4	**801.8**
FY45	533.2	38.7	62.8	51.2	76.4	26.8	89.5	**878.7**
FY46	588.0	41.8	67.2	55.6	82.8	28.6	96.4	**960.4**
FY47	656.6	45.8	71.9	60.4	89.5	30.4	103.6	**1058.1**
FY48	727.6	49.7	77.0	65.9	97.0	32.4	111.7	**1161.3**
FY49	805.7	53.9	82.1	71.1	104.5	34.4	119.6	**1271.3**
FY50	892.4	58.5	87.9	77.4	113.1	36.6	128.8	**1394.6**
FY51	991.9	63.7	93.9	84.3	122.1	38.9	138.4	**1533.1**

Source: Steer analysis

Table B.10: Revenue Forecasts(with impacts) for horizon years (INR Crores) at TP2 Etturvattam

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY22	16.8	1.8	5.2	3.4	7.0	3.2	10.2	**47.6**
FY23	19.9	2.1	6.4	3.9	8.1	3.6	11.6	**55.7**
FY24	22.9	2.3	7.3	4.3	8.9	3.9	12.8	**62.5**
FY25	25.6	2.6	7.9	4.9	9.8	4.2	13.9	**68.7**
FY26	29.1	2.9	8.6	5.4	10.8	4.5	15.0	**76.3**
FY27	32.9	3.2	9.3	6.0	11.9	4.8	16.3	**84.4**
FY28	37.2	3.5	10.1	6.5	13.1	5.2	17.9	**93.5**
FY29	42.2	3.9	10.8	7.2	14.3	5.5	19.4	**103.3**
FY30	47.1	4.3	11.7	7.9	15.6	5.9	21.0	**113.5**
FY31	52.6	4.7	12.5	8.7	17.0	6.3	22.8	**124.5**
FY32	58.7	5.1	13.5	9.6	18.6	6.8	24.7	**136.9**
FY33	66.2	5.6	14.5	10.4	20.1	7.2	26.6	**150.6**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY34	73.2	6.1	15.5	11.5	21.9	7.7	28.7	**164.7**
FY35	80.8	6.6	16.7	12.5	23.8	8.2	31.0	**179.6**
FY36	90.7	7.3	17.9	13.8	25.9	8.8	33.6	**197.9**
FY37	101.7	8.0	19.2	15.0	28.0	9.3	36.1	**217.3**
FY38	111.3	8.6	20.5	16.4	30.3	9.9	38.9	**236.0**
FY39	124.4	9.5	22.0	17.8	32.9	10.6	41.9	**259.0**
FY40	138.9	10.4	23.6	19.5	35.7	11.2	45.3	**284.6**
FY41	153.8	11.3	25.2	21.2	38.6	11.9	48.6	**310.7**
FY42	170.3	12.3	27.0	23.0	41.9	12.7	52.3	**339.5**
FY43	188.1	13.4	28.9	25.0	45.3	13.5	56.4	**370.7**
FY44	207.9	14.6	31.0	27.3	49.2	14.4	60.8	**405.2**
FY45	228.0	15.7	33.0	29.6	53.0	15.3	65.2	**439.8**
FY46	254.3	17.3	35.3	32.1	57.3	16.3	70.1	**482.6**
FY47	279.8	18.7	37.8	35.0	61.9	17.3	75.4	**525.8**
FY48	311.0	20.4	40.5	38.3	67.1	18.5	81.3	**577.0**
FY49	342.8	22.2	43.2	41.4	72.4	19.6	87.2	**628.7**
FY50	374.6	23.9	46.2	44.9	78.1	20.9	93.6	**682.2**
FY51	414.0	26.0	49.4	48.9	84.5	22.2	100.6	**745.5**

Source: Steer analysis

Table B.11: Revenue Forecasts(with impacts) for horizon years (INR Crores)at TP3 Salaipudhur

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY22	18.7	2.2	5.8	3.7	7.4	3.3	9.0	**50.1**
FY23	22.3	2.6	7.1	4.2	8.5	3.7	10.3	**58.8**
FY24	25.0	2.8	8.1	4.7	9.4	4.0	11.3	**65.5**
FY25	28.8	3.2	8.8	5.2	10.4	4.3	12.3	**73.0**
FY26	32.4	3.5	9.6	5.8	11.4	4.6	13.3	**80.7**
FY27	36.7	3.9	10.4	6.4	12.5	5.0	14.5	**89.5**
FY28	42.0	4.4	11.3	7.1	13.8	5.4	15.8	**99.6**
FY29	46.6	4.8	12.1	7.8	15.1	5.7	17.1	**109.2**
FY30	52.6	5.3	13.1	8.6	16.4	6.1	18.6	**120.7**
FY31	58.3	5.7	14.0	9.4	17.9	6.5	20.1	**132.0**
FY32	66.2	6.4	15.1	10.4	19.6	7.0	21.8	**146.4**
FY33	72.7	6.9	16.2	11.3	21.3	7.4	23.4	**159.2**
FY34	81.7	7.6	17.3	12.4	23.0	7.9	25.3	**175.3**
FY35	90.9	8.3	18.6	13.5	25.0	8.4	27.4	**192.1**
FY36	101.8	9.1	20.1	14.8	27.3	9.0	29.7	**211.7**
FY37	112.9	9.9	21.4	16.1	29.6	9.6	31.9	**231.4**
FY38	125.3	10.8	23.0	17.5	32.0	10.2	34.4	**253.2**
FY39	138.7	11.7	24.6	19.2	34.7	10.9	37.0	**276.7**
FY40	154.4	12.9	26.4	20.9	37.7	11.6	40.0	**303.9**
FY41	169.6	13.9	28.2	22.7	40.7	12.3	42.9	**330.3**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY42	189.3	15.2	30.2	24.7	44.1	13.1	46.2	**362.8**
FY43	207.5	16.4	32.3	26.9	47.7	13.9	49.7	**394.4**
FY44	231.0	18.0	34.6	29.4	51.8	14.9	53.7	**433.4**
FY45	256.2	19.6	37.0	32.0	55.9	15.8	57.5	**474.0**
FY46	282.9	21.3	39.6	34.8	60.5	16.8	61.9	**517.7**
FY47	312.9	23.2	42.3	37.8	65.3	17.9	66.5	**565.8**
FY48	344.7	25.1	45.3	41.2	70.8	19.0	71.8	**617.9**
FY49	379.8	27.3	48.3	44.5	76.2	20.2	77.0	**673.3**
FY50	420.0	29.7	51.6	48.3	82.4	21.5	82.7	**736.2**
FY51	463.5	32.2	55.2	52.5	89.1	22.8	88.8	**804.2**

Source: Steer analysis

Table B.12: Revenue Forecasts(with impacts) for horizon years (INR Crores)at TP4 Nanguneri

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY22	20.7	2.3	5.5	3.2	6.0	3.7	7.7	**49.0**
FY23	25.0	2.6	7.0	3.7	6.9	4.2	8.8	**58.2**
FY24	28.9	3.0	7.9	4.1	7.6	4.5	9.6	**65.7**
FY25	32.2	3.2	8.6	4.5	8.4	4.9	10.5	**72.3**
FY26	36.5	3.6	9.3	5.0	9.2	5.3	11.5	**80.5**
FY27	41.2	4.0	10.1	5.7	10.2	5.7	12.6	**89.4**
FY28	47.2	4.4	11.0	6.2	11.2	6.1	13.8	**99.8**
FY29	52.8	4.9	11.8	6.9	12.2	6.5	14.9	**109.9**
FY30	58.9	5.3	12.7	7.5	13.3	6.9	16.1	**120.8**
FY31	66.5	5.9	13.7	8.2	14.5	7.4	17.5	**133.7**
FY32	74.1	6.4	14.7	9.1	15.8	7.9	19.0	**147.1**
FY33	81.9	7.0	15.8	9.9	17.2	8.4	20.4	**160.6**
FY34	91.5	7.6	16.9	10.8	18.6	9.0	22.1	**176.6**
FY35	103.1	8.5	18.2	11.9	20.4	9.6	23.8	**195.4**
FY36	113.7	9.2	19.5	13.0	22.1	10.3	25.8	**213.6**
FY37	126.9	10.0	20.9	14.2	24.0	10.9	27.7	**234.5**
FY38	141.5	11.0	22.4	15.4	25.9	11.6	29.9	**257.7**
FY39	155.9	11.9	24.0	16.9	28.2	12.3	32.2	**281.4**
FY40	173.4	13.0	25.7	18.4	30.6	13.2	34.8	**309.1**
FY41	192.9	14.2	27.5	20.0	33.0	14.0	37.3	**338.8**
FY42	160.1	11.6	22.1	16.4	26.8	11.1	30.2	**278.4**
FY43	169.5	12.1	22.6	17.0	27.8	11.3	31.1	**291.5**
FY44	179.9	12.6	23.2	17.8	28.8	11.6	32.1	**305.9**
FY45	296.7	20.0	36.3	28.1	46.2	18.4	51.5	**497.3**
FY46	326.8	21.7	38.8	30.6	50.0	19.5	55.4	**542.9**
FY47	361.2	23.6	41.5	33.3	54.0	20.8	59.5	**594.0**
FY48	399.7	25.7	44.5	36.2	58.5	22.1	64.2	**651.0**
FY49	438.6	27.8	47.5	39.2	63.1	23.5	68.8	**708.5**

Year	CJV	Mini LCV	Buses	LCV	2A	3A	MAV	Total
FY50	484.3	30.2	50.8	42.7	68.2	25.0	73.9	**775.2**
FY51	536.4	32.9	54.2	46.4	73.6	26.6	79.5	**849.7**

Source: Steer analysis

C Data Collection exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1 Kappalur

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
18-01-2021	TP1	TVC	18,130	2,010	2,231	3,644	816	377	697	27,905
19-01-2021	TP1	TVC	15,140	2,209	2,559	3,522	1,147	684	730	25,991
20-01-2021	TP1	TVC	14,842	2,192	2,701	3,319	1,152	709	755	25,670
21-01-2021	TP1	TVC	13,854	2,318	2,486	3,298	1,148	626	807	24,537
22-01-2021	TP1	TVC	14,474	2,435	2,691	3,269	1,119	674	842	25,504
23-01-2021	TP1	TVC	18,457	2,355	2,780	3,359	1,304	649	837	29,741
24-01-2021	TP1	TVC	22,027	1,804	2,945	3,486	816	572	868	32,518

Source: Steer analysis

Table C.2: WADT TVC vs TMS at TP1 Kappalur

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	69%	10%	12%	4%	5%	-	100%
	TMS	69%	10%	10%	5%	6%	0%	100%

Source: Steer analysis

Table C.3: 7-day TVC counts at TP2 Etturvattam

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
18-01-2021	TP1	TVC	8,295	658	1,159	1,340	430	225	549	12,656
19-01-2021	TP1	TVC	6,676	834	1,359	1,234	660	312	735	11,810
20-01-2021	TP1	TVC	6,488	763	1,436	1,144	680	324	661	11,496
21-01-2021	TP1	TVC	5,846	848	1,361	1,086	742	358	826	11,067
22-01-2021	TP1	TVC	6,378	882	1,447	1,092	706	308	748	11,561
23-01-2021	TP1	TVC	8,425	900	1,469	1,105	763	331	752	13,745

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
24-01-2021	TP1	TVC	10,573	760	1,507	1,202	486	281	624	15,433

Source: Steer analysis

Table C.4: WADT TVC vs TMS at TP2 Etturvattam

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	66%	11%	9%	5%	8%	-	100%
	TMS	69%	9%	6%	7%	8%	0%	100%

Source: Steer analysis

Table C.5: 7-day TVC counts at TP3 Salaipudhur

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
18-01-2021	TP1	TVC	7,618	718	1,112	1,187	467	189	367	11,658
19-01-2021	TP1	TVC	6,124	811	1,335	1,095	573	284	475	10,697
20-01-2021	TP1	TVC	6,047	776	1,292	1,012	644	293	451	10,515
21-01-2021	TP1	TVC	5,648	878	1,260	955	702	354	478	10,275
22-01-2021	TP1	TVC	6,032	879	1,431	978	682	339	476	10,817
23-01-2021	TP1	TVC	7,789	946	1,395	970	736	285	504	12,625
24-01-2021	TP1	TVC	9,562	788	1,504	1,109	449	232	455	14,099

Source: Steer analysis

Table C.6: WADT TVC vs TMS at TP3 Salaipudhur

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	68%	12%	9%	5%	6%	-	100%
	TMS	73%	7%	7%	7%	7%	0%	100%

Source: Steer analysis

Table C.7: 7-day TVC counts at TP4 Nanguneri

Date	Toll Plaza	Source	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	Total
18-01-2021	TP1	TVC	9,779	870	1,310	1,253	464	249	391	14,316
19-01-2021	TP1	TVC	7,585	972	1,295	1,152	544	327	559	12,434
20-01-2021	TP1	TVC	7,731	952	1,331	1,158	575	369	524	12,640
21-01-2021	TP1	TVC	7,353	935	1,252	1,135	598	369	583	12,225
22-01-2021	TP1	TVC	7,451	994	1,384	1,141	563	382	629	12,544
23-01-2021	TP1	TVC	9,228	1,064	1,378	1,153	610	373	619	14,425
24-01-2021	TP1	TVC	10,040	722	1,369	1,178	336	218	416	14,279

Source: Steer analysis

Table C.8: WADT TVC vs TMS at TP4 Nanguneri

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	71%	10%	9%	4%	6%	-	100%
	TMS	68%	12%	8%	5%	7%	0%	100%

Source: Steer analysis

Zone list

Table C.9: Zone list used for OD analysis

Zone No	Zone name	State
1	Madurai	Tamil Nadu
2	Madurai International Airport	Tamil Nadu
3	Thiruparankundram	Tamil Nadu
4	Nagamalai Puthukottai	Tamil Nadu
5	Thattanur	Tamil Nadu
6	Vilachery	Tamil Nadu
7	Thoppur	Tamil Nadu
8	Nilaiyur	Tamil Nadu
9	Kappalur	Tamil Nadu
10	Tirumangalam	Tamil Nadu
11	Alampatti	Tamil Nadu
12	Meenakshi Puram	Tamil Nadu
13	Sivarakottai	Tamil Nadu
14	Vadakkampatti	Tamil Nadu
15	Kalligudi	Tamil Nadu
16	Vellakulam	Tamil Nadu
17	Maittanpatti	Tamil Nadu
18	Allampatti	Tamil Nadu
19	Virudunagar	Tamil Nadu
20	Naduvapatti	Tamil Nadu
21	Etturvattam	Tamil Nadu
22	Ramalingapuram	Tamil Nadu
23	Sattur	Tamil Nadu
24	Chattrapatti	Tamil Nadu
25	Kovilpatti	Tamil Nadu
26	Ayyaneri	Tamil Nadu
27	Venkatachalapuram	Tamil Nadu
28	Zamin Devarkulam	Tamil Nadu
29	Thonugal	Tamil Nadu
30	Nallatinputhur	Tamil Nadu
31	Vanaramutti	Tamil Nadu
32	Kumaretiyapuram	Tamil Nadu
33	Uthupatti	Tamil Nadu
34	Kalampatti	Tamil Nadu
35	Idaiseval	Tamil Nadu
36	Kattalankulam	Tamil Nadu
37	Cithamparampatti	Tamil Nadu
38	Villiseri	Tamil Nadu

Zone No	Zone name	State
39	Sivagnanapuram	Tamil Nadu
40	Chettikurichi	Tamil Nadu
41	Vellalankottai	Tamil Nadu
42	Karunkulam	Tamil Nadu
43	Akhilandapuram	Tamil Nadu
44	Veerapandia Kattabomman	Tamil Nadu
45	Kayathar	Tamil Nadu
46	Thalayalnadanthankulam	Tamil Nadu
47	Pudukudi	Tamil Nadu
48	Gangaikondan	Tamil Nadu
49	Ithikulam	Tamil Nadu
50	Vengadasalapuram	Tamil Nadu
51	Rajavallipuram	Tamil Nadu
52	Naranammalpuram	Tamil Nadu
53	Tirunelveli	Tamil Nadu
54	Sengulam	Tamil Nadu
55	Maruthakulam	Tamil Nadu
56	Pannankulam	Tamil Nadu
57	Nanguneri	Tamil Nadu
58	Vallioor	Tamil Nadu
59	Dohnavur	Tamil Nadu
60	Thirukkurungudi	Tamil Nadu
61	Rosemiyapuram	Tamil Nadu
62	Madappuram	Tamil Nadu
63	Panakudi	Tamil Nadu
64	Kavalkinaru	Tamil Nadu
65	Aralvaimozhi	Tamil Nadu
66	Vadakankulam	Tamil Nadu
67	Chettikulam	Tamil Nadu
68	Azhagappapuram	Tamil Nadu
69	Kottaram	Tamil Nadu
70	Periyakadu	Tamil Nadu
71	Thuckalay	Tamil Nadu
72	Munnar	Kerala
73	Agasthyamalai	Tamil Nadu
74	Anamalai	Tamil Nadu
75	Kodaikanal	Tamil Nadu
76	Sirumalai	Tamil Nadu
77	Dindigul	Tamil Nadu
78	Theni	Tamil Nadu
79	Megamalai	Tamil Nadu
80	Maharajapuram	Tamil Nadu
81	Rajapalayam	Tamil Nadu
82	Sivakasi	Tamil Nadu
83	Sankarankovil	Tamil Nadu
84	Sivaganga	Tamil Nadu
85	Melur	Tamil Nadu
86	Pandalkudi	Tamil Nadu
87	Kamudi	Tamil Nadu

Zone No	Zone name	State
88	Pudukottai	Tamil Nadu
89	Pattukottai	Tamil Nadu
90	Paramakudi	Tamil Nadu
91	Kothari	Tamil Nadu
92	Poovatrakkudi	Tamil Nadu
93	Ilayankudi	Tamil Nadu
94	Aruppukottai	Tamil Nadu
95	SIPCOT Gangaikondan	Tamil Nadu
96	Vilathikulam	Tamil Nadu
97	Sayalgudi	Tamil Nadu
98	Ervadi	Tamil Nadu
99	Pasuvanthanai	Tamil Nadu
100	Nanjankulam	Tamil Nadu
101	Valavallan	Tamil Nadu
102	Thiruchendur	Tamil Nadu
103	Srivilliputhur	Tamil Nadu
104	Kovalam	Kerala
105	India Cements, Tirunelveli	Tamil Nadu
106	Ramco Cements, Tulukkapatti	Tamil Nadu
107	Ariyalur	Tamil Nadu
108	Chennai	Tamil Nadu
109	Coimbatore	Tamil Nadu
110	Cuddalore	Tamil Nadu
111	Dharmapuri	Tamil Nadu
112	Erode	Tamil Nadu
113	Kancheepuram	Tamil Nadu
114	Kanniyakumari	Tamil Nadu
115	Karur	Tamil Nadu
116	Krishnagiri	Tamil Nadu
117	Namakkal	Tamil Nadu
118	Perambalur	Tamil Nadu
119	Pudukkottai	Tamil Nadu
120	Ramanathapuram	Tamil Nadu
121	Salem	Tamil Nadu
122	Thanjavur	Tamil Nadu
123	The Nilgiris	Tamil Nadu
124	Thiruvallur	Tamil Nadu
125	Thiruvarur	Tamil Nadu
126	Thoothukkudi	Tamil Nadu
127	Tiruchirappalli	Tamil Nadu
128	Tiruppur	Tamil Nadu
129	Tiruvannamalai	Tamil Nadu
130	Vellore	Tamil Nadu
131	Viluppuram	Tamil Nadu
132	Nagappattinam	Tamil Nadu
133	Tuticorin Port	Tamil Nadu
134	Tuticorin (Thoothukudi)	Tamil Nadu
135	Rameshwaram, Dhanushkodi	Tamil Nadu
136	Velankanni	Tamil Nadu

Zone No	Zone name	State
137	Kanyakumari	Tamil Nadu
138	Kudankulam (nuclear plant)	Tamil Nadu
139	Manapad	Tamil Nadu
140	Theri Kaadu (red desert)	Tamil Nadu
141	Karaikal	Tamil Nadu
142	Neyveli	Tamil Nadu
143	Chennai Port	Tamil Nadu
144	Colachel	Tamil Nadu
145	Alappuzha	Kerala
146	Ernakulam	Kerala
147	Idukki	Kerala
148	Kannur	Kerala
149	Kasaragod	Kerala
150	Kollam	Kerala
151	Kottayam	Kerala
152	Kozhikode	Kerala
153	Malappuram	Kerala
154	Palakkad	Kerala
155	Pathanamthitta	Kerala
156	Thiruvananthapuram	Kerala
157	Thrissur	Kerala
158	Wayanad	Kerala
159	Poovar	Kerala
160	Andaman & Nicobar Island	Andaman & Nicobar Island
161	Andhra Pradesh	Andhra Pradesh
162	Arunanchal Pradesh	Arunanchal Pradesh
163	Assam	Assam
164	Bihar	Bihar
165	Chandigarh	Chandigarh
166	Chhattisgarh	Chhattisgarh
167	Dadara & Nagar Havelli	Dadara & Nagar Havelli
168	Daman & Diu	Daman & Diu
169	Goa	Goa
170	Gujarat	Gujarat
171	Haryana	Haryana
172	Himachal Pradesh	Himachal Pradesh
173	Jammu & Kashmir	Jammu & Kashmir
174	Jharkhand	Jharkhand
175	Karnataka	Karnataka
176	Lakshadweep	Lakshadweep
177	Madhya Pradesh	Madhya Pradesh
178	Maharashtra	Maharashtra
179	Manipur	Manipur
180	Meghalaya	Meghalaya
181	Mizoram	Mizoram
182	Nagaland	Nagaland
183	NCT of Delhi	NCT of Delhi
184	Puducherry	Puducherry
185	Punjab	Punjab

Zone No	Zone name	State
186	Rajasthan	Rajasthan
187	Sikkim	Sikkim
188	Telangana	Telangana
189	Tripura	Tripura
190	Uttar Pradesh	Uttar Pradesh
191	Uttarakhand	Uttarakhand
192	West Bengal	West Bengal
193	Odisha	Odisha
194	Kariapatti	Tamil Nadu
195	Palani	Tamil Nadu
196	Nagercoil	Tamil Nadu
197	Tenkasi	Tamil Nadu
198	Courtallam	Tamil Nadu

Source: Steer analysis

Direction-wise commodity distribution

Table C.10: Commodity distribution towards Madurai for TP1 Kappalur

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	11%	9%	11%	7%
Construction	3%	6%	7%	3%
Stone	-	-	-	-
Groceries	9%	8%	12%	7%
Minerals	5%	6%	9%	21%
Manufacturing	34%	38%	27%	44%
Petroleum	2%	3%	4%	-
Chemicals	-	-	-	-
Miscellaneous	3%	2%	2%	2%
Machinery	-	-	-	-
Container	-	0%	-	-
Empty	33%	25%	25%	14%
Cement	1%	2%	4%	3%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.11: Commodity distribution towards Tirunelveli for TP1 Kappalur

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	16%	14%	12%	8%
Construction	1%	4%	4%	2%
Stone	-	-	-	-
Groceries	13%	11%	13%	11%
Minerals	8%	6%	5%	10%
Manufacturing	31%	33%	29%	25%

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Petroleum	1%	6%	2%	3%
Chemicals	-	-	-	-
Miscellaneous	6%	4%	3%	3%
Machinery	-	-	-	-
Container	-	0%	1%	-
Empty	22%	20%	22%	13%
Cement	2%	2%	10%	26%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.12: Commodity distribution towards Madurai for TP2 Etturvattam

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	18%	17%	13%	8%
Construction	1%	1%	2%	-
Stone	-	-	-	-
Groceries	9%	9%	22%	19%
Minerals	6%	6%	13%	6%
Manufacturing	23%	20%	17%	8%
Petroleum	1%	5%	4%	5%
Chemicals	-	-	-	-
Miscellaneous	3%	4%	2%	2%
Machinery	-	-	-	-
Container	-	-	-	-
Empty	38%	15%	22%	39%
Cement	2%	24%	6%	13%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.13: Commodity distribution towards Kanyakumari for TP2 Etturvattam

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	21%	9%	12%	8%
Construction	1%	-	-	1%
Stone	-	-	-	-
Groceries	15%	8%	21%	13%
Minerals	3%	11%	9%	6%
Manufacturing	17%	16%	15%	13%
Petroleum	5%	9%	6%	5%
Chemicals	-	-	-	-
Miscellaneous	4%	5%	3%	2%

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Machinery	-	-	-	-
Container	-	-	-	-
Empty	30%	30%	20%	18%
Cement	4%	12%	14%	33%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.14: Commodity distribution towards Madurai for TP3 Salaipudhur

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	11%	6%	5%	5%
Construction	1%	12%	25%	-
Stone	-	-	-	-
Groceries	4%	1%	4%	2%
Minerals	4%	3%	7%	12%
Manufacturing	24%	25%	22%	29%
Petroleum	5%	3%	8%	2%
Chemicals	-	-	-	-
Miscellaneous	1%	0%	-	-
Machinery	-	-	-	-
Container	-	-	-	7%
Empty	49%	48%	27%	14%
Cement	1%	2%	2%	29%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.15: Commodity distribution towards Kanyakumari for TP3 Salaipudhur

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	24%	17%	12%	6%
Construction	2%	3%	8%	1%
Stone	-	-	-	-
Groceries	12%	13%	14%	10%
Minerals	4%	2%	4%	6%
Manufacturing	27%	26%	24%	20%
Petroleum	1%	8%	4%	5%
Chemicals	-	-	-	-
Miscellaneous	3%	4%	1%	0%
Machinery	-	-	-	-
Container	-	-	-	1%
Empty	27%	18%	16%	5%

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Cement	1%	7%	18%	44%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.16: Commodity distribution towards Madurai for TP4 Nanguneri

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	16%	5%	7%	4%
Construction	0%	1%	2%	-
Stone	-	-	-	-
Groceries	8%	7%	4%	3%
Minerals	3%	5%	7%	4%
Manufacturing	7%	14%	16%	3%
Petroleum	3%	5%	4%	19%
Chemicals	-	-	-	-
Miscellaneous	1%	1%	-	-
Machinery	-	-	-	-
Container	-	-	-	-
Empty	60%	62%	57%	59%
Cement	1%	1%	2%	9%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.17: Commodity distribution towards Kanyakumari for TP4 Nanguneri

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	29%	21%	18%	8%
Construction	3%	5%	12%	16%
Stone	-	-	-	-
Groceries	11%	16%	15%	10%
Minerals	3%	3%	4%	6%
Manufacturing	15%	24%	13%	15%
Petroleum	2%	7%	2%	1%
Chemicals	-	-	-	-
Miscellaneous	1%	1%	1%	-
Machinery	-	-	-	-
Container	1%	0%	2%	-
Empty	33%	17%	18%	19%
Cement	2%	6%	17%	26%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Trip length distribution

Table C.18: Trip length frequency for TP1 Kappalur

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	35%	39%	34%	23%	17%	9%
65-300 km	44%	47%	44%	50%	44%	35%
300-500 km	12%	7%	14%	14%	15%	23%
500-1000 km	8%	7%	8%	11%	19%	26%
>1000 km	0%	0%	1%	3%	5%	7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.19: Trip length frequency for TP2 Etturvattam

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	4%	3%	5%	3%	6%	2%
65-300 km	57%	55%	59%	52%	46%	51%
300-500 km	20%	19%	21%	27%	23%	23%
500-1000 km	17%	23%	13%	14%	20%	15%
>1000 km	1%	0%	2%	4%	6%	9%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.20: Trip length frequency for TP3 Salaipudhur

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	10%	11%	12%	11%	7%	2%
65-300 km	55%	59%	61%	49%	43%	39%
300-500 km	18%	11%	17%	20%	25%	21%
500-1000 km	17%	19%	10%	18%	21%	30%
>1000 km	0%	0%	0%	1%	4%	8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.21: Trip length frequency for TP4 Nanguneri

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
0-65 km	5%	7%	4%	4%	2%	3%

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A	3A	MAV
65-300 km	71%	72%	78%	67%	69%	60%
300-500 km	12%	8%	11%	17%	14%	18%
500-1000 km	12%	11%	7%	12%	13%	18%
>1000 km	1%	1%	1%	1%	3%	1%
Total	100%	100%	100%	100%	100%	100%

Source: Steer analysis of OD data

D Impact Analysis

GJC comparison

D.1 Present below are the generalised journey cost comparisons for each of the impacts assumed for the Asset.

D.2 Please find below the table for improvement in level of service due to six-laning on the Asset

Table D.1: GJC comparison for level of service improvement for TP1 Kappalur

	Asset		
	CJV	2A	MAV
Existing Toll rates	80	270	425
Length	52	52	52
Existing GJC	465	1,465	3,074
GJC post improvement	436	1,365	2,762

Source: Steer analysis

Table D.2: GJC comparison for level of service improvement for TP4 Nanguneri

	Asset		
	CJV	2A	MAV
Existing Toll rates	95	320	500
Length	63	63	63
Existing GJC	559	1,762	3,695
GJC post improvement	524	1,641	3,319

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit 4.0

Author/originator

Aditya Karan

Reviewer/approver

Shipra Bhatia

Other contributors

Vaibhav Gupta

Distribution

Client:

Steer:

Version control/issue number

V2.0

Date

April 2022

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence Nelamangala Devihalli Expressway Private Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence Nelamangala Devihalli Expressway Private Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002,
India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited. This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Content

Disclaimer ..... **vi**

Glossary Items ..... **viii**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Concession and tolling details 7

Key economic activities 9

Key Network Developments 9

3 Traffic Description **11**

Introduction 11

Historical trends 11

Key findings of the TVC data analysis 21

Key findings of origin-destination analysis 24

Conclusions 34

4 Socio Economic Context **36**

Introduction 36

Population growth 36

Economic growth 37

5 Traffic growth analysis **39**

Introduction 39

Estimation of background elasticities 39

Forecasts for background elasticities 44

Forecasts for growth drivers 45

6 Forecasts: Base year AADT and Impacts **47**

Introduction 47
Seasonality Correction factors 47
Analysis of potential network/developmental impacts 49
Revenue forecasting assumptions 51
Upside and Downside Cases 58
Traffic and Revenue Forecasts-Upside case 60
Traffic and Revenue Forecasts-Downside case 63
Summary outlook 66

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4
Figure 2.1: Asset location in the regional road network 6
Figure 2.2: Asset context 7
Figure 2.3: Typical cross section of the Asset and toll plaza 8
Figure 3.1: Historical evolution in vehicle shares and reported AADT, TP1 Doddakarenahalli .. 14
Figure 3.2: Historical evolution in vehicle shares and reported AADT, TP2 Karbylu 14
Figure 3.3: Month on Month traffic recovery vs FY20 – Asset level 15
Figure 3.4: Ticket-segmentation for CJV, TP1 Doddakarenahalli 17
Figure 3.5: Ticket-segmentation for MAV, TP1 Doddakarenahalli 18
Figure 3.6: Ticket-segmentation for CJV, TP2 Karbylu 18
Figure 3.7: Ticket Segmentation for MAV, TP2 Karbylu 19
Figure 3.8: TVC WADT 22
Figure 3.9: Comparison between TVC and TMS daily traffic data on TP1 Doddakarenahalli 22
Figure 3.10: Comparison between TVC and TMS daily traffic data on TP2 Karbylu 23
Figure 3.11 Comparison between vehicle shares from TVC and TMS WADTs 23
Figure 3.12: Zonal influence, TP1 Doddakarenahalli 26
Figure 3.13: Zonal influence, TP2 Karbylu 27
Figure 3.14: Internal-external distribution, TP1 Doddakarenahalli 27
Figure 3.15 Internal-external distribution, TP2 Karbylu 28
Figure 3.16: Commodity distribution, TP1 Doddakarenahalli (Total) 30
Figure 3.17: Commodity distribution, TP1 Doddakarenahalli (towards Hassan) 30
Figure 3.18: Commodity distribution, TP1 Doddakarenahalli (towards Bangalore) 31

Figure 3.19: Commodity distribution, TP2 Karbylu (Total) 31
Figure 3.20: Commodity distribution, TP2 Karbylu (towards Hassan) 32
Figure 3.21: Commodity distribution, TP2 Karbylu (towards Bangalore) 32
Figure 3.22: Trip length distribution, TP1 Doddakarenahalli 33
Figure 3.23: Trip length distribution, TP2 Karbylu 34
Figure 4.1: Evolution of Karnataka's state GDP and national GDP 37
Figure 4.2: Sectoral contribution to Karnataka's GSDP 38
Figure 5.1: Relationship between CJV traffic and Karnataka GSDP 41
Figure 5.2: Relationship between LCV+2A combined traffic and Karnataka GSDP 42
Figure 5.3: Relationship between Bus traffic and Karnataka GSDP 43
Figure 5.4: Relationship between 3A+MAV combined traffic and India's GDP 44
Figure 5.5: GDP-GSDP forecast 46
Figure 6.1: Alternate routes and Asset route shown against the regional network context 50
Figure 6.2 Traffic and growth rates for forecast PCUs - Background and final- TP1 58
Figure 6.3 Traffic and growth rates for forecast PCUs - Background and final- TP2 58

Tables

Table 1.1: Scope of work and sources of data 1
Table 2.1: Concession details 8
Table 2.2: Single toll rates on the Asset (INR), applicable September 2021 to August 2022 9
Table 2.3: PCU factors 10
Table 3.1: Historical evolution in AADT by vehicle class at TP1- Doddakarenahalli 11
Table 3.2: Historical evolution in AADT by vehicle class at TP2- Karbylu 11
Table 3.3: Historical YoY growth rates and CAGR by vehicle class at TP1- Doddakarenahalli 12
Table 3.4: Historical YoY growth rates and CAGR by vehicle class at TP2- Karbylu 12
Table 3.5: Historical revenue evolution (in INR crores): Asset level 14
Table 3.6: Typical ticket types sold at NHAI plazas 16
Table 3.7: Timeline of national ETC implementation 16
Table 3.8 Historical ticket segmentation at TP1 Doddakarenahalli 20
Table 3.9: Historical ticket segmentation at TP2 Karbylu 20
Table 3.10: Data collection schedule 21

Table 3.11: Difference in vehicle counts when combined 24
Table 3.12: Sample rates for OD data 24
Table 3.13: Zone aggregations for zonal influence analysis 25
Table 3.14: Aggregate commodity categories 28
Table 4.1: CAGR of population in India 36
Table 4.2: Population Growth in India (2001 – 2011) 37
Table 5.1: Vehicle-wise growth and CAGR (%) at Doddakarenahalli toll plaza 39
Table 5.2: Vehicle-wise growth and CAGR (%) at Karbylu toll plaza 40
Table 5.3: Split between individual vehicle types 40
Table 5.4: Identified growth drivers to model traffic growth 40
Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 45
Table 6.1: Key intermediate and final outputs in the forecast 47
Table 6.2: Seasonality correction factors for TP1 – Doddakarenahalli 48
Table 6.3: Seasonality correction factors for TP2- Karbylu 48
Table 6.4 Monthly AADT and Adopted AADT for FY22 – TP1- Doddakarenahalli 49
Table 6.5: List of network/other developments 50
Table 6.6: Impact of Peripheral Ring Road 51
Table 6.7: Summary of impact assessments for CJVs 51
Table 6.8: WPI growth forecast assumptions 52
Table 6.9: Toll estimation overview 52
Table 6.10: Forecast toll segmentation FY22 onwards, TP1 Doddakarenahalli 53
Table 6.11: Forecast toll segmentation FY22 onwards, TP2 Karbylu 53
Table 6.12: Trip factors for the forecast years, TP1 Doddakarenahalli 53
Table 6.13: Trip factors for the forecast years, TP2 Karbylu 53
Table 6.14: Revenue reconciliation summary for Feb 2022 54
Table 6.15: Traffic forecast (with impacts) at TP1 Doddakarenahalli 54
Table 6.16: Traffic forecast (with impacts) growth rates (%), TP1 Doddakarenahalli 55
Table 6.17: Revenue forecasts (in INR crores) at TP1 Doddakarenahalli 55
Table 6.18: Revenue forecast with growth rates (%), TP1 Doddakarenahalli 56
Table 6.19: Traffic forecast (with impacts) at TP2 Karbylu 56
Table 6.20: Traffic forecast (with impacts) with growth rates at TP2 Karbylu 56
Table 6.21: Revenue forecast (in INR crores) at TP2 Karbylu 57

Table 6.22: Revenue forecast with growth rates (%) at TP2 Karbylu 57
Table 6.23: Summary of Macro Assumptions for upside and downside cases 59
Table 6.24: Summary of impacts on the Assets..... 59
Table 6.25: Summary of impacts on the Assets..... 59
Table 6.26: Traffic forecast (With Upside Impacts) for TP1: Doddakarenahalli 60
Table 6.27: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Doddakarenahalli. 60
Table 6.28: Revenue forecast (With Upside Impacts) for TP1: Doddakarenahalli (In Cr) 60
Table 6.29: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Doddakarenahalli..... 61
Table 6.30: Traffic forecast (With Upside Impacts) for TP2: Karbylu 61
Table 6.31: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Karbylu..... 62
Table 6.32: Revenue forecast (With Upside Impacts) for TP2: Karbylu (In Cr)..... 62
Table 6.33: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Karbylu..... 62
Table 6.34: Traffic forecast (With Dowside Impacts) for TP1: Doddakarenahalli 63
Table 6.35: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Doddakarenahalli 63
Table 6.36: Revenue forecast (With Downside Impacts) for TP1: Doddakarenahalli 63
Table 6.37: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Doddakarenahalli.. 64
Table 6.38: Traffic forecast (With Downside Impacts) for TP2: Karbylu 64
Table 6.39: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Karbylu..... 64
Table 6.40: Revenue forecast (With Downside Impacts) for TP2: Karbylu (In Cr)..... 65
Table 6.41: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Karbylu 65

Appendices

A Top OD Pairs

B Detailed Forecasts

C Data Collection Exercise

D Impact Analysis

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over-sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an Asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (referred to as 'Client' hereafter) has commissioned Steer Davies Gleave India Private Limited (hereafter called 'Steer') for a traffic due diligence to be carried out on Nelamangala Devihalli Expressway Private Limited (hereafter called 'Asset').

1.2 Our scope of work for the traffic and revenue forecasting process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from Assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the Asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the Asset

Scope of work	Data source
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI, and WPI line based on forecasts provided by client

1.3 This report presents the draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from FY17 to FY22.
  - Concession agreement and toll notifications
  - Previous studies
- Steer-commissioned TVC counts from 18th-24th January 2021
- OD data collected on behalf of the Client from surveys conducted in September 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the Asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.

- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the Asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each Asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the Asset against our Steer knowledge base (e.g., similar Asset types in the same state), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each Asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each Asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of toll, network, or other exogenous factors specific to the Asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India on 24th March FY20, the Central government announced a nationwide 25-day lockdown which was extended for another three weeks until May 3rd2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all highways in India was stopped between 25th March and 20th April for national highways. These lockdowns resulted in significant disruptions to traffic, with a reduction of both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued to a lesser extent due to a need to supply essential goods such as food, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

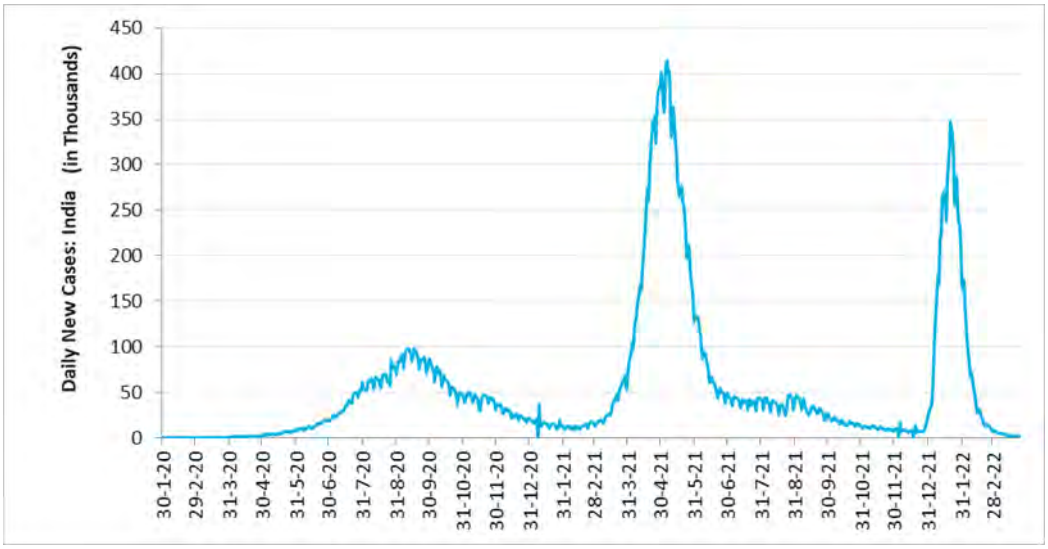
1.11 Data from various roads across the country indicates that the largest impact on traffic was experienced between the months of March 2020 and June 2020. Following a passive traffic recovery in Q2FY21 the Asset witnessed full traffic recovery Q3FY21 onwards to FY20 levels. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, as well as, underlying long-term growth trends in various

sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., are more stable and are driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 28th February 2022.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as the first wave when the whole country went under strict lockdown for two quarters. This can be attributed to the fact that almost all the restrictions were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October and November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe on the health, and hence the resultant lockdowns were short-lived and

had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed in the second wave.

1.16 Now that COVID-19 has an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network. This shift is expected to sustain and continue in the short term as such perception shifts for longer periods of time could result in more permanent changes in passenger choices. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters, including Chapter 1 providing an introduction:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visit;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset;
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

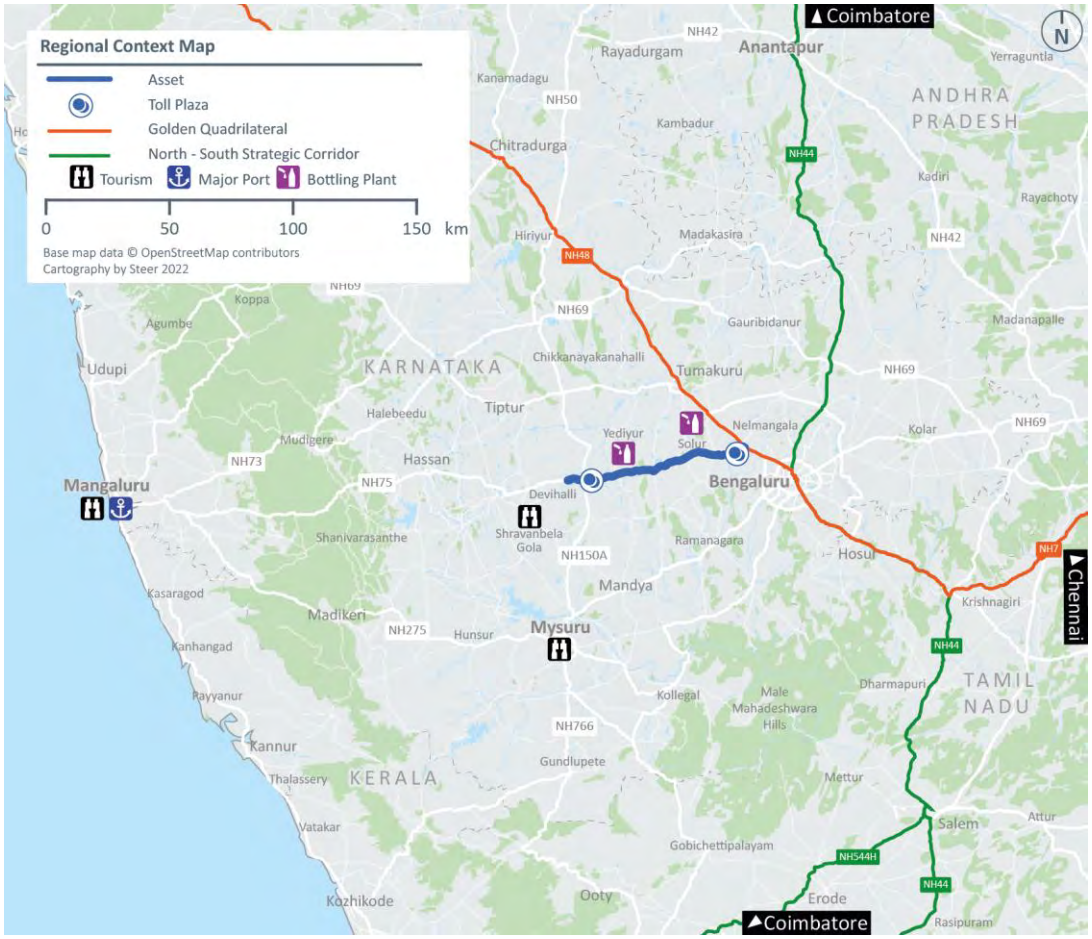
Introduction

2.1 This chapter provides a description of the Asset, based on both primary (site visits) data, and our understanding of the regional and network and the Asset. Starting with the strategic network context, the chapter discusses the Asset-level context, followed by economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the southern state of Karnataka, connecting the city of Bangalore to Mangalore via NH75. It is one of the three sections making the corridor, the other two being Devihalli-Hassan Tollway Limited (DHTL) and Hassan-Mangalore highway. The figure below shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional road network



Source: Steer cartography using OpenStreetMap data

2.3 The Asset primarily caters to the following different types of movements, by virtue of its strategic location on various corridors:

- Medium-distance movements between Bangalore and Mangalore primarily for leisure and tourism. The CJVs contribute around 70% to the total traffic on the Asset. This is driven by the large number of tourist destinations along the Asset and close to the Asset which drives the car growth.
- Work and leisure trips between local cities, towns and villages like Nelamangala, Hassan, tourist spots, and Bangalore city.
- Petroleum-related traffic:
  - Between ports and refineries in Mangalore and Kochi,and bottling plants lying on the Asset, viz HPCL plant at Yediyur and BPCL plant at Solur.
  - Between bottling plants and neighbouring consumption centres like Bangalore.

2.4 The Asset is an 80.26-km toll road which forms a part of NH75 in Karnataka. This is a four-lane road with two toll plazas, namely, Doddakarenahalli/Nelamangala (TP1 closer to Bangalore) and Karbylu (TP2 closer to Devihalli). The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context

Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plazas on the Asset have been operational since June 2012. There are still 12 years left in the concession period with FY33 being the last year of contract.

Table 2.1: Concession details

	Particulars
State	Karnataka
Highway	NH 75 4-lane
Toll Plaza	• TP1: Doddakarenahalli • TP2: Karbylu
Length (km)	• TP1: 40.13 km • TP2: 40.13 km
Commencement of operations*	• TP1: July 2012 • TP2: July 2012
Concession period	25 years
Last year of concession	FY33

Source: Concession agreement

2.6 Figure 2.3 shows a typical cross-section of the Asset and its toll plaza.

Figure 2.3: Typical cross section of the Asset and toll plaza

Source: Steer site visit

2.7 Tolls are collected for the toll categories and rates for a Single ticket, as shown in the following table. The toll plazas have dedicated FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable September 2021 to August 2022

Type of Vehicle	Single Journey Fee (INR)	
	TP1 Doddakarenahalli	TP2 Karbylu
CJV	45	45
LCV	80	80
Bus/Truck	160	160
3A/MAV/OSV	260	260

Source: NHAI Revision of User fee Rate w.e.f 01.09.2021

2.9 Apart from the CA-prescribed toll categories mentioned above, the toll plaza management charges a small number of school buses on a agreed monthly amount.

Key economic activities

2.10 Bangalore is both the capital and the largest city of Karnataka. The Asset, passing through several districts, is located just outside and to the west of the Bengaluru urban district. The industrial town of Nelamangala, at the Asset's eastern end, has several large-scale industries[1].

2.11 Tourist locations include Bangalore, Mangalore, Madikeri and temple tourism spots between the two cities. While Bangalore earlier known as the 'Garden City' was popular for its lakes, gardens, and pleasant weather. Mangalore, on the western Indian coast, is known for its beaches and cuisine. Apart from Shravanabela Gola near Channarayapattana, there are several temple locations in Dakshina Kannada district. Madikeri district, also known as Coorg, is a popular hill destination and coffee-growing region.

2.12 The Asset has two major LPG bottling plants, Solur and Yediyur, in close vicinity. Solur is present near TP1 whereas Yediyur is present near TP2. With rising average household incomes and urban population, the dependence on solid biomass is expected to reduce leading to increase in LPG production. This change in production levels will add traffic and hence, will be proven beneficial for the Asset. Furthermore, the active implementation of government schemes like Prandhan Mantri Ujjwala Yojna is adding to the growth of LPG sector in the country. The consumption grew by 7.3% in the first three months of 2021. At present, India's LPG demand in residential sector is growing at 3.3% CAGR and is forecasted to overtake China as the world's largest cooking gas LPG market with 34 MT per annum demand in 2030.

Key Network Developments

2.13 4 laning of part of the Hassan-Mangalore section (with addition of 3 bypasses)[2] is expected to reduce journey times between Bangalore and Mangalore.

2.14 The proposed construction of the Bangalore Peripheral ring road[3] will result in a direct connection between the region covered by the Asset and East Bangalore.

---

[11] http://dcmsme.gov.in/dips/2016-17/Bengaluru%20Rural.pdf

[2] https://www.thehindu.com/news/cities/Mangalore/four-lane-work-on-45-km-of-nh-75-likely-to-be-ready-by-march-next/article34126731.ece

[3] https://www.thehindu.com/news/cities/bangalore/peripheral-ring-road-under-ppp-model/article34022482.ece

2.15 Planned expansion of the HPCL LPG bottling plant is also expected to result in the sustained traffic levels on the Asset[4].

2.16 There are no alternate long-distance or medium-distance routes that pose a threat to the Asset. Also, during our site visit to the Asset, no major micro-diversions through local roads were observed close to the toll plazas.

2.17 Chapter 6 provides a discussion and estimation of potential impacts on the Asset.

PCU factors considered for reporting

2.18 Please refer the PCU factors considered in the below table as per IRC64 1990. Based on the discussion with client, for reporting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5 as defined in IRC64 1990.

Table 2.3: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.5
OSV	4.5

Source: Steer analysis and IRC64,1990

[4]http://environmentclearance.nic.in/writereaddata/Online/TOR/05_May_2017_151105580LFGHM12JPFR.pdf

3 Traffic Description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data, including that which was collected as a part of this study, and data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of demand currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand, on the Asset.

3.3 Actual toll plaza data is used as the primary basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information. The next section provides key findings around AADT, historical trends and toll segmentation from the Client data.

Historical trends

3.4 The table below presents the historical traffic evolution for each of the plazas.

Table 3.1: Historical evolution in AADT by vehicle class at TP1- Doddakarenahalli

Vehicle category	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	4,971	6,690	7,975	9,395	11,520	12,794	13,000	14,458	15,656	16,509
LCV	1,622	2,021	2,095	2,211	2,452	2,658	2,631	2,775	2,476	1,241
Bus	1,417	1,617	1,551	1,525	1,626	1,522	1,436	1,442	570	974
2A	689	810	765	886	674	894	812	806	987	711
3A/MAV	643	707	664	651	798	831	744	952	960	999
Total	**9,342**	**11,846**	**13,050**	**14,668**	**17,070**	**18,699**	**18,623**	**20,432**	**20,649**	**20,433**
PCU	**15,841**	**19,335**	**20,255**	**22,092**	**24,730**	**26,770**	**26,144**	**28,502**	**27,206**	**26,717**

Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 includes full year data till Mar'22), 3A/MAV PCU is a weighted average of Rigid-trailer PCU (MAV) and 3A/MAV splits using TVC to arrive at 3A/MAV PCU.

Table 3.2: Historical evolution in AADT by vehicle class at TP2- Karbylu

Vehicle category	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	3,312	4,727	5,832	6,958	8,649	8,997	8,766	10,301	11,285	12,376

Vehicle category	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
LCV	1,000	1,491	1,623	1,726	1,897	1,998	1,956	2,155	1,902	901
Bus	972	1,335	1,276	1,283	1,390	1,281	1,227	1,240	599	806
2A	422	593	562	786	479	709	583	605	656	553
3A/MAV	569	748	698	699	840	776	660	918	884	952
Total	**6,274**	**8,894**	**9,991**	**11,452**	**13,255**	**13,761**	**13,193**	**15,218**	**15,326**	**15,587**
PCU	**10,868**	**15,216**	**16,082**	**18,059**	**19,871**	**20,522**	**19,309**	**22,092**	**20,819**	**20,942**

Source: Steer analysis of the Client data (MAV includes 3A, FY21 data includes the operational days for April 2020, FY22 includes full year data till Mar'22), 3A/MAV PCU is a weighted average of Rigid-trailer PCU (MAV) and 3A/MAV splits using TVC to arrive at 3A/MAV PCU.

3.1 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Table 3.3: Historical YoY growth rates and CAGR by vehicle class at TP1- Doddakarenahalli

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY16-22	CAGR FY18-22
CJV	17.8%	22.6%	11.1%	1.6%	11.2%	8.3%	5.4%	**16.7%**	**9.9%**	**6.6%**
LCV	5.5%	10.9%	8.4%	(1.0%)	5.5%	(10.8%)	(49.9%)	**4.6%**	**(9.2%)**	**(17.3%)**
Bus	(1.7%)	6.7%	(6.4%)	(5.6%)	0.4%	(60.5%)	70.8%	**(2.9%)**	**(7.2%)**	**(10.6%)**
2A	15.8%	(23.9%)	32.6%	(9.1%)	(0.8%)	22.5%	(28.0%)	**4.6%**	**(3.6%)**	**(5.6%)**
3A/MAV	(1.9%)	22.4%	4.2%	(10.6%)	28.0%	0.8%	4.1%	**(4.0%)**	**7.4%**	**4.7%**
Total	12.4%	16.4%	9.5%	(0.4%)	9.7%	1.1%	(1.0%)	**11.3%**	**5.7%**	**2.2%**
PCU	8.7%	12.3%	8.1%	(2.6%)	9.6%	(4.3%)	(1.6%)	**6.5%**	**3.4%**	**0.1%**

Source: Steer analysis of TMS data provided by client

Table 3.4: Historical YoY growth rates and CAGR by vehicle class at TP2- Karbylu

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY16-22	CAGR FY18-22
CJV	19.3%	24.3%	4.0%	(2.6%)	17.5%	9.6%	9.7%	**13.7%**	**10.1%**	**8.3%**
LCV	6.3%	9.9%	5.3%	(2.1%)	10.2%	(11.7%)	(52.6%)	**7.6%**	**(10.3%)**	**(18.1%)**
Bus	0.5%	8.3%	(7.8%)	(4.2%)	1.0%	(51.7%)	34.6%	**(0.1%)**	**(7.5%)**	**(10.9%)**
2A	39.8%	(39.1%)	48.0%	(17.7%)	3.7%	8.5%	(15.8%)	**(5.1%)**	**(5.7%)**	**(6.0%)**
3A/MAV	0.2%	20.2%	(7.6%)	(14.9%)	39.0%	(3.6%)	7.6%	**5.3%**	**5.3%**	**5.2%**
Total	14.6%	15.7%	3.8%	(4.1%)	15.3%	0.7%	1.7%	**9.6%**	**5.3%**	**3.2%**
PCU	11.7%	10.5%	2.7%	(6.3%)	15.4%	(5.7%)	0.9%	**6.5%**	**2.6%**	**0.7%**

Source: Steer analysis of TMS data provided by client

3.2 In terms of vehicle composition, CJVs are the biggest contributor on the Asset with a share of over 60%. As discussed in Chapter 2, the Asset to caters to large volume of tourism oriented traffic travelling from Bangalore to tourism centres such as Coorg, Maidkeri, and Shravanabela Gola which contribute towards the CJV traffic on the Asset. These shares are slightly higher at TP1 which is closer to the urban centre of Bangalore.

3.3 However, since FY21 the Asset is witnessing a declining traffic trend across all major vehicle categories. CJV's have witnessed the degrowth due to persistent closure of tourism related travel around the Asset related to COVID-19 restrictions. With the ongoing partial restrictions in FY22 the Asset hasn't shown traffic recovery to pre-COVID-19 levels.

3.4 The LCVs on the Asset are mainly carrying the items of daily needs and agriculture commodities. In FY22, there has been sharp decline in LCVs observed on the Asset, this is primarily due to Mini LCVs now being reported correctly in CJVs post FASTag implementation, which were earlier accounted in the LCVs. Since, the Asset is a high tourism driven corridor with religious centres surrounding the Asset, this justifies the high volume of Bus traffic observed on the Asset.

3.5 Share of MAVs on the Asset has been flat with around 5-6% of total traffic. Majority of these MAVs carry LPG cylinders from the Hindustan Petroleum Corporation Limited (HPCL) bottling plants at Solur and Yediyur.

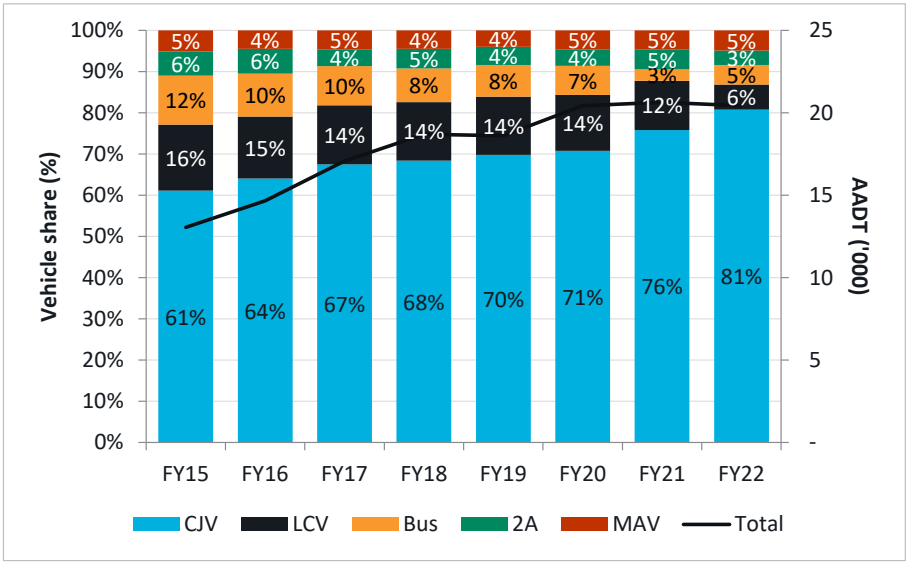
3.6 As can be seen in the figures below, the Asset saw steady and healthy growth from FY15 to FY22, except for a decline in FY21 due to COVID-19. The underlying growth trends between FY12 and FY18, shows the underlying strength of traffic growth drivers that influence this Asset.

3.7 Both TPs saw the strong growth in the number of CJVs on the route – the only exception being in FY19 due to construction on the Hassan-Mangalore section at Shiradi Ghat, which was a temporary impact and FY21 due to COVID-19 related restrictions. The increasing number of CJVs observed on this Asset (5% annual increase FY20 onwards) can be directly linked to the growth of the city of Bangalore both in terms of population and per capita income levels. As mentioned previously, this corridor is primarily used for social, leisure and tourism activities, the growth in local economy and local tourism has led to strong growth in the CJV traffic. The growth in CJVs in FY22 is also attributed to Mini LCV now being correctly tolled in CJVs post FASTag implementation, which were earlier accounted in LCVs.

3.8 In the previous years, it is seen that MAVs have grown at a healthy rate at a CAGR of 7.4% at TP1 and 5.3% at TP2 between FY16-22. This growth has been similar between FY18 and FY22 with slight negative impact due to COVID-19 waves. The MAVs at both plazas declined significantly in FY16 and FY19 due to the Shiradi Ghat closure and construction on the Hassan-Mangalore section, these have been temporary impacts and the traffic have since exhibited strong recovery and growth from FY20 onwards.

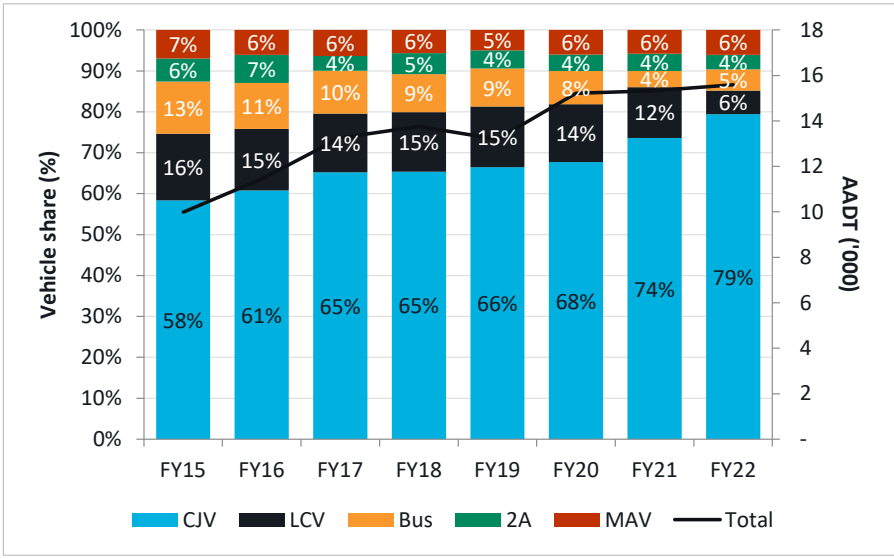
3.9 The flat or negative growth trend in LCV and 2A between FY15-FY21 as well as in FY22 is related to the classification of these vehicle categories getting influenced due FASTag implementation. With some Mini-LCVs getting reclassified to CJVs, LCVs have shown a flat or negative growth trend. The impact of these past trends on the future outlook of traffic growth have been discussed in further detail in later chapters.

Figure 3.1: Historical evolution in vehicle shares and reported AADT, TP1 Doddakarenahalli



Source: Steer analysis of the Client data (MAV includes 3A , FY21 data includes the operational days for April 2020, FY22 includes full year data till Mar'22)

Figure 3.2: Historical evolution in vehicle shares and reported AADT, TP2 Karbylu



Source: Steer analysis of the Client data (MAV includes 3A , FY21 data includes the operational days for April 2020, FY22 includes full year data till Mar'22)

3.10 The table below presents the reported historical revenue of the Asset.

Table 3.5: Historical revenue evolution (in INR crores): Asset level

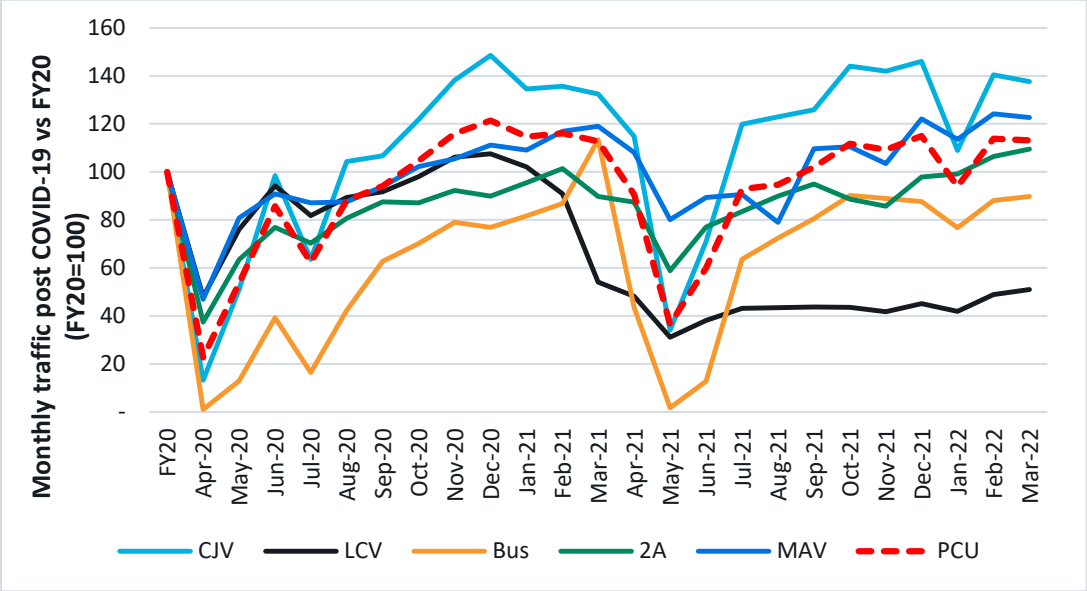
	FY 19	FY 20	FY 21	FY 22
Annual Revenue (INR Crore)	63.35	71.80	69.39	72.49

Source: Steer analysis of the Client data

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.11 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. 2nd wave of COVID-19 resulted in regional lockdowns in Q1 and Q2 FY22, while the 3rd wave of COVID-19 impacted traffic volumes in Q4 of FY22. The evolution of traffic FY20 onwards is presented in the figure below:

Figure 3.3: Month on Month traffic recovery vs FY20 – Asset level



Source: Steer analysis of the Client data

3.12 As we can see from the figure above, the Asset reached the FY20 PCU levels in Oct-20 (FY21) when the Hassan- Managlore section got operational. Since then, the CJV volumes have increased significantly on a monthly basis peaking to 40% higher than FY20 volumes in March 2022. The impact of 2nd wave of COVID-19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to goods traffic. The goods traffic on this Asset wasn't much impacted by the COVID-19 as seen in the above chart where MAV volume are similar/slightly higher to FY20 levels.

Toll Frequencies

3.13 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.14 Understanding the toll frequency gives insights into the nature of the traffic. CJVs generally have higher shares of return or single passes, while heavy trucks mostly have single tickets since they travel longer distance. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Assets catering to short distance local traffic generally observes high share of

return or other local monthly passes while the Assets catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.15 The following are different types of tickets being sold at the plaza of the Asset.

Table 3.6: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows the vehicle to take two trips within a day with second trip at 50% of single fee.
Local Personal	Discounted single entry monthly pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. The pass allows single entry only.
Monthly	For all vehicle categories which charges the user 1/3rd the fee of 50 Single trips
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.16 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

FASTag implementation

3.17 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.7: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021.

Source: NHAI.gov.in and Wikipedia

3.18 FY21 had multiple disruptions in traffic patterns related to the pandemic. There was also significant change in ticket segmentation observed across several toll roads around the country due to the imposition of mandatory use of FASTag, the electronic toll payment mechanism mandated by NHAI. This resulted in shares of users paying by FASTag jump significantly across all vehicle categories. To encourage that nearly all toll plaza users shift to FASTag, there was also a penalty for cash payers introduced. The final deadline for mandatory

use of FASTag was set for 15th February 2021 which has had the desired impact of over 95% of toll revenue collection now being collected through FASTag across the NHAI toll plazas. This has also increased the operational efficiency of toll plazas significantly as well as improved the traffic and revenue reporting standards due to limited use of cash through manual means at toll plazas. The table below presents the reported percentage of transactions via FASTag.

Table 3.8: %age of traffic via FASTag, Mar 2022

Toll Plaza	CJV	LCV	2A	Bus	MAV
TP1 Doddakarenahalli	80.1%	92.2%	95.1%	96.8%	97.8%
TP2 Karbylu	85.8%	94.8%	95.7%	96.5%	98.4%

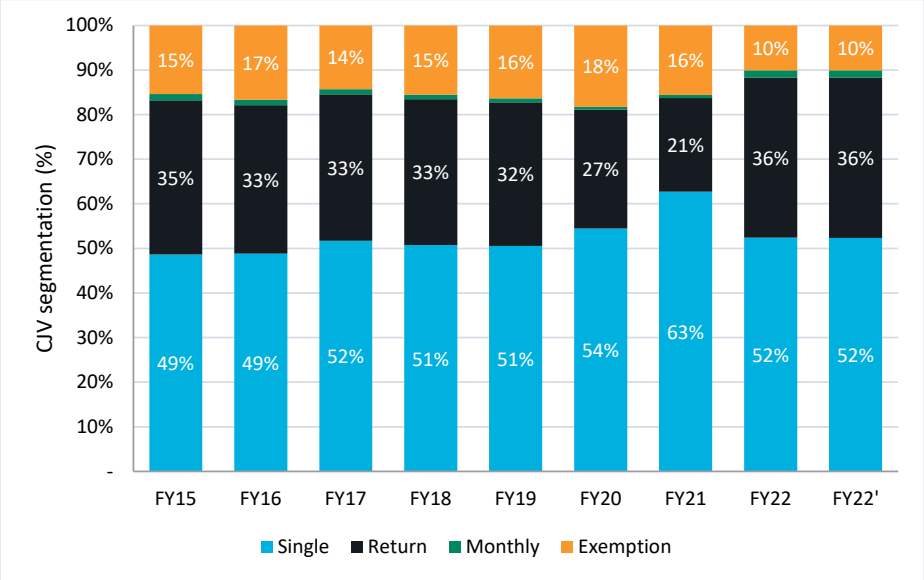
Source: Steer Analysis of Client data

3.19 As we can see from the table above by March FY22 most of the vehicle types across the toll plaza were reporting more than 95% FASTag penetration except for CJV. This is more because CJVs are local in nature. The increase FASTag ensured efficient tolling operations as well as increased compliance. Moreover, with better management due to FASTag the combined share of exemption and violations reported under CJV category as shown in section below have decreased by 5-6% in FY22 in comparison to FY20.

3.20 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as local/return/monthly/through and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in ETC penetration, it was observed that traffic patterns have begun to return to their initial segmentation.

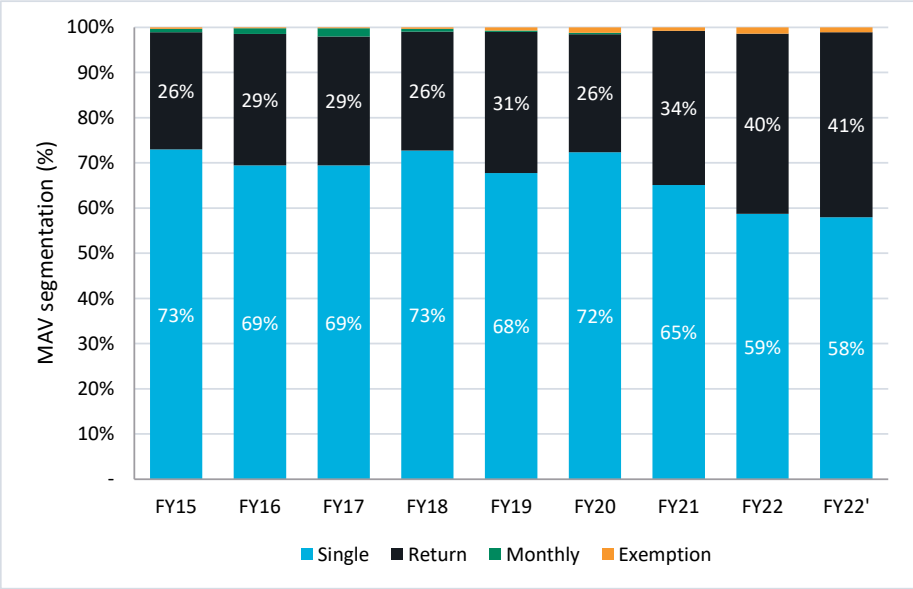
3.21 The following figures provide the toll segmentation for the historical years at TP1 Doddakarenahalli and TP2 Karbylu for CJV and MAV while the table provides the same for the remaining vehicle types.

Figure 3.4: Ticket-segmentation for CJV, TP1 Doddakarenahalli



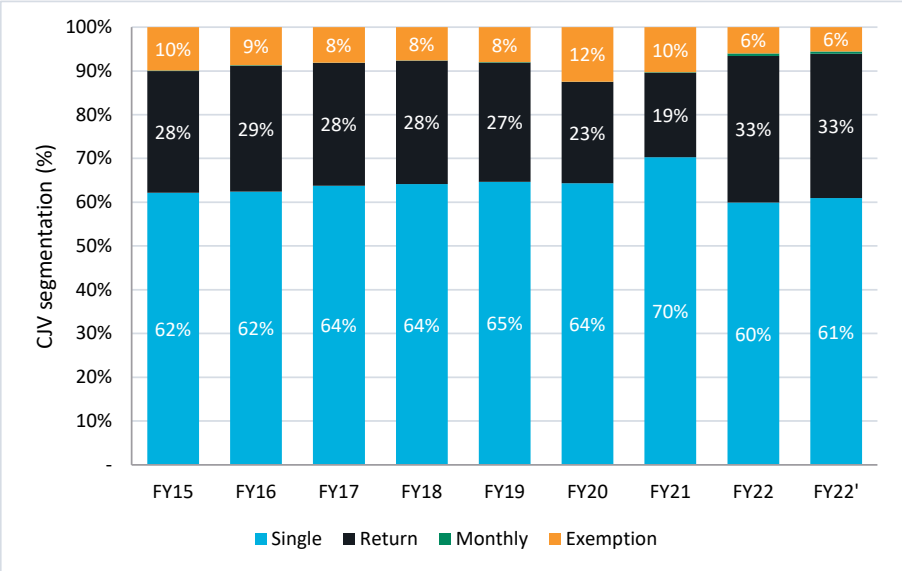
Source: Steer analysis of the Client data, FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

Figure 3.5: Ticket-segmentation for MAV, TP1 Doddakarenahalli



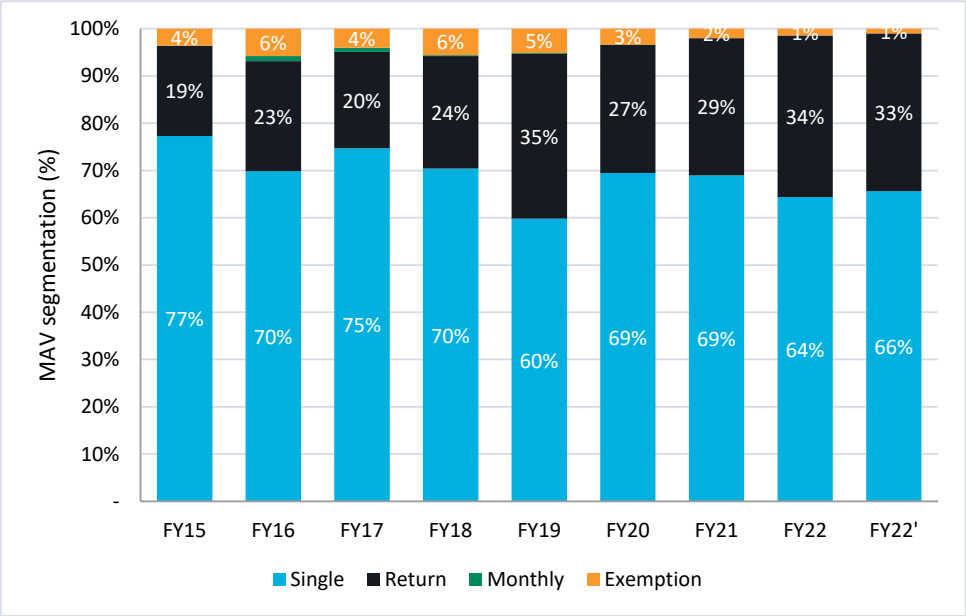
Source: Steer analysis of the Client data, FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

Figure 3.6: Ticket-segmentation for CJV, TP2 Karbylu



Source: Steer analysis of the Client data, FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

Figure 3.7: Ticket Segmentation for MAV, TP2 Karbylu



Source: Steer analysis of the Client data; FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

3.22 For CJVs, the dominant ticket type at both plazas is 'Single' tickets (over 50% at TP1 and 60% at TP2), due to the high share of tourism-related traffic, wherein the commuters generally travel for couple of days, not making users eligible for a return ticket.

3.23 The share of exemptions observed on this Asset is in line with our observations on similar urban Assets across the region. The share of exemptions is higher on TP1 due to its urban nature. With increasing ETC penetration on the Asset, the combined share of exemption on the Asset has dropped by 5-6% compared to FY20 levels. This is likely because of better management and operation of traffic system post FASTag implementation. Looking into the CJV exemptions in more detail, at TP1 Doddakarenahalli, there is reportedly a mix of local and political influence that leads to a relatively high proportion of reported exemptions for CJV.

3.24 MAVs also show a high share of 'Single' ticket type (over 60% at TP1 and 65% at TP2), showing the significance of medium-distance traffic. The remaining shares for MAVs are primarily held by 'Return' tickets. Since TP1 of the Asset caters to more local traffic feeding the local industries as verified from the OD data in chapter 3 therefore the share of return tickets is higher on TP1 of the Asset. In case of MAVs exemptions, both the plazas report minimal exemptions within 2%. Later in this Chapter we discuss the TVC-TMS comparison analysis which helped us understand the share of violations and forced exemptions further.

Table 3.8 Historical ticket segmentation at TP1 Doddakarenahalli

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
LCV									
Single	37%	36%	37%	37%	38%	46%	64%	38%	37%
Return	49%	50%	53%	53%	52%	44%	29%	53%	55%
Monthly	1%	1%	1%	1%	1%	0%	0%	0%	0%
Local commercial	5%	5%	4%	4%	4%	4%	4%	5%	5%
Exemption	9%	8%	6%	5%	5%	5%	4%	3%	3%
Bus									
Single	18%	17%	15%	15%	16%	22%	12%	10%	10%
Return	58%	53%	59%	53%	55%	55%	88%	88%	89%
Monthly	25%	30%	26%	32%	29%	22%	0%	2%	1%
Exemption	0%	0%	0%	0%	0%	0%	0%	0%	0%

Source: Steer analysis of the Client data, FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

Table 3.9: Historical ticket segmentation at TP2 Karbylu

	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
LCV									
Single	47%	46%	46%	44%	45%	49%	64%	48%	48%
Return	38%	40%	40%	42%	41%	36%	26%	49%	49%
Monthly	0%	0%	0%	0%	0%	0%	0%	0%	0%
Local commercial	8%	8%	9%	9%	8%	8%	4%	2%	1%
Exemption	8%	7%	5%	5%	6%	7%	6%	2%	2%
Bus									
Single	20%	18%	17%	17%	17%	24%	11%	11%	10%
Return	50%	46%	52%	45%	43%	51%	77%	87%	88%
Monthly	29%	35%	31%	38%	40%	25%	11%	2%	2%
Exemption	1%	0%	0%	0%	0%	0%	0%	0%	0%

Source: Steer analysis of the Client data, FY22' is the averaged Oct-Mar segmentation; FY22 is the annual level segmentation

Overloading

3.25 The Asset being a part of NHAI concession follows the NHAI Overloading policy released in 2016 which bans the overloading of commercial vehicle on any NHAI toll plaza. In case of non-compliance, overloaded vehicles on the Asset are charged twice the toll fee they would otherwise pay for a Single ticket at the toll plaza. The Asset currently doesn't report overloading under any ticket category.

Data Collection exercise

Overview

3.26 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.10: Data collection schedule

TP#	7-day videography based TVC			1 day OD survey	
	Start date	End date	Time (hrs)	Start date	Time (hrs)
TP1 Doddakarenahalli	18 January 2021	24 January 2021	0000-2359	7 Nov 2019	08:00
TP2 Karbylu	18 January 2021	24 January 2021	0000-2359	8 Nov 2019	08:00

Source: Data collection plan as followed for collecting independent survey data

3.27 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

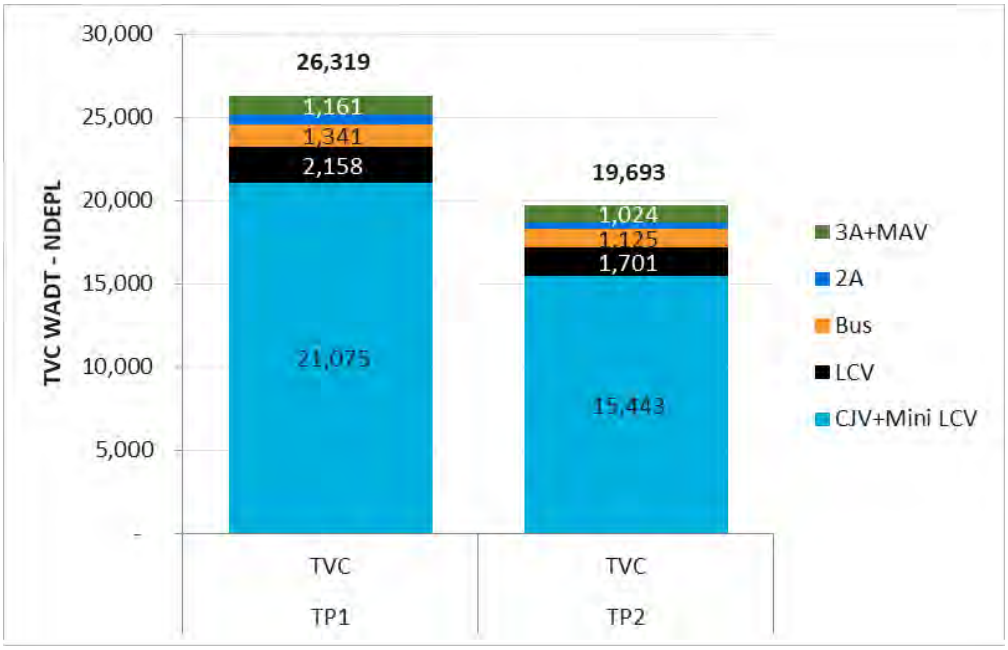
Key findings of the TVC data analysis

WADT estimates

3.28 Taking an average of the seven-day TVC counts (18th – 24th Jan 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicle such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicle, government vehicle and other vehicle types officially allowed as 'exempted' under the concession agreement.

3.29 As can be seen, CJVs are the largest vehicle category (19,569 at TP1 and 14,331 at TP2), followed by LCV (2,158 at TP1 and 1,701 at TP2).

Figure 3.8: TVC WADT



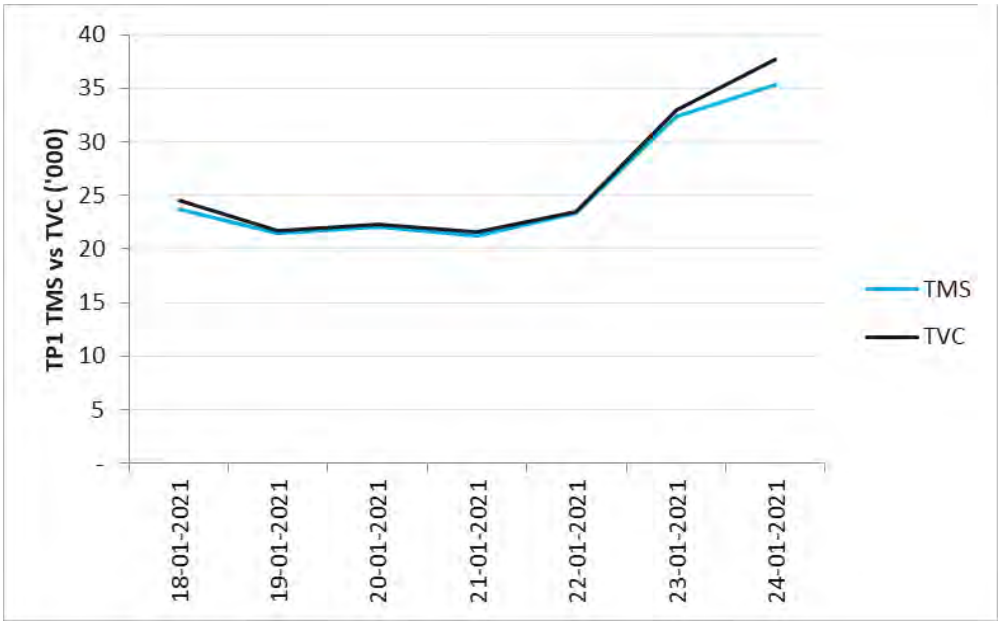
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.30 We used our TVC data to validate the toll plaza data for the same days, as supplied by the Client via their toll management system (TMS). This TMS data was then used as the base data, for our forecasting model.

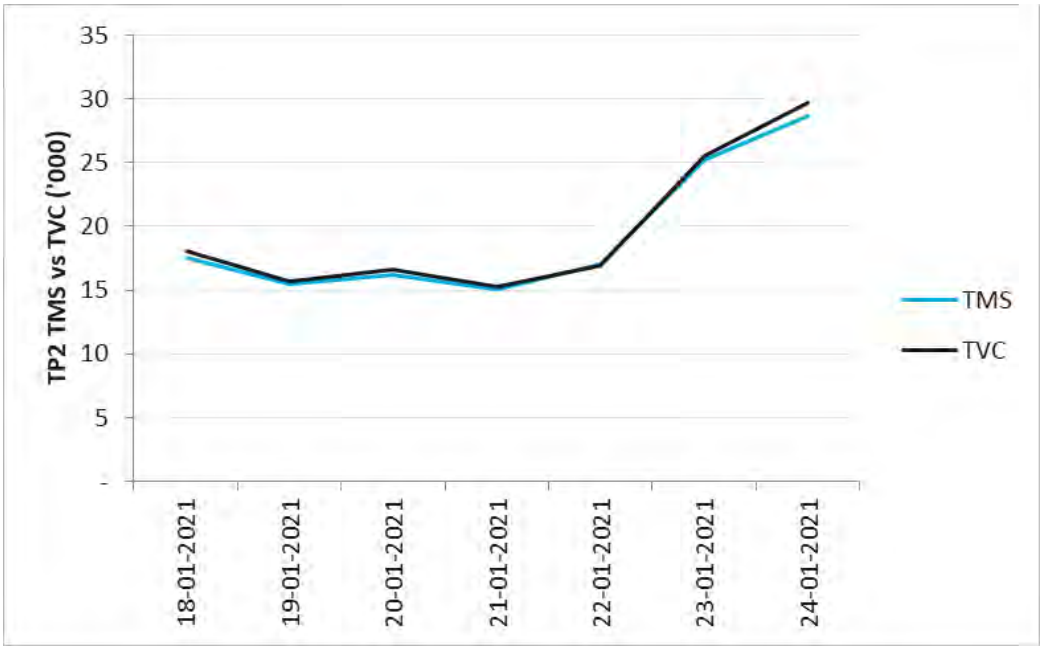
3.31 The figures below show the comparison between daily traffic data and shares of vehicle categories in TVC and TMS for the two toll plazas. As can be seen both TP1 Doddakarenahalli and TP2 Karbylu show a good fit between the TVC and TMS. The minor difference on two days of the seven-day period is within the acceptable range of variation.

Figure 3.9: Comparison between TVC and TMS daily traffic data on TP1 Doddakarenahalli



Source: Steer analysis of TVC and Client TMS data

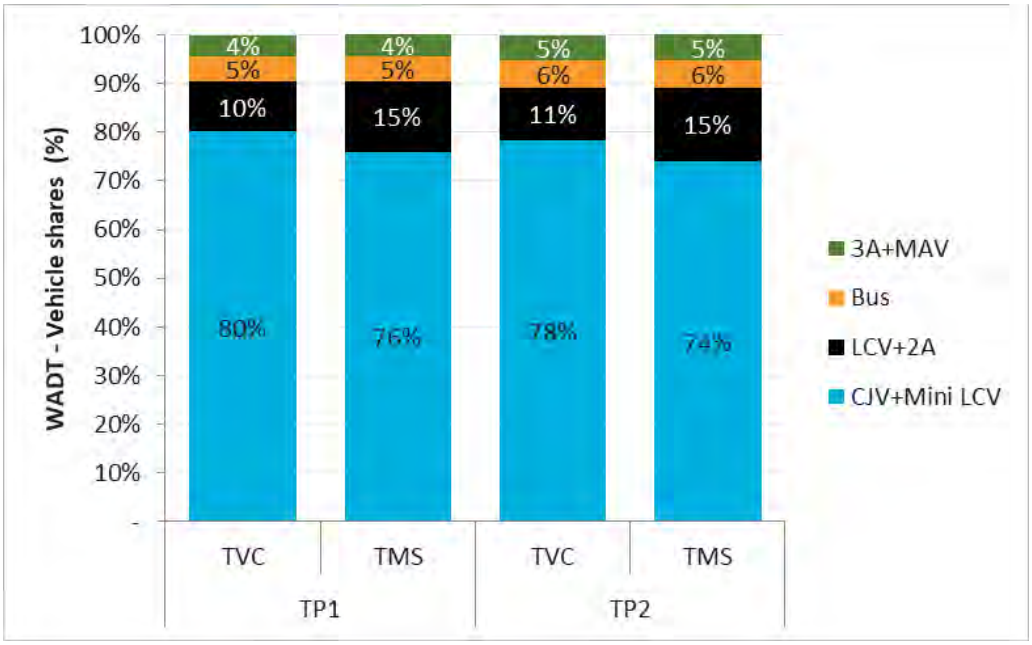
Figure 3.10: Comparison between TVC and TMS daily traffic data on TP2 Karbylu



Source: Steer analysis of TVC and Client TMS data

3.32 The figure below compares the shares of vehicle types at both plazas, between TVC and TMS data. We see that while most vehicle categories show similar shares, the CJV shares show differences between TMS and TVC. This difference is mostly compensated by the shares of LCVs showing the reverse. This reciprocal mismatch between CJV and LCVs can be attributed to common misclassification of vehicle categories especially the Mini LCVs. Other vehicle class shares hold consistent across the TVC and TMS.

Figure 3.11 Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.33 Upon combining these two vehicle categories, as shows in the table below, we see that the difference stays high in case of CJV's in terms of absolute numbers and volumes both.

Table 3.11: Difference in vehicle counts when combined

Vehicle type	TP1 Doddakarenahalli			TP2 Karbylu		
	TVC	TMS	TMS vs TVC (%)	TVC	TMS	TMS vs TVC (%)
CJV+Mini LCV	21,705	19,463	8.3%	15,443	14,301	8.0%
Bus	1,341	1,290	4.0%	1,125	1,068	5.4%
LCV+2A	2,731	3,748	(27.1%)	2,095	2,938	(28.7%)
3A+MAV+OSV	1,171	1,146	(2.1%)	1,029	1,025	(0.4%)
Total	26,319	25,646	(2.6%)	19,693	19,332	(1.8%)

Source: Steer analysis of TVC and Client TMS data

Key findings of origin-destination analysis

Overview

3.34 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in November 2019. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred in this period.

3.35 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.36 While zonal analysis and the list of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution show 'how far' vehicles and people travel, and goods get transported. This set of analyses is generally used to estimate the key drivers of traffic and aid the making of informed forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.37 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples captured by the traffic counts (based on the TVC data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at both the toll plazas. We believe that the sample rates of the OD data are reasonable.

Table 3.12: Sample rates for OD data

Vehicle type	TP1 Doddakarenahalli	TP2 Karbylu
Car	17%	35%

Vehicle type	TP1 Doddakarenahalli	TP2 Karbylu
Bus	54%	86%
LCV	31%	32%
2A Truck	46%	45%
3A Truck	45%	75%
MAV	44%	97%
Total	24%	42%

Source: Steer analysis of OD data

Zone categories

3.38 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the following table. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.13: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.
Immediate area of influence (IAOI)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of Karnataka	Rest of the cities/Districts in the state that Asset lies in.
Kerala	Kerala
Madhya Pradesh	Madhya Pradesh
Maharashtra	Maharashtra
Odisha	Odisha
Puducherry	Puducherry
Tamil Nadu	Tamil Nadu
Telangana	Telangana
Goa	Goa
Chhattisgarh	Chhattisgarh
Andhra Pradesh	Andhra Pradesh
North East India	North east Indian states, West Bengal
North India	Punjab, Karnataka, Haryana, Delhi NCR
Rest of India	Rest of Indian states
Outside India	Nepal, Bhutan, Bangladesh

Source: Steer analysis

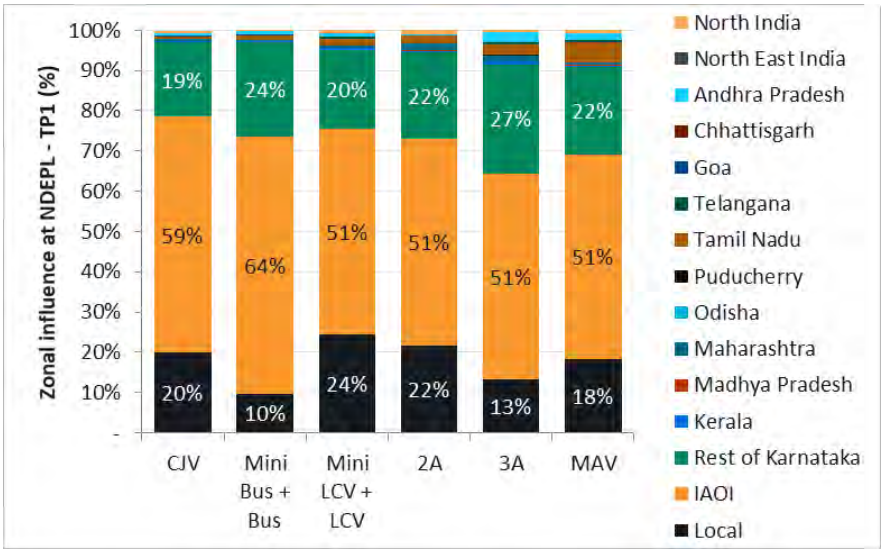
Zonal influence

3.39 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[5] at each toll plaza of each Asset, aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed on trip ends and not trips.

3.40 The figures below present the zonal influence on various vehicle types on the toll plaza. We can see that 'IAOI' trips make up the largest share for all vehicle types. We find high shares of local and IAOI zonal influence. Combined with the internal-external distribution (presented in the next section, showing high I-ROS and ROS-I shares), we see that understandably, trips with one end at various locations in Bangalore district dominate the traffic profile. These reflect in the IAOI zonal influence.

3.41 At TP1 Doddakarenahalli, the highest share of trips can be attributed to IAOI with a share of 50%-60% local trips and 'Rest of Karnataka' has about 20% share each across all vehicle categories. MAVs also have a small proportion of trips from Tamil Nadu and Andhra Pradesh.

Figure 3.12: Zonal influence, TP1 Doddakarenahalli

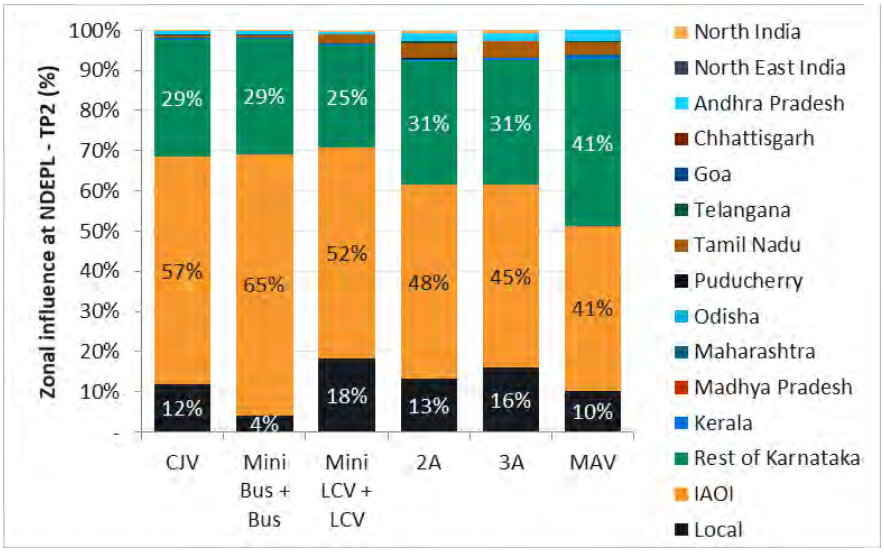


Source: Steer analysis of OD data

3.42 For TP2 Karbylu, IAOI retains the highest proportion on zone influence across all vehicle types, ranging between 41%-65%. This is closely followed by 'Rest of Karnataka' trips, especially for heavy vehicles. Compared to TP1, the share of local trips is comparatively lower at 5%-10% share across the vehicle categories.

[5] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad is 50% since one trip end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.13: Zonal influence, TP2 Karbylu



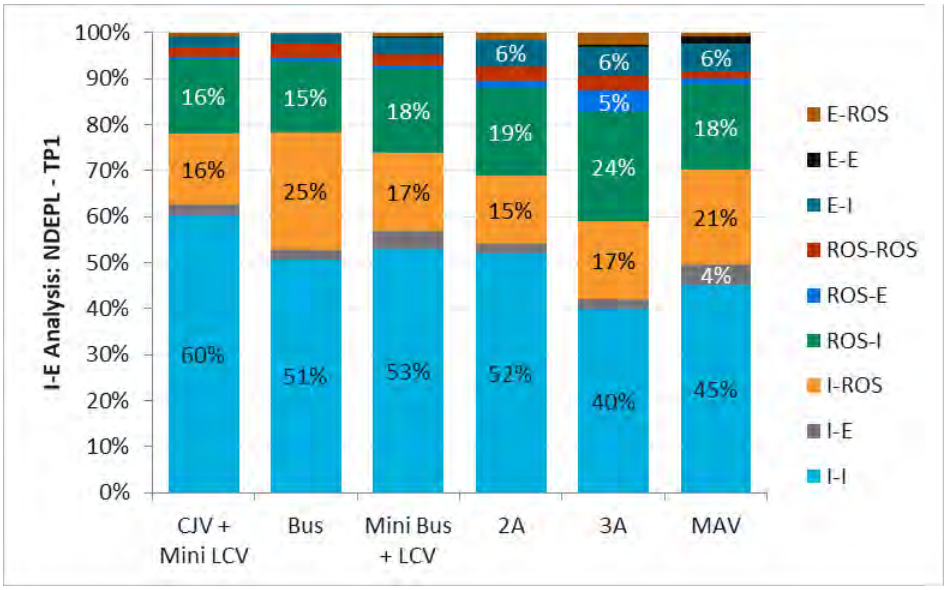
Source: Steer analysis of OD data

Internal External analysis

3.43 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local or IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

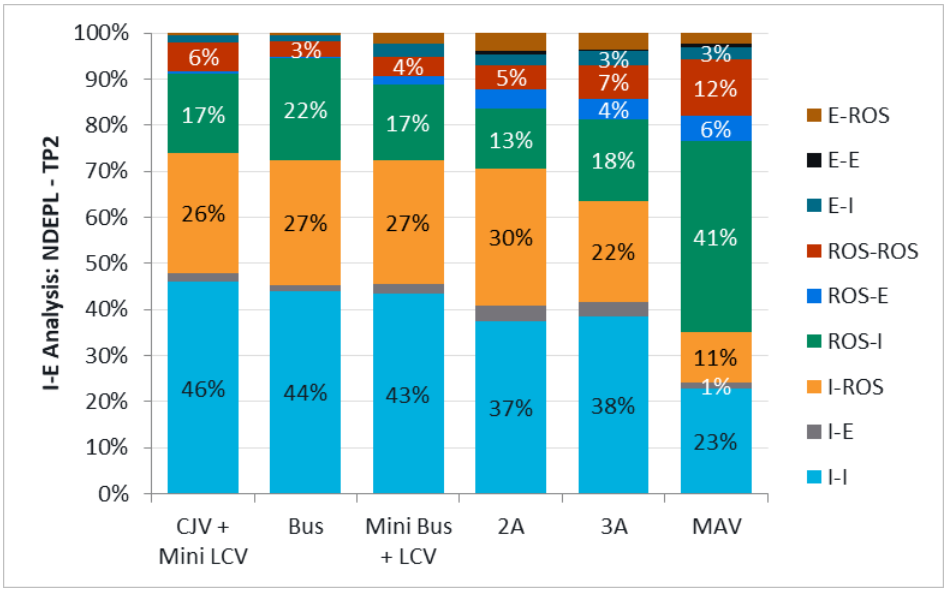
3.44 The graphs below show the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation but at a trip level.

Figure 3.14: Internal-external distribution, TP1 Doddakarenahalli



Source: Steer analysis of OD data

Figure 3.15 Internal-external distribution, TP2 Karbylu



Source: Steer analysis of OD data

3.45 As can be seen from the charts above, the I-I distribution makes up the major share for both light and heavy vehicles. This is followed by the trips which have one end of the trip in rest of the state, this includes places like Bangalore, Mangalore and Hassan and other end on the Asset.

Commodity distribution

3.46 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.14: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	

Commodity Description	Code	Combined codes used for charts
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

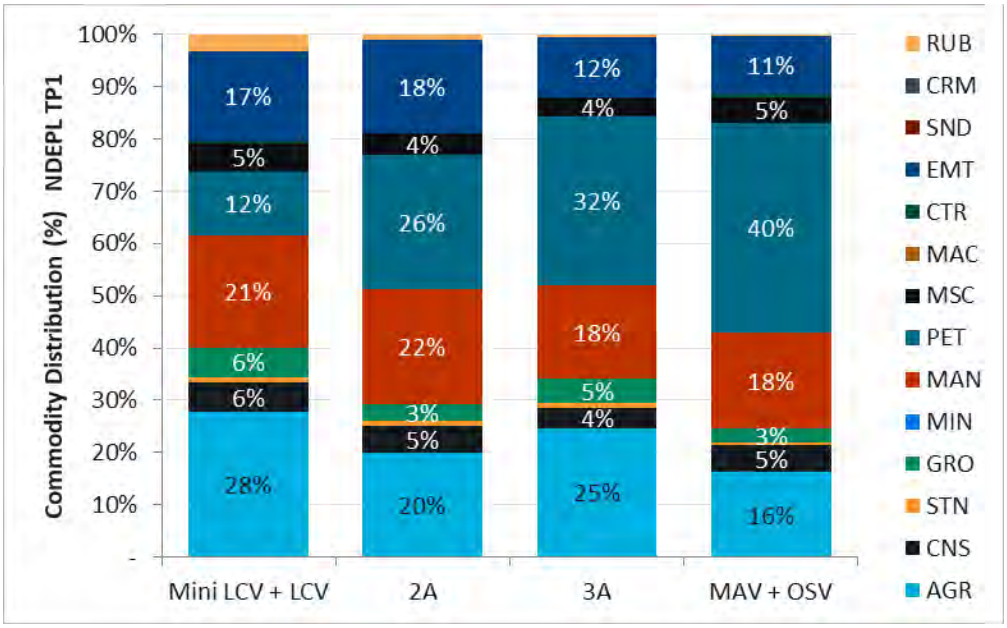
3.47 The figures below present the commodity distribution for goods vehicles at this toll plaza. These help in identifying the mix of goods carried on the Asset and in turn, the potential growth drivers.

3.48 As also observed during our site visits, we see that a significant number of vehicles are bullet tankers carrying petroleum from port and oil refineries in Mangalore to bottling plants at Yediyur and Solur, and trucks that carry bottled petroleum products. These lie very close to the Asset road leading to the high proportion of petroleum (up to 40% for MAVs) in the commodity distribution.

3.49 Manufactured products make up the second most common aggregate category at this toll plaza, going up to 20% for MAVs.

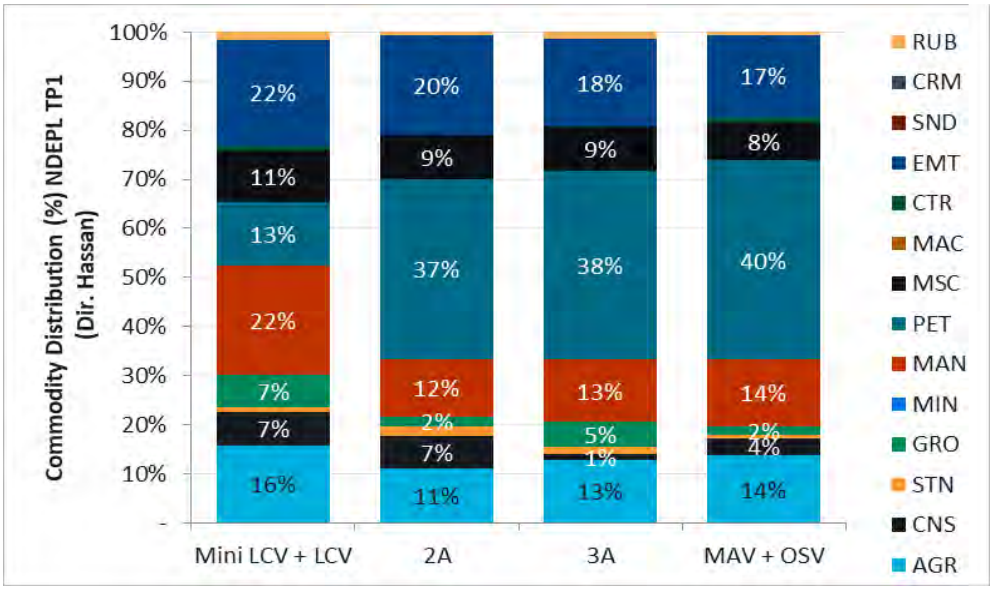
3.50 Looking by direction, at TP1 the commodity shares in the direction towards Hassan, and the direction towards Bangalore are fairly similar. As mentioned above, both directions have a dominant share of petroleum products (40%). The key differences are that whilst towards Hassan has higher shares of empty trucks and towards Bangalore has a higher share of manufactured products, this primarily includes empty trucks coming from the city of Bangalore to be loaded and carrying back commodities for the city consumption. At TP2, the direction towards Hassan has an equal share of manufactured products and petroleum products (25% each), whereas in the opposite direction petroleum is dominant at a 42% share. Construction materials hold a stronger share in the direction towards Hassan, at 32% compared to just 8% in the opposite direction to Bangalore.

Figure 3.16: Commodity distribution, TP1 Doddakarenahalli (Total)



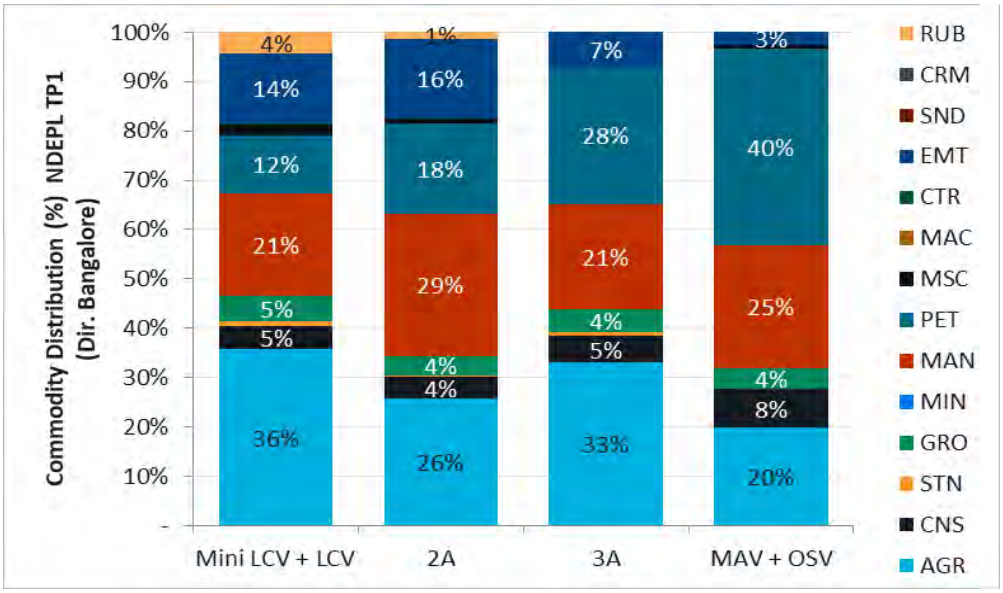
Source: Steer analysis of OD data

Figure 3.17: Commodity distribution, TP1 Doddakarenahalli (towards Hassan)



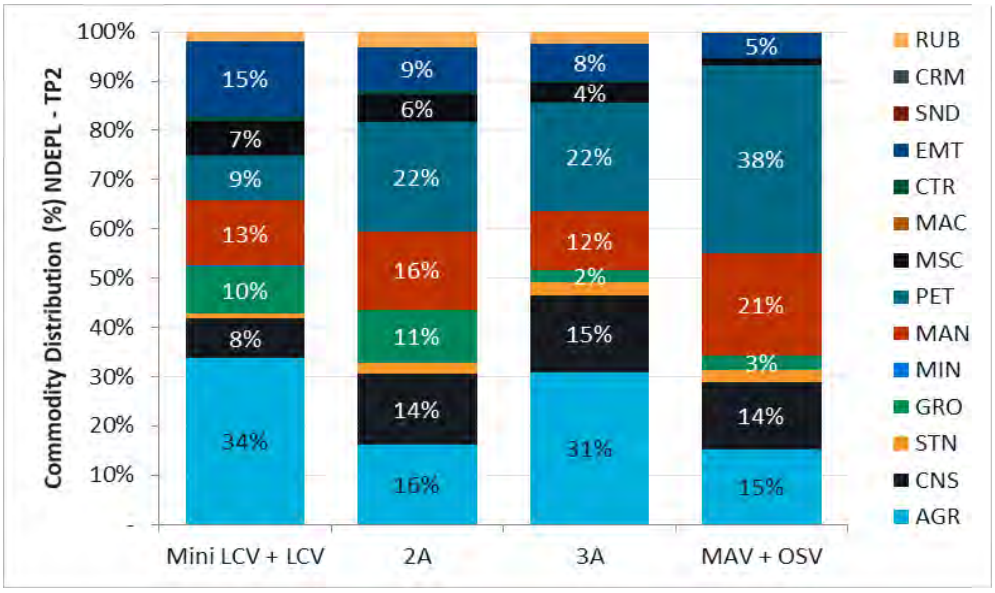
Source: Steer analysis of OD data

Figure 3.18: Commodity distribution, TP1 Doddakarenahalli (towards Bangalore)



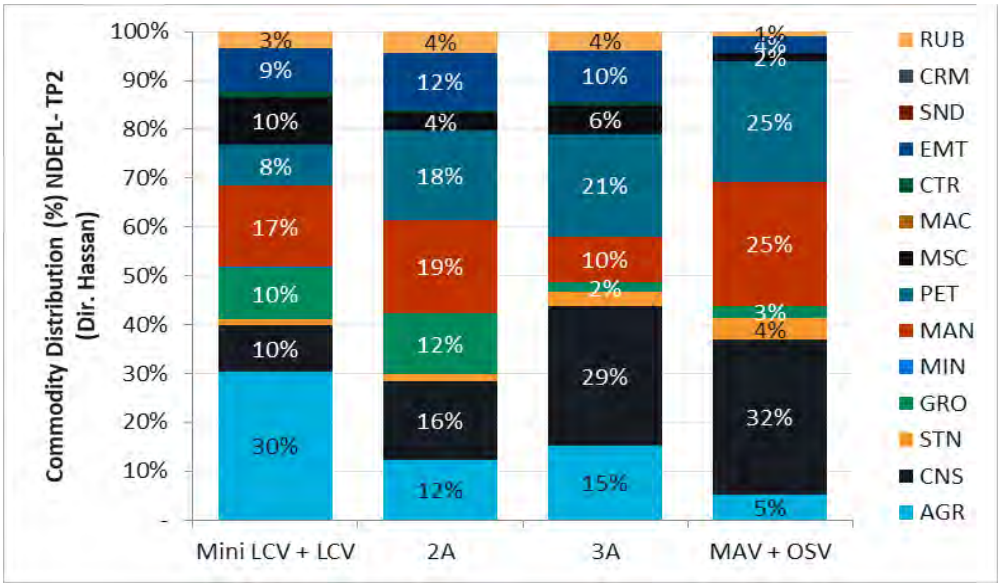
Source: Steer analysis of OD data

Figure 3.19: Commodity distribution, TP2 Karbylu (Total)



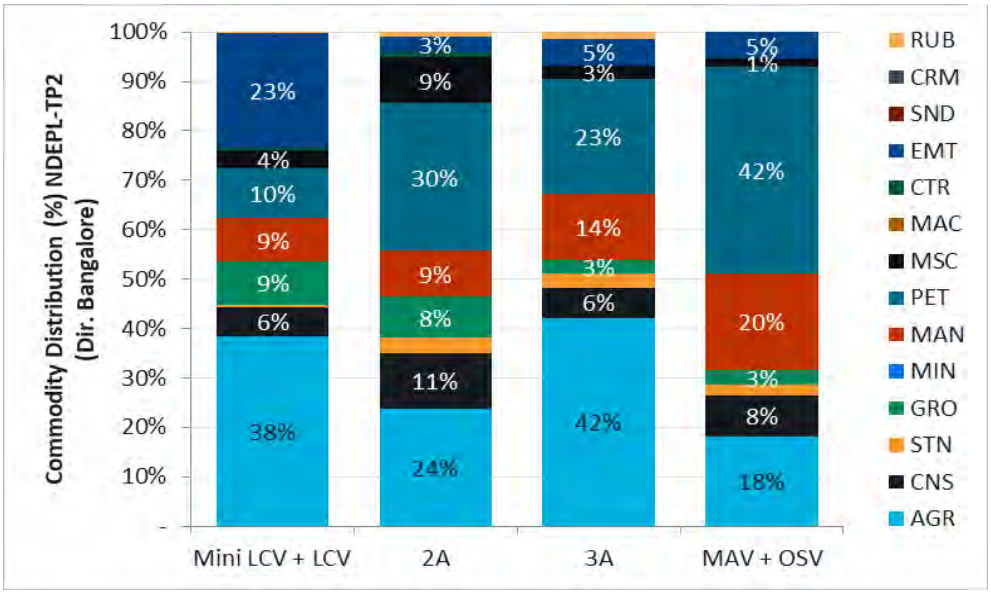
Source: Steer analysis of OD data

Figure 3.20: Commodity distribution, TP2 Karbylu (towards Hassan)



Source: Steer analysis of OD data

Figure 3.21: Commodity distribution, TP2 Karbylu (towards Bangalore)



Source: Steer analysis of OD data

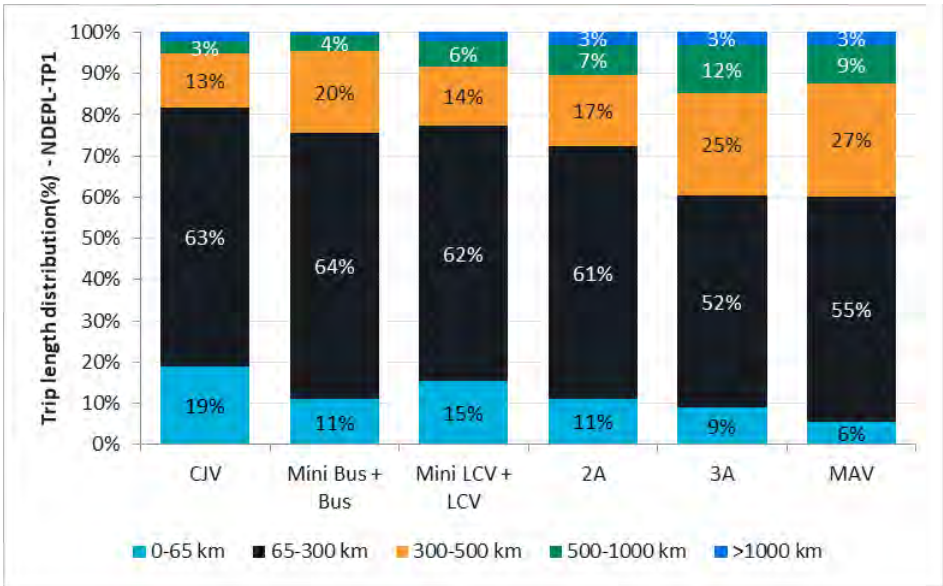
Trip length analysis

3.51 Trip-length distribution provides the distance-based profile of various vehicle types. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into groups –local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[6]

3.52 The figures below present the distribution of trip distances for various vehicle categories at the toll plazas on the Asset.

Figure 3.22: Trip length distribution, TP1 Doddakarenahalli



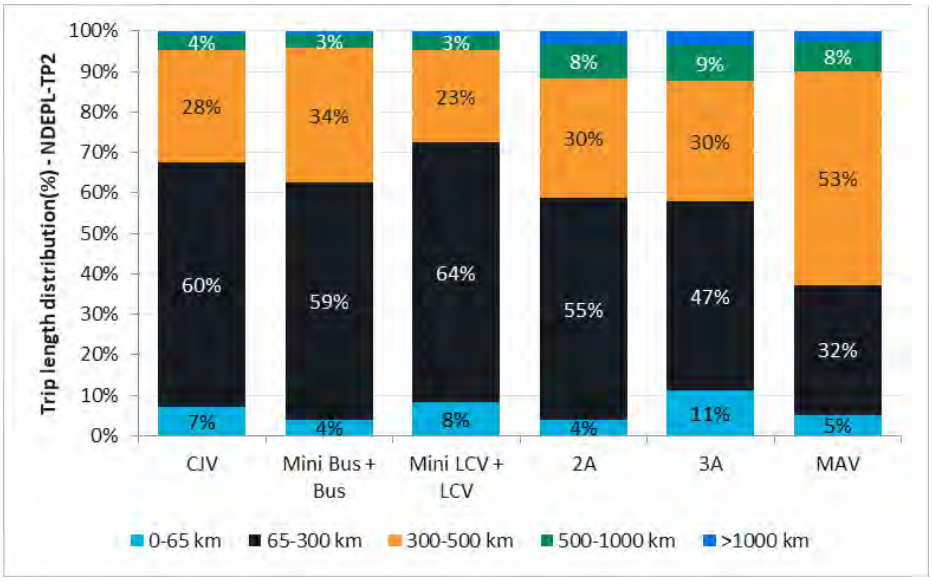
Source: Steer analysis of OD data

3.53 At TP1 Doddakarenahalli on the eastern end of the Asset, there is a very high share of vehicles covering 65-300 km (55%-63%) while at TP2 the highest proportion is of vehicles covering 300-500 km (25%-55%). As discussed earlier, this Asset generally serves mostly short/medium distance traffic which is mostly focussed on Bangalore to be one of the major centres, and Mangalore and Hassan being other influencers of traffic on the Asset. The higher proportion of shorter trips (<300 km) at TP1 reflects its proximity of Bangalore and Nelamangala.

3.54 As expected, as we move towards heavy vehicle categories, the trip distances increase. However, the strategic location of the Asset in the east-west direction on the southern Indian peninsular region limits trips to medium-distance. Therefore, MAVs do not show high shares of long-distance traffic (12% in the '>500 km' category) as they do in most Assets located on strategic corridors across the country.

[6] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: **https://developers.google.com/maps/documentation/distance-matrix/start**. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Figure 3.23: Trip length distribution, TP2 Karbylu



Source: Steer analysis of OD data

Conclusions

3.55 In summary, in FY22 the Asset had an AADT of 20,433 at TP1 Doddakarenahalli and an AADT of 15,587 at TP2 Karbylu. Looking at vehicle shares of this Asset CJVs are dominant at both plazas, representing around 70% of the vehicle share. LCVs are the next most prominent vehicle class at 14%. MAVs constitute a small share, 5% at TP1 and 6% at TP2. The COVID-19 pandemic impacted traffic on the Asset significantly from March to May 2020, but the Asset has recovered very strongly with the economic recovery across the Asset corridor as evident from traffic levels observed between June 2020 till February 2022 in CJVs and MAV vehicle categories.

3.56 The Asset saw steady and healthy growth from FY15 to FY18, with a small decline in growth in FY19 and FY20. The underlying growth trends between FY12 and FY18 combined with the strong recovery observed in FY21 and then in FY22, which was a pandemic influenced year, shows the underlying strength of traffic growth drivers that influence this Asset.

3.57 Whilst overall the TVC counts is similar to the TMS, TMS is consistently 1-2% lower than TVC counts. This difference is well within the acceptable ranges and ensures that the systems used by the toll plazas are robust in nature and are able to capture the traffic correctly.

3.58 The OD analysis found that in terms of zonal influence, IAOI retains the highest proportion on zone influence across all vehicle types. This is followed by 'Rest of Karnataka' trips (note the a higher share of 'Rest of Karnataka' at TP2). Looking at local trips, the share is 5%-10% lower at TP2 compared to TP1 share across the vehicle categories. Key commodities transported on the Asset include Petroleum products, which is expected given the location of the Asset relative to the Mangalore and the petroleum bottling plants at Yediyur and Solur. Manufactured products and agriculture products also hold a considerable share at both plazas (18-21% and 15-16% respectively).

3.59 When considering the internal – external analysis, I-I, I-ROS and ROS-I distribution makes up the major share for both light and heavy vehicles. The trip length analysis has found that the Asset predominantly serves short/medium distance traffic, with the majority of trips at TP1

being under 300km (61%), and at TP2 the majority under 500km (90%). The high share of I-I and short/medium distance traffic is considered to be the captive traffic which will remain sticky to the Asset.

3.60 Overall, the historical analysis, the TVC counts and the OD survey data point to the highly tourism and car-dominated nature of the Asset with regional movement of goods traffic, with petroleum being a major regional industry.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and,
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic and macro-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Karnataka (containing the Asset), compared to that of the country. Overall, urbanisation is seen at both the state and

national levels, as shown by the fact that the rural population is growing slower than the urban population. Karnataka has grown at a rate which is similar to the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Karnataka	53	35	18	61	37	24	1.5%	0.7%	2.8%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of urbanisation, and the dynamic nature of local population migration (both of which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

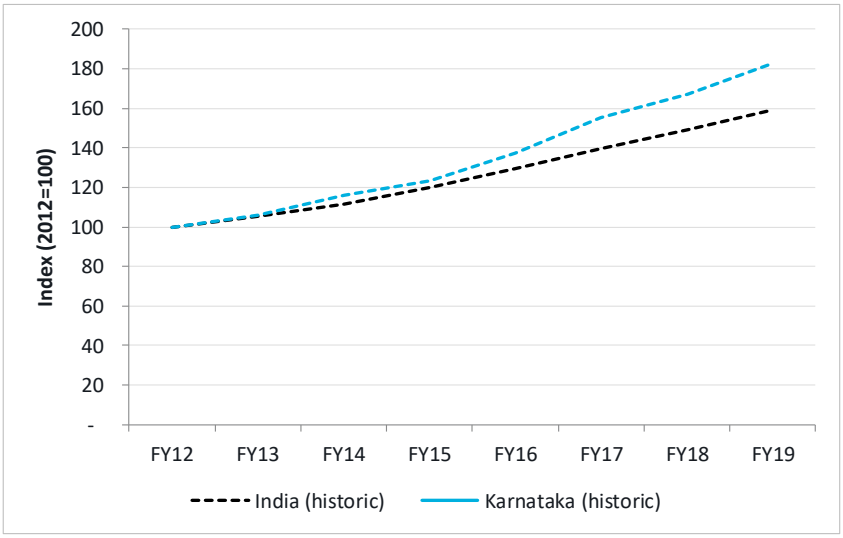
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Karnataka has been stronger than the country as a whole. The state contributes approximately 7.5% to India's GDP. The following figures illustrate the evolution of Karnataka's GSDP.

Figure 4.1: Evolution of Karnataka's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

4.9 Karnataka is the information and technology (IT) hub of India and home to the fourth largest technology cluster in the world - Bangalore. The state has 23 operational IT/SEZs, five software

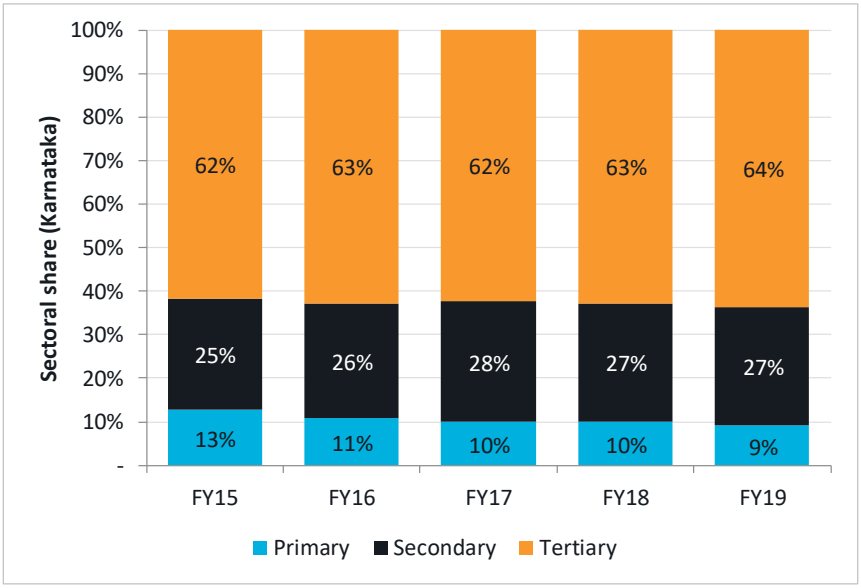
technology parks and dedicated IT investment regions. The state is also the largest software exporter of the country.

4.10 The state economy is largely driven by the tertiary sector which contributes close to 65% to state GSDP. The IT and professional services sector understandably constitute a majority of this tertiary sector. The tertiary sector is followed by the secondary and primary sectors, with shares varying only slightly during the last five years.

4.11 In terms of the secondary sector, the state has key industrial areas in Hubli-Dharwad, Belgaum and Bengaluru (automobile cluster), Mangalore and Udupi (petrochemical), Bellary, Koppal, Raichur (steel and iron ore) and Belgaum and Bengaluru (aerospace). The state also has a major port in Mangalore, which is known for import of crude and petroleum products.

4.12 The key primary industries in the state include agro- and food processing, apart from crop production. The state is mainly known for production of oil seeds, sugarcane, coffee and cocoa.

Figure 4.2: Sectoral contribution to Karnataka's GSDP



Source: Central Statistics Organisation

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'. To understand the historical traffic trends in relation to these growth drivers, we carry out regression analyses to determine the historical relationship between each traffic belonging to each major vehicle category and its macroeconomic growth driver at each toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.3 Typically, passenger and light commercial vehicle traffic like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state in which the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because the majority of light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.4 Elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in growth drivers of traffic. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.5 Following the brief note on historical trends shown in Chapter 3, we now delve deeper into results of the historical growth analysis for each major vehicle type. The table below shows the historical CAGRs on the Asset by vehicle type.

Table 5.1: Vehicle-wise growth and CAGR (%) at Doddakarenahalli toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY16-22	CAGR FY18-22
CJV	17.8%	22.6%	11.1%	1.6%	11.2%	8.3%	5.4%	16.7%	9.9%	6.6%
LCV	5.5%	10.9%	8.4%	(1.0%)	5.5%	(10.8%)	(49.9%)	4.6%	(9.2%)	(17.3%)
Bus	(1.7%)	6.7%	(6.4%)	(5.6%)	0.4%	(60.5%)	70.8%	(2.9%)	(7.2%)	(10.6%)
2A	15.8%	(23.9%)	32.6%	(9.1%)	(0.8%)	22.5%	(28.0%)	4.6%	(3.6%)	(5.6%)
3A/MAV	(1.9%)	22.4%	4.2%	(10.6%)	28.0%	0.8%	4.1%	(4.0%)	7.4%	4.7%
Total	**12.4%**	**16.4%**	**9.5%**	**(0.4%)**	**9.7%**	**1.1%**	**(1.0%)**	**11.3%**	**5.7%**	**2.2%**

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY16-22	CAGR FY18-22
PCU	**8.7%**	**12.3%**	**8.1%**	**(2.6%)**	**9.6%**	**(4.3%)**	**(1.6%)**	**6.5%**	**3.4%**	**0.1%**

Source: Steer analysis of Client TMS data

Table 5.2: Vehicle-wise growth and CAGR (%) at Karbylu toll plaza

YoY (%)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-18	CAGR FY16-22	CAGR FY18-22
CJV	19.3%	24.3%	4.0%	(2.6%)	17.5%	9.6%	9.7%	13.7%	10.1%	8.3%
LCV	6.3%	9.9%	5.3%	(2.1%)	10.2%	(11.7%)	(52.6%)	7.6%	(10.3%)	(18.1%)
Bus	0.5%	8.3%	(7.8%)	(4.2%)	1.0%	(51.7%)	34.6%	(0.1%)	(7.5%)	(10.9%)
2A	39.8%	(39.1%)	48.0%	(17.7%)	3.7%	8.5%	(15.8%)	(5.1%)	(5.7%)	(6.0%)
3A/MAV	0.2%	20.2%	(7.6%)	(14.9%)	39.0%	(3.6%)	7.6%	5.3%	5.3%	5.2%
Total	**14.6%**	**15.7%**	**3.8%**	**(4.1%)**	**15.3%**	**0.7%**	**1.7%**	**9.6%**	**5.3%**	**3.2%**
PCU	**11.7%**	**10.5%**	**2.7%**	**(6.3%)**	**15.4%**	**(5.7%)**	**0.9%**	**6.5%**	**2.6%**	**0.7%**

Source: Steer analysis of Client TMS data

5.6 As the TMS data did not provide a breakup between the individual vehicle categories for the toll categories 3A/MAV, we have used TVC splits of FY21, as discussed in Chapter 3, to estimate the splits in FY22. The following table presents the splits which have also helped in the elasticity estimation. However, in our regression analysis, we have used the combined traffic as data for historical years which were available only in combined form.

Table 5.3: Split between individual vehicle types

Toll plaza	Vehicle type (for growth)	Share (%)
Doddakarenahalli	3A	38%
	MAV	62%
Doddakarenahalli	Bus	70%
	2A	30%
Karbylu	3A	36%
	MAV	64%
Karbylu	Bus	74%
	2A	26%

Source: Steer analysis of independent TVC data

5.7 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.4: Identified growth drivers to model traffic growth

Vehicle type	Growth Driver
Car	GSDP Karnataka
LCV	GSDP Karnataka
Bus	GSDP Karnataka

Vehicle type	Growth Driver
2A	GSDP Karnataka
3A	GDP India
MAV	GDP India

Source: Steer analysis of Client data

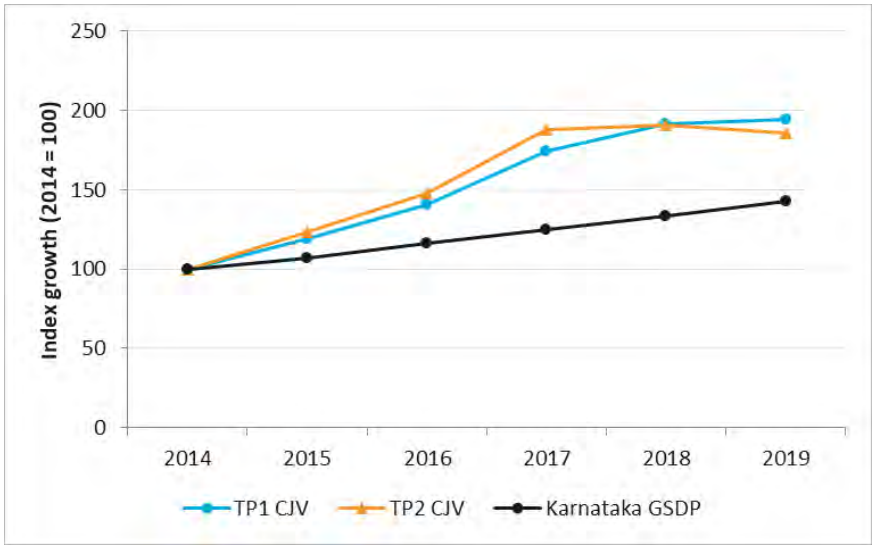
5.8 The recent historical period of tolling is chequered with variations in traffic growth between years for certain vehicle types, due to construction on the Hassan-Mangalore section of the corridor and the introduction of the petroleum pipeline between the Mangalore Port and HPCL bottling plant at Yediyur. Therefore, certain affected years were not available for the regression analysis. This is one of the reasons for differences between the derived and assumed elasticities as we typically forecast elasticities to reflect the more recently observed relationship between traffic growth and macroeconomic growth either based on recent elasticities or benchmarks.

5.9 Please note that in our regression analysis, we have used the combined traffic for toll categories as data for historical years were available only in combined form. Further, FY21 and FY22 have been impacted by COVID-19 related restrictions and the traffic volumes on the Asset were significantly impacted during the travel restrictions imposed during the First, second and third wave of COVID-19. Hence, FY21 and FY22 have not been considered while undertaking the regression analysis.

CJV

5.10 We see from the OD data that the CJVs primarily cater to regional movements between Bangalore, Hassan, Mangalore, Kunigal and other towns lying on the Asset. We have therefore taken Karnataka GSDP to be the growth driver to model the growth of CJV traffic. The following figures show the relationship between indexed values of CJV traffic and Karnataka GSDP at TP1 Doddakarenahalli and TP2 Karbylu.

Figure 5.1: Relationship between CJV traffic and Karnataka GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.11 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in

GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. This assumption is very contextual and subject to change as there are changes in economic policies of government and overall economic stability nationally and globally.

5.12 Historically, the CJV traffic on the Asset over the FY14-FY20 period has shown very strong growth except in FY19 due to construction on the Hassan-Mangalore section at Shiradi Ghat. The regression analysis suggests that between FY14 and FY19 (except FY16 during closure of Shiradi Ghat), traffic has grown with a background traffic growth elasticity of 1.1 and 1.3 at TP1 and TP2 respectively, with respect to GSDP.

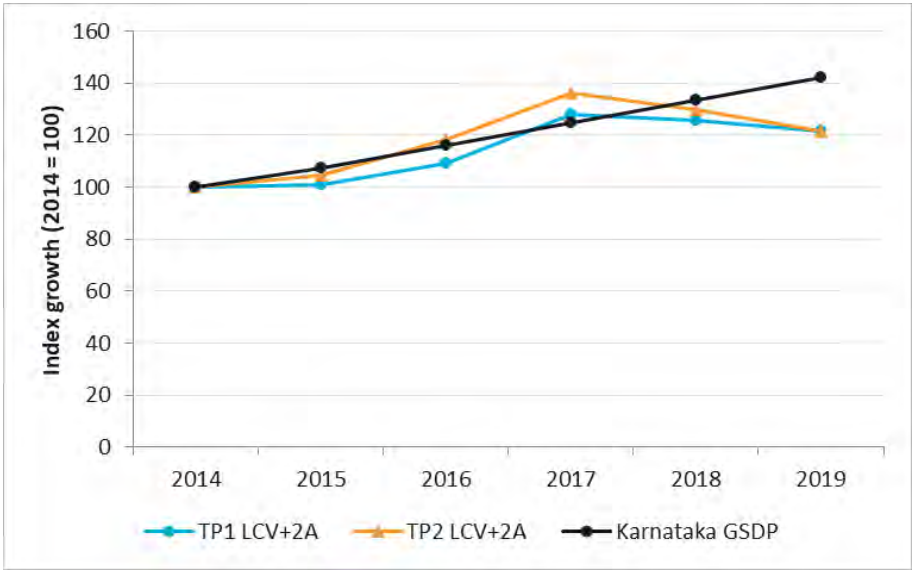
5.13 Taking note of (i) the positive outlook for passenger traffic on the tourism-driven Asset, (ii) proximity to the fast-growing Bangalore urban agglomeration, (iii) strong positive recovery growth observed in FY20, and the (iv) regression results, we have assumed a forecast background elasticity starting of 1.42 at TP1 and 1.22 at TP2 for CJV.

5.14 Given the elasticity relationship between fast-growing passenger traffic in urban areas and the regional economic growth (Karnataka GSDP in this case) slows down after the period of fast urbanisation, we have assumed the elasticity to reduce to 1.0 in FY25. This also considers a tapered modelling of the unravelling of continued positive recovery growth after completion of construction of the Shiradi Ghat section.

LCV, 2A

5.15 Compared to heavy vehicles like 3A and MAV, LCV and 2A have more regional movements within the state – Karnataka in this case, as seen in the OD data analysis. More than 85% of LCVs and 2As have both trip ends within Karnataka. We have therefore taken GSDP of Karnataka to be the growth driver to model growth of LCV+2A traffic. The following figures show the relationship between indexed values of LCV+2A combined traffic and Karnataka's GSDP.

Figure 5.2: Relationship between LCV+2A combined traffic and Karnataka GSDP



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.16 As seen in the tables above, LCV+2A combinedly grew at small positive rates in FY15 and FY16 before peaking at a double-digit growth in FY17. FY18 and FY19 show negative growth rates,

before improving to positive growth rates in FY20. Until FY18, we see that for certain years, LCV grows faster than 2A, while for other years, 2A grows faster. FY19 onwards, after the introduction of new axle load norms that allow about 20% more load to be carried, we see that LCVs show higher growth rates. Though contrary to that observed in several other Assets across the country especially in the north, the higher growth rates and much higher volumes of LCVs (compared to 2A) indicates a preference for LCVs in light of the new norms in the logistics ecosystem operating on the Asset.

5.17 For LCV+2A combined, regression results during earlier years showed elasticities of 1.0 and 0.7 at TP1 and TP2 respectively. Considering the behaviour of LCVs with respect to 2As after the new axle load norms, we have assumed an elasticity of 0.8/0.7 at TP1/TP2 for LCVs and 0.25 for 2As, with respect to Karnataka GSDP growth.

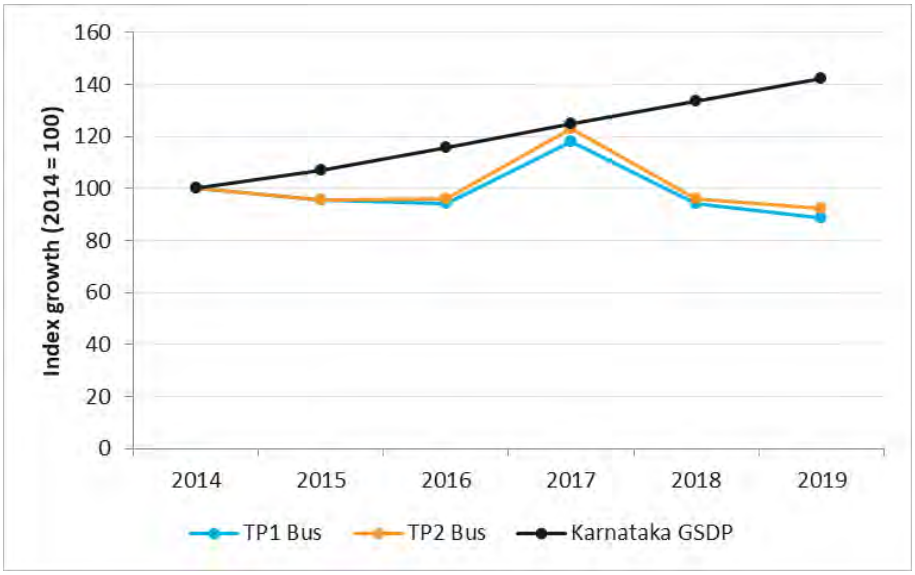
Bus

5.18 The following figures show the relationship between indexed values of bus traffic and Karnataka's GSDP.

5.19 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at intervals of time. Based on our experience across the country, buses on inter-urban and tourism corridors show elasticities of 0.4 to 0.6 with respect to the GSDP.

5.20 However, as seen in the tables presented earlier, buses have not shown good growth and have overall grown negative in the period from FY15 to FY19. Considering benchmarks with minimal growth in bus traffic, we have assumed an elasticity of 0.25 with respect to GSDP Karnataka going forward.

Figure 5.3: Relationship between Bus traffic and Karnataka GSDP



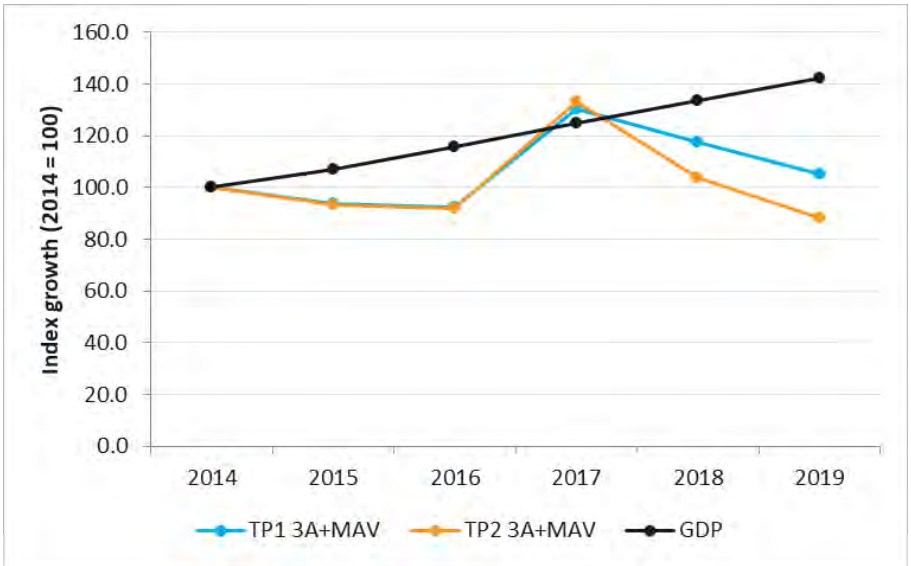
Source: Steer analysis of Client TMS data and publicly available GSDP data

3A/MAV Trucks

5.21 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in their commodity distribution which means that traffic growth in 3A and

MAV is dependent on industry demand-supply ecosystems spread across the country, we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

Figure 5.4: Relationship between 3A+MAV combined traffic and India's GDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.22 As seen in the tables earlier presented in the chapter, 3A and MAV combinedly show negative growth in FY16 due to the Shiradi Ghat-related road closure. FY17 shows a good positive recovery growth. Similarly, during construction on the Hassan-Mangalore section in FY19, we see a big negative impact, followed by a very strong positive recovery growth in FY20.

5.23 We believe 3A to grow slower as compared to MAV due to a shift, as there is an increasing preference seen for MAVs instead of 3As for long-distance movements. This is because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are likely certain commodities or movements which are best served by 3As.

5.24 Based on the above points, considering the overall growth on the Asset over the five-year historical period, the future positive outlook given completion of Shiradi Ghat sections and good recovery from the COVID-19 lockdown impact, we have assumed elasticities of 0.60 and 0.80 for 3A and MAV trucks respectively at both toll plazas, with respect to India GDP growth.

Forecasts for background elasticities

5.25 The below table presents a summary of the results of the regression analysis carried out on the historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.26 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.5: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle type	Growth driver	History		Forecast	
		Derived elasticity	**Years considered**	**Assumed forecast elasticity**	**Evolution of elasticity**
TP1 Doddakarenahalli					
Car	GSDP Karnataka	1.20	FY12-FY13, FY15, FY18-FY19	1.42	Reduce to 1.0 by FY25
LCV*	GSDP Karnataka	1.00	FY12-FY15, FY18	0.80	No change
Bus	GSDP Karnataka	1.70#	FY11, FY18-FY19	0.25	No change
2A*	GSDP Karnataka	1.00#	FY12-FY15, FY18	0.25	No change
3A	GDP	1.00	FY12-FY15, FY17-FY18	0.60	No change
MAV	GDP			0.80	No change
TP2 Karbylu					
Car	GSDP Karnataka	1.30	FY11-FY19	1.22	Reduce to 1.0 by FY25
LCV*	GSDP Karnataka	0.70	FY12-FY14, FY16, FY18	0.70	No change
Bus	GSDP Karnataka	1.10#	FY11, FY14, FY18-FY19	0.25	No change
2A*	GSDP Karnataka	0.70#	FY12-FY14, FY16, FY18	0.25	No change
3A	GDP	0.10	FY12-FY15, FY17	0.60	No change
MAV	GDP			0.80	No change

Source: Steer analysis of Client data *regression was run on LCV-2A and 3A-MAV combinedly #derived elasticity not representative

Forecasts for growth drivers

1.1 Following the discussion in Chapter 4 on the nature of economic activity in the state of Karnataka, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. In particular, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.27 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 5%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.28 Furthermore, the last months of FY20 and FY21 have been largely affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been

addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in Figure 5.5.

5.29 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY33, end of concession.

The India GDP growth provided by the Client is in line with other independent forecasts available form from independent sources such as IMF, World Bank and RBI in the short and medium term, while the longer-term GDP forecasts are considered to be optimistic.

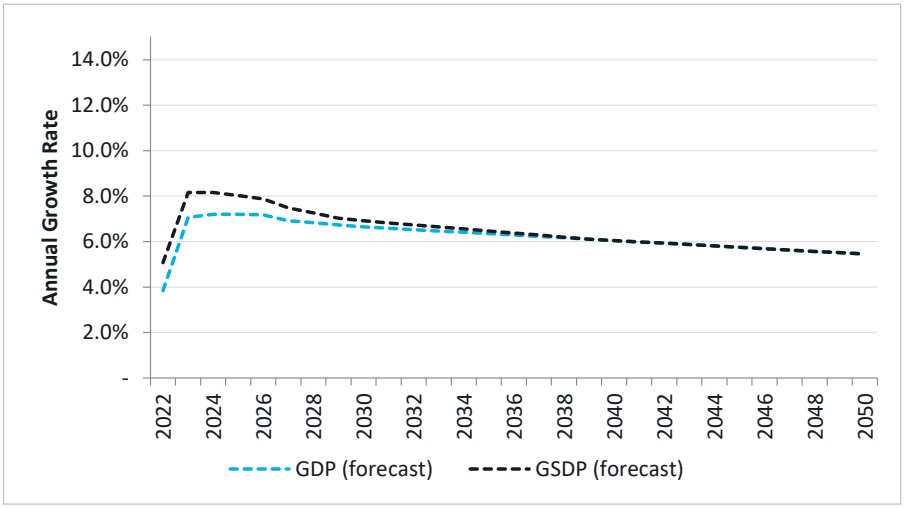
Karnataka GSDP

5.30 As per Client projections, Karnataka's GSDP growth assumes to continue outpacing the national GDP throughout the concession period. We believe this assumption is reasonable as there are significant investments expected to take place as part of the state's plan and Karnataka is expected to receive a significant proportion of these investments, given its leading position in industrial investments. Higher than expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Karnataka's state economy. The growing global IT services sector in Bengaluru is a key contributor to the GSDP growth.

5.31 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka itself, and the national GDP growth rate will start reducing.

5.32 The GDP-GSDP lines are expected to converge by 2050. The chart below shows the forecast growth lines for GDP and Karnataka GSDP.

Figure 5.5: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP projections based on historical GSDP wrt to India GDP

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on estimated and assumed forecast background growth rates in the previous chapter, this chapter first deals with the forecasting assumptions around base year AADT and potential impacts on traffic growth on the Asset. Later, it also presents the assumed toll segmentation, trip factors and evolution of toll rates for the forecast period which are used to estimate the forecast revenue based on the forecast traffic. In the final section, the chapter summarises the traffic growth rates for the forecast years. The following table lists key intermediate and final outputs that have presented in chapter 3, 5 and 6.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Background historical elasticities with respect to growth drivers	Chapter 3, 5, Appendix A
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix A
	Impact growth rates and staging	Impacts	Asset vs alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer analysis

6.2 All traffic is presented as AADT by vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Though FY33 is the last year of concession, we have presented our forecasts until FY34 for the Client's reference in the Appendices.

Seasonality Correction factors

6.3 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is

generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.4 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.5 To achieve this, we studied the seasonality between monthly average daily traffic (MADT) – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. This averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.6 The seasonality factors assumed for individual vehicle types are shown in the table below.

Table 6.2: Seasonality correction factors for TP1 – Doddakarenahalli

SCF	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.94	0.87	1.02	1.20	1.08	1.19	0.93	0.97	1.01	1.06	0.94	0.95
LCV	1.00	0.92	0.98	1.06	1.04	1.07	1.02	0.98	0.99	1.04	0.94	0.99
Bus	1.00	0.96	0.98	1.04	1.01	1.02	0.96	0.97	1.00	1.04	1.00	1.03
2A	1.02	1.04	1.05	1.00	0.95	0.99	0.97	0.96	1.03	1.08	0.94	0.99
3A	1.10	1.10	1.07	1.03	1.01	1.03	1.01	0.94	1.01	1.02	0.89	0.95
MAV	1.10	1.10	1.07	1.03	1.01	1.03	1.01	0.94	1.01	1.02	0.89	0.95

Source: Steer analysis of Client historical TMS data

Table 6.3: Seasonality correction factors for TP2- Karbylu

SCF	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.97	0.85	1.05	1.21	1.08	1.15	0.87	0.96	0.93	1.04	0.98	1.04
LCV	0.98	0.92	1.02	1.10	1.04	1.07	0.99	0.99	0.98	1.01	0.95	0.98
Bus	0.98	0.95	0.98	1.04	1.03	1.04	0.95	0.97	0.98	1.06	1.00	1.03
2A	1.03	1.02	1.06	1.05	0.97	0.92	1.00	0.96	0.97	1.04	0.96	1.06
3A	1.06	1.09	1.07	1.05	1.06	1.04	0.99	0.92	0.97	1.00	0.92	0.94
MAV	1.06	1.09	1.07	1.05	1.06	1.04	0.99	0.92	0.97	1.00	0.92	0.94

Source: Steer analysis of Client historical TMS data

Base year FY22 AADT estimates

6.7 As discussed earlier in chapter 1 and in section 3.11, The second wave of COVID-19 infections peaked in the country in the months of April and May 2021. The tourist centres of Bangalore, Mangalore and other Karnataka districts had implemented strict COVID-19 related protocols

for tourists. As a result, a significant reduction in tourism travel was recorded during that period. Therefore, the traffic volumes on the Asset were impacted during Q1FY22.

6.8 In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.9 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.10 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.4 Monthly AADT and Adopted AADT for FY22 – TP1- Doddakarenahalli

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	19,229	19,956	20,278	15,501	19,975	20,081	19,141
LCV	1,211	1,212	1,295	1,193	1,438	1,499	1,297
Bus	1,316	1,302	1,282	1,128	1,299	1,316	1,292
2A	718	702	773	783	830	829	769
3A/MAV	1,056	996	1,159	1,054	1,161	1,179	1,066
Total	**23,529**	**24,168**	**24,787**	**19,659**	**24,702**	**24,906**	**23,564**
PCU	**30,629**	**31,070**	**32,208**	**26,499**	**32,345**	**32,657**	**30,783**

Source: Steer analysis *FY22 is averaged Oct-Mar (excluding Jan) for CJV and Bus due to 3rd wave COVID-19 impact

Table 6.5 Adopted AADT for FY22 – TP2- Karbylu

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	15,995	15,022	15,647	11,413	14,705	14,056	14,427
LCV	940	861	939	879	988	1,031	922
Bus	1,106	1,087	1,071	933	1,067	1,093	1,072
2A	533	510	603	612	664	702	604
3A/MAV	1,010	940	1,124	1,068	1,160	1,115	1,020
Total	**19,583**	**18,419**	**19,384**	**14,905**	**18,584**	**17,998**	**18,045**
PCU	**25,650**	**24,201**	**25,784**	**20,889**	**25,206**	**24,666**	**24,201**

Source: Steer analysis *FY22 is averaged Oct-Mar (excluding Jan) for CJV and Bus due to 3rd wave COVID-19 impact

Analysis of potential network/developmental impacts

Summary of alternate routes and planned changes

6.11 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in Chapter 2, in order to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.12 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context

Source: Steer analysis and cartography

6.13 While past network developments on the corridor includes the construction and improvement of the Shiradi Ghat section on the Hassan-Mangalore road, upcoming developments include potential construction of the Peripheral Ring Road around Bangalore. The following table presents the upcoming network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6.5: List of network/other developments

S. No.	Development	Route affected	Year	Impact (+/-)
1.	Peripheral Ring Road around Bangalore	Trips with one end northeast of Bangalore.	FY26 onwards	+ve

Source: Steer analysis

Impact assessment for network/other developments

6.14 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated from each of these. Please note that all traffic volumes for impacts were estimated as impact rates applied on FY22 AADT.

Peripheral Ring Road around Bangalore

6.15 The planned Peripheral Ring Road around the city of Bangalore on its north-eastern side is expected to provide a direct bypass between traffic from the western and eastern sides of the city. For the Asset in particular, the Peripheral Ring Road is expected to connect the Asset with the region east of Bangalore. This includes trips with one end at Chittoor and Kolar districts of Karnataka, and Vellore (excludes Ambur and Thirupattur), Kancheepuram, Thiruvallur and Chennai districts of Tamil Nadu.

6.16 Alternatives for this traffic currently include the NICE road running on the southern and western peripheries of the city to access the Asset road, and the Outer Ring Road that passes through congested residential, commercial and office areas of the city on its eastern and northern peripheries.

6.17 Based on an elasticity-based approach to estimate increase in traffic with improvement in level of service (i.e. reduction in GJC), we estimate the impact at 0.5% and 0.4% for CJVs. The table below summarises the net positive impact.

Table 6.6: Impact of Peripheral Ring Road

Vehicle type	FY26 onwards
TP1 Doddakarenahalli	
CJV	0.5%
TP2 Karbylu	
CJV	0.4%

Source: Steer analysis of Client OD data, Client TMS data and publicly available information.

Summary of impact assessments

6.18 The table below summarises the potential impacts on the Asset due to the several ongoing and foreseen improvements on the alternate routes, the Asset route and other regulatory developments.

Table 6.7: Summary of impact assessments for CJVs

Impact	Year of impact	Probability/ scale of impact	In-scope traffic		Magnitude of impact	
			TP1	TP2	TP1	TP2
Peripheral Ring Road: Improvement in level of service for trips with one end at Chittoor and Kolar districts of Karnataka, and Vellore (excludes Ambur and Thirupattur), Kancheepuram, Thiruvallur and Chennai districts of Tamil Nadu	FY26 onwards	Medium	(3%)	(3%)	(+0.5%)	(+0.4%)

Source: Steer analysis of OD data, Client TMS data and publicly available information

Revenue forecasting assumptions

6.19 To forecast the revenues for a forecast year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate. While toll segmentation provides the breakup of trips paying each ticket type, trip factors provide the

conversion factor to convert from traffic (trips) to tickets sold. This section discusses assumptions related to toll segmentation, trip factors and toll rates for the forecast period.

Toll evolution

6.20 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is July) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.21 We have used actual toll rates from the FY22 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.8: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.27%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Toll evolution

Table 6.9: Toll estimation overview

Toll fee escalation	Revision date	Nearest rounding
Linked to 100% WPI increase	September	5

Source: Concession agreement and toll notification

Toll segmentation and trip factors

6.22 We have analysed the historical TMS data split by toll categories, to understand trends, as shown in Chapter 2. We see that trends show stabilising of patterns from FY22 onwards. We have therefore assumed that the split between ticket types will remain the same in the future

for all plazas. The table below provides the toll segmentation and trip factors assumed for the period of forecast.

Table 6.10: Forecast toll segmentation FY22 onwards, TP1 Doddakarenahalli

Forecast	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	52%	37%	9%	37%	58%
Return	36%	55%	85%	59%	41%
Monthly	0%	0%	1%	0.1%	0%
Local commercial	0%	5%	5%	0%	0%
Local personal	1.6%	0.5%	0%	0%	0%
Exemptions	10%	3%	0.2%	4%	1%

Source: Steer analysis of Client TMS data

Table 6.11: Forecast toll segmentation FY22 onwards, TP2 Karbylu

Forecast	CJV/Mini-LCV	LCV	Bus	2A	3A/MAV
Single	61%	48%	10%	50%	66%
Return	33%	49%	85%	45%	33%
Monthly	0%	0%	2%	0%	0%
Local commercial	0%	1%	4%	0%	0%
Local personal	0.5%	0%	0%	0%	0%
Exemptions	5%	2%	0.1%	5%	1%

Source: Steer analysis of Client TMS data

Table 6.12: Trip factors for the forecast years, TP1 Doddakarenahalli

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Return	2.1	2.2	2.2	2.6	2.2	2.1	2.1
Monthly	29.3	29.3	45.0	18.0	6.6	45.0	45.0
Local commercial	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Local personal	29.3	1.0	1.0	1.0	1.0	1.0	1.0
Exemptions	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Violations	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Source: Steer analysis of Client TMS data

Table 6.13: Trip factors for the forecast years, TP2 Karbylu

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Single	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Forecast	CJV	Mini LCV	LCV	Bus	2A	3A	MAV
Return	2.0	2.1	2.1	2.4	2.2	2.1	2.1
Monthly	21.4	21.4	45.0	76.7	45.0	45.0	45.0
Local commercial	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Local personal	21.4	1.0	1.0	1.0	1.0	1.0	1.0
Exemptions	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Violations	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Source: Steer analysis of Client TMS data

Revenue reconciliation

6.23 As part of the validation process to test our model, we have carried out a revenue reconciliation exercise where we compare actual reported revenue against the modelled revenue. For the Asset we have reconciled reported revenue for the month of Feb 2022 with the modelled revenue based on Feb 2022 MADT and forecast assumptions on toll segmentation, trip factors and toll rates.

6.24 The comparison, as shown in the table below, shows that modelled revenue overall is within a variation of 1% from the reported revenue. This gives us confidence that the revenues estimated using the traffic data in our forecasts are accurately representing the revenues being reported from the Asset.

Table 6.14: Revenue reconciliation summary for Feb 2022

Toll Plaza	Steer Daily modelled revenue (INR cr)	Daily Reported revenue (INR cr)	Difference (%)
Doddakarenahalli	0.13	0.13	0.6%
Karbylu	0.11	0.11	0.1%

Source: Steer comparison between modelled and reported revenue for Feb 2022

Traffic and Revenue forecasts

6.25 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the AADT/PCU forecast growth rates and CAGRs on this Asset. Further, Appendix A presents the AADT and revenues for the forecast period.

6.26 For MAV, based on the discussion with client, for forecasting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5.

Table 6.15: Traffic forecast (with impacts) at TP1 Doddakarenahalli

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	17,773	19,467	21,189	24,819	28,613	39,814
Mini LCV	1,368	1,498	1,631	1,900	2,191	3,048
LCV	1,297	1,381	1,471	1,665	1,867	2,435

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
Bus	1,292	1,318	1,345	1,399	1,451	1,580
2 Axle	769	782	796	825	854	927
3 Axle	404	422	440	479	519	630
MAV	652	689	729	815	907	1,173
OSV	9	10	10	12	13	17
AADT	**23,564**	**25,567**	**27,611**	**31,914**	**36,414**	**49,623**
PCUs	**30,825**	**33,080**	**35,390**	**40,255**	**45,336**	**60,139**

Source: Steer analysis

Table 6.16: Traffic forecast (with impacts) growth rates (%), TP1 Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	9.5%	8.8%	8.2%	7.4%	7.61%
Mini LCV	9.5%	8.8%	8.0%	7.4%	7.56%
LCV	6.5%	6.5%	6.4%	5.9%	5.90%
Bus	2.0%	2.0%	2.0%	1.8%	1.84%
2 Axle	1.8%	1.8%	1.8%	1.7%	1.71%
3 Axle	4.2%	4.3%	4.3%	4.1%	4.11%
MAV	5.7%	5.8%	5.8%	5.5%	5.48%
OSV	5.7%	5.8%	5.8%	5.5%	5.48%
AADT	**8.5%**	**8.0%**	**7.5%**	**6.8%**	**7.00%**
PCUs	**7.3%**	**7.0%**	**6.7%**	**6.1%**	**6.26%**

Source: Steer analysis

Table 6.17: Revenue forecasts (in INR crores) at TP1 Doddakarenahalli

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	23.0	28.4	33.7	43.3	56.2	94.6
Mini LCV	2.0	2.4	2.8	3.6	4.7	7.9
LCV	2.9	3.4	4.0	5.0	6.2	9.8
Bus	4.6	5.2	5.7	6.6	7.6	10.1
2 Axle	3.5	4.0	4.4	5.1	5.8	7.8
3 Axle	3.3	3.8	4.3	5.2	6.3	9.4
MAV	5.4	6.2	7.2	8.9	11.0	17.4
OSV	0.1	0.1	0.1	0.2	0.2	0.3
Total	**44.8**	**53.5**	**62.3**	**77.8**	**97.9**	**157**

Source: Steer analysis

Table 6.18: Revenue forecast with growth rates (%), TP1 Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	23.2%	18.5%	13.4%	14.0%	13.69%
Mini LCV	22.7%	18.3%	13.2%	13.8%	13.61%
LCV	17.3%	16.8%	12.0%	10.8%	11.67%
Bus	12.4%	11.3%	7.1%	7.3%	7.42%
2 Axle	12.3%	11.3%	7.2%	7.2%	7.40%
3 Axle	14.3%	14.0%	9.7%	9.8%	9.88%
MAV	15.9%	15.5%	11.2%	11.2%	11.33%
OSV	15.8%	15.5%	11.3%	11.2%	11.33%
Total	**19.3%**	**16.5%**	**11.8%**	**12.2%**	**12.09%**

Source: Steer analysis

Table 6.19: Traffic forecast (with impacts) at TP2 Karbylu

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	13,388	14,576	15,818	18,514	21,344	29,700
Mini LCV	1,039	1,131	1,227	1,430	1,649	2,295
LCV	922	975	1,031	1,149	1,270	1,605
Bus	1,072	1,094	1,116	1,161	1,204	1,310
2 Axle	604	614	625	648	670	727
3 Axle	363	378	395	430	466	565
MAV	652	689	728	815	907	1,172
OSV	5	5	6	6	7	8
AADT	**18,045**	**19,463**	**20,946**	**24,153**	**27,517**	**37,383**
PCUs	**24,250**	**25,885**	**27,597**	**31,287**	**35,150**	**46,386**

Source: Steer analysis

Table 6.20: Traffic forecast (with impacts) with growth rates at TP2 Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	8.9%	8.5%	8.2%	7.4%	7.51%
Mini LCV	8.9%	8.5%	8.0%	7.4%	7.47%
LCV	5.7%	5.7%	5.6%	5.2%	5.16%
Bus	2.0%	2.0%	2.0%	1.8%	1.84%
2 Axle	1.8%	1.8%	1.8%	1.7%	1.71%
3 Axle	4.2%	4.3%	4.3%	4.1%	4.11%
MAV	5.7%	5.8%	5.8%	5.5%	5.48%
OSV	4.2%	4.3%	4.3%	4.1%	4.11%
AADT	**7.9%**	**7.6%**	**7.4%**	**6.7%**	**6.85%**

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
PCUs	**6.7%**	**6.6%**	**6.5%**	**6.0%**	**6.07%**

Source: Steer analysis

Table 6.21: Revenue forecast (in INR crores) at TP2 Karbylu

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	18.8	23.0	27.2	34.9	45.4	76.4
Mini LCV	1.5	1.8	2.2	2.8	3.6	6.1
LCV	2.2	2.6	3.0	3.8	4.6	7.0
Bus	4.0	4.5	5.0	5.7	6.6	8.8
2 Axle	2.9	3.2	3.6	4.1	4.7	6.3
3 Axle	3.1	3.5	4.0	4.8	5.8	8.6
MAV	5.5	6.3	7.3	9.1	11.2	17.8
OSV	0.1	0.1	0.1	0.1	0.1	0.2
Total	**38.0**	**45.1**	**52.4**	**65.2**	**82.0**	**131**

Source: Steer analysis

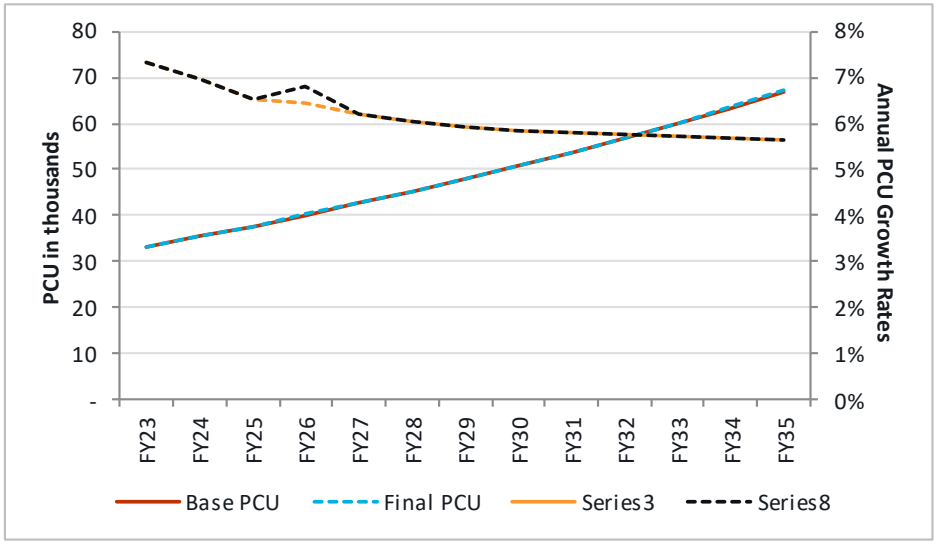
Table 6.22: Revenue forecast with growth rates (%) at TP2 Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	22.6%	18.1%	13.3%	14.0%	13.60%
Mini LCV	22.4%	18.0%	13.1%	14.0%	13.55%
LCV	16.7%	16.1%	11.1%	10.1%	10.91%
Bus	12.4%	11.3%	7.1%	7.4%	7.43%
2 Axle	12.4%	11.4%	7.3%	7.1%	7.43%
3 Axle	14.4%	14.0%	9.7%	9.8%	9.88%
MAV	15.9%	15.6%	11.2%	11.2%	11.33%
OSV	14.3%	14.0%	9.8%	9.8%	9.89%
Total	**18.7%**	**16.2%**	**11.6%**	**12.1%**	**11.93%**

Source: Steer analysis

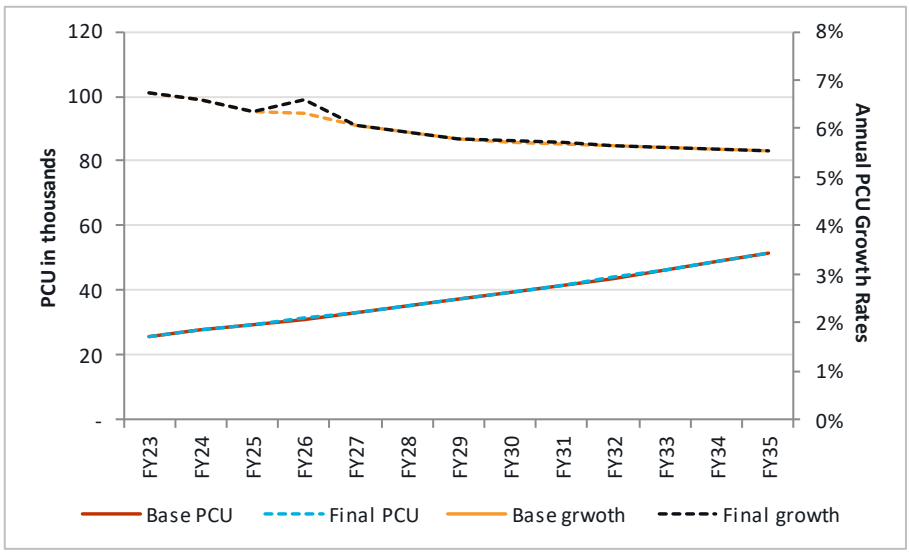
6.27 As presented in the table above, at TP1 and TP2, CAGRs (FY22-FY33) in terms of PCUs for the traffic forecast (background plus impacts) growth rates are 6.2% and 6.0% respectively. While the background growth is primarily driven by car growth followed by heavy vehicle (3A+MAV) growth, the minimal uplift in final growth rates (as also seen in the chart below) is due to only one minor impact expected i.e. the proposed Peripheral Ring Road around Bangalore.

Figure 6.2 Traffic and growth rates for forecast PCUs - Background and final- TP1



Source: Steer analysis

Figure 6.3 Traffic and growth rates for forecast PCUs - Background and final- TP2



Source: Steer analysis

Upside and Downside Cases

6.28 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.29 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.30 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.23: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
NDEPL	GDP/GSDP	+1% every year	-1% every year
NDEPL	WPI	+1% every year	-1% every year
NDEPL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.31 Further, network developments are highly dependent on governmental directions, policies, legal and financial measure which might result in early or delayed completion of developments discussed in previous sections of this Chapter. Therefore, we have included an Upside (optimistic) and a Downside (pessimistic) case for impacts below. However, at this stage, we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

Impacts-Upside Case

6.32 The upside case impacts included in forecasts are summarised in below:

Table 6.24: Summary of impacts on the Assets

Impact	Peripheral Ring Road, Bengaluru
Year	**FY26**
TP-1	0.5%
TP-2	0.4%

Source: Steer analysis of OD data, and publicly available information

6.33 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Impacts-Downside Case

6.34 The downside case impacts included in forecasts are summarised in below:

Table 6.25: Summary of impacts on the Assets

Impact	Peripheral Ring Road, Bengaluru
Year	--
TP-1	--
TP-2	--

Source: Steer analysis of OD data, and publicly available information

6.35 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.36 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case. Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.26: Traffic forecast (With Upside Impacts) for TP1: Doddakarenahalli

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	17,773	19,864	22,034	26,724	31,871	48,175
Mini LCV	1,368	1,529	1,696	2,046	2,440	3,689
Bus	1,297	1,401	1,514	1,762	2,031	2,834
LCV	1,292	1,325	1,358	1,426	1,492	1,660
2A	769	786	803	840	877	972
3A	404	426	449	499	552	705
MAV	652	699	749	861	984	1,360
OSV	9	10	11	12	14	20
AADT	**23,564**	**26,039**	**28,614**	**34,169**	**40,262**	**59,414**
PCU's	**30,825**	**33,614**	**36,524**	**42,800**	**49,658**	**71,013**

Source: Steer analysis

Table 6.27: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	11.8%	10.9%	10.1%	9.2%	9.49%
Mini LCV	11.8%	10.9%	9.8%	9.2%	9.44%
Bus	8.1%	8.1%	7.9%	7.4%	7.37%
LCV	2.5%	2.5%	2.5%	2.3%	2.30%
2A	2.2%	2.3%	2.3%	2.2%	2.16%
3A	5.3%	5.4%	5.4%	5.2%	5.18%
MAV	7.1%	7.2%	7.2%	6.9%	6.91%
OSV	7.1%	7.2%	7.2%	6.9%	6.91%
AADT	**10.5%**	**9.9%**	**9.3%**	**8.5%**	**8.77%**
PCU's	**9.0%**	**8.7%**	**8.3%**	**7.7%**	**7.88%**

Source: Steer analysis

Table 6.28: Revenue forecast (With Upside Impacts) for TP1: Doddakarenahalli (In Cr)

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	23.4	29.4	35.6	47.4	63.6	116.3
Mini LCV	1.8	2.2	2.7	3.6	4.8	8.7

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
Bus	3.4	4.0	4.8	6.1	7.8	13.2
LCV	4.7	5.4	6.0	7.0	8.1	11.0
2A	3.3	3.7	4.2	4.8	5.6	7.6
3A	3.3	3.8	4.4	5.4	6.7	10.5
MAV	5.4	6.3	7.4	9.4	11.9	20.2
OSV	0.1	0.1	0.1	0.2	0.2	0.4
Total Revenue	**45.4**	**55.0**	**65.1**	**83.8**	**108.7**	**188**

Source: Steer analysis

Table 6.29: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	25.7%	20.8%	15.4%	15.9%	15.68%
Mini LCV	25.7%	20.8%	15.1%	15.9%	15.63%
Bus	19.0%	18.4%	13.6%	12.5%	13.23%
LCV	13.0%	11.9%	7.6%	7.9%	7.96%
2A	12.6%	11.7%	7.6%	7.6%	7.80%
3A	15.5%	15.2%	10.9%	10.9%	11.01%
MAV	17.5%	17.1%	12.8%	12.7%	12.84%
OSV	**17.4%**	**17.1%**	**12.8%**	**12.7%**	**12.84%**
Total	**21.2%**	**18.3%**	**13.5%**	**13.9%**	**13.78%**

Source: Steer analysis

Table 6.30: Traffic forecast (With Upside Impacts) for TP2: Karbylu

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	13,388	14,855	16,418	19,897	23,730	35,869
Mini LCV	1,039	1,153	1,274	1,537	1,833	2,771
Bus	922	987	1,057	1,208	1,369	1,834
LCV	1,072	1,099	1,127	1,183	1,238	1,377
2A	604	617	631	660	688	763
3A	363	382	403	448	496	633
MAV	652	698	749	860	984	1,359
OSV	5	6	6	6	7	9
AADT	**18,045**	**19,797**	**21,664**	**25,799**	**30,345**	**44,616**
PCU's	**24,250**	**26,273**	**28,427**	**33,183**	**38,386**	**54,550**

Source: Steer analysis

Table 6.31: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP2: Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	11.0%	10.5%	10.1%	9.2%	9.37%
Mini LCV	11.0%	10.5%	9.8%	9.2%	9.33%
Bus	7.1%	7.1%	6.9%	6.4%	6.45%
LCV	2.5%	2.5%	2.5%	2.3%	2.30%
2A	2.2%	2.3%	2.3%	2.2%	2.16%
3A	5.3%	5.4%	5.4%	5.2%	5.18%
MAV	7.1%	7.2%	7.2%	6.9%	6.91%
OSV	5.3%	5.4%	5.4%	5.2%	5.18%
AADT	**9.7%**	**9.4%**	**9.1%**	**8.5%**	**8.58%**
PCU's	**8.3%**	**8.2%**	**8.0%**	**7.6%**	**7.65%**

Source: Steer analysis

Table 6.32: Revenue forecast (With Upside Impacts) for TP2: Karbylu (In Cr)

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	18.9	23.6	28.4	37.8	50.8	92.9
Mini LCV	1.5	1.8	2.2	2.9	3.9	7.1
Bus	2.2	2.7	3.1	4.0	4.9	8.0
LCV	4.1	4.7	5.2	6.0	7.0	9.6
2A	2.7	3.0	3.4	3.9	4.5	6.2
3A	3.1	3.5	4.1	5.0	6.1	9.6
MAV	5.5	6.4	7.5	9.6	12.2	20.7
OSV	0.1	0.1	0.1	0.1	0.1	0.2
AADT	**38.0**	**45.8**	**54.0**	**69.3**	**89.6**	**154**

Source: Steer analysis

Table 6.33: Revenue growth (With Upside Impacts) CAGR (%) for TP2: Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY22-FY33
CJV	24.9%	20.3%	15.3%	16.0%	15.57%
Mini LCV	24.9%	20.3%	15.0%	16.0%	15.52%
Bus	18.2%	17.6%	12.5%	11.4%	12.27%
LCV	13.0%	11.9%	7.6%	7.9%	7.96%
2A	12.7%	11.8%	7.7%	7.5%	7.84%
3A	15.6%	15.2%	10.8%	10.9%	11.01%
MAV	17.5%	17.1%	12.7%	12.7%	12.84%
OSV	15.5%	15.2%	10.9%	10.9%	11.02%
Total	**20.5%**	**17.9%**	**13.2%**	**13.8%**	**13.58%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.37 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.38 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.34: Traffic forecast (With Dowside Impacts) for TP1: Doddakarenahalli

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	17,773	19,110	20,445	23,084	25,807	33,327
Mini LCV	1,368	1,471	1,573	1,777	1,986	2,565
Bus	1,297	1,363	1,434	1,581	1,729	2,124
LCV	1,292	1,313	1,334	1,376	1,416	1,511
2A	769	779	790	812	834	888
3A	404	418	432	461	491	569
MAV	652	681	711	776	843	1,027
OSV	9	10	10	11	12	15
AADT	**23,564**	**25,145**	**26,729**	**29,878**	**33,118**	**42,025**
PCU's	**30,825**	**32,602**	**34,392**	**37,968**	**41,637**	**51,673**

Source: Steer analysis

Table 6.35: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY23-FY33
CJV	7.5%	7.0%	6.3%	5.7%	5.88%
Mini LCV	7.5%	7.0%	6.3%	5.7%	5.88%
Bus	5.2%	5.2%	5.0%	4.6%	4.59%
LCV	1.6%	1.6%	1.6%	1.4%	1.43%
2A	1.4%	1.4%	1.4%	1.3%	1.32%
3A	3.3%	3.3%	3.3%	3.2%	3.16%
MAV	4.4%	4.5%	4.5%	4.2%	4.21%
OSV	4.4%	4.5%	4.5%	4.2%	4.21%
AADT	**6.7%**	**6.3%**	**5.7%**	**5.3%**	**5.40%**
PCU's	**5.8%**	**5.5%**	**5.1%**	**4.7%**	**4.81%**

Table 6.36: Revenue forecast (With Downside Impacts) for TP1: Doddakarenahalli

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	23.4	28.3	33.0	40.9	51.5	80.4
Mini LCV	1.8	2.1	2.5	3.1	3.9	6.1
Bus	3.4	3.9	4.5	5.5	6.6	9.9
LCV	4.7	5.3	5.9	6.7	7.7	10.0

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
2A	3.3	3.7	4.1	4.7	5.3	6.9
3A	3.3	3.8	4.2	5.0	5.9	8.5
MAV	5.4	6.1	7.0	8.4	10.2	15.3
OSV	0.1	0.1	0.1	0.2	0.2	0.3
Total Revenue	**45.4**	**53.4**	**61.4**	**74.5**	**91.3**	**137**

Source: Steer analysis

Table 6.37: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Doddakarenahalli

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY23-FY33
CJV	20.9%	16.5%	11.3%	12.2%	11.87%
Mini LCV	20.9%	16.5%	11.3%	12.2%	11.87%
Bus	15.8%	15.2%	10.6%	9.6%	10.30%
LCV	12.0%	10.9%	6.7%	7.0%	7.04%
2A	11.7%	10.7%	6.7%	6.7%	6.91%
3A	13.3%	12.9%	8.7%	8.8%	8.88%
MAV	14.5%	14.1%	9.9%	9.9%	9.99%
OSV	14.4%	14.1%	9.9%	9.9%	9.99%
Total	**17.6%**	**14.9%**	**10.2%**	**10.7%**	**10.59%**

Source: Steer analysis

Table 6.38: Traffic forecast (With Downside Impacts) for TP2: Karbylu

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	13,388	14,326	15,290	17,263	19,300	24,923
Mini LCV	1,039	1,112	1,186	1,340	1,498	1,934
Bus	922	964	1,008	1,098	1,188	1,422
LCV	1,072	1,089	1,107	1,142	1,175	1,254
2A	604	612	620	638	655	697
3A	363	375	388	414	441	511
MAV	652	680	711	776	843	1,026
OSV	5	5	6	6	6	7
AADT	**18,045**	**19,164**	**20,315**	**22,675**	**25,104**	**31,775**
PCU's	**24,250**	**25,537**	**26,865**	**29,593**	**32,390**	**40,032**

Source: Steer analysis

Table 6.39: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP2: Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY23-FY33
CJV	7.0%	6.7%	6.3%	5.7%	5.81%
Mini LCV	7.0%	6.7%	6.3%	5.7%	5.81%

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY23-FY33
Bus	4.5%	4.5%	4.4%	4.0%	4.02%
LCV	1.6%	1.6%	1.6%	1.4%	1.43%
2A	1.4%	1.4%	1.4%	1.3%	1.32%
3A	3.3%	3.3%	3.3%	3.2%	3.16%
MAV	4.4%	4.5%	4.5%	4.2%	4.21%
OSV	3.3%	3.3%	3.3%	3.2%	3.16%
AADT	**6.2%**	**6.0%**	**5.7%**	**5.2%**	**5.28%**
PCU's	**5.3%**	**5.2%**	**5.0%**	**4.6%**	**4.66%**

Source: Steer analysis

Table 6.40: Revenue forecast (With Downside Impacts) for TP2: Karbylu (In Cr)

Vehicle Type	FY22	FY23	FY24	FY26	FY28	FY33
CJV	18.9	22.8	26.5	32.8	41.3	64.6
Mini LCV	1.5	1.8	2.0	2.5	3.2	5.0
Bus	2.2	2.6	3.0	3.6	4.3	6.2
LCV	4.1	4.6	5.1	5.8	6.7	8.7
2A	2.7	3.0	3.3	3.8	4.3	5.6
3A	3.1	3.5	3.9	4.6	5.5	7.8
MAV	5.5	6.3	7.2	8.6	10.4	15.6
OSV	0.1	0.1	0.1	0.1	0.1	0.1
Total Revenue	**38.0**	**44.5**	**51.1**	**61.8**	**75.7**	**114**

Source: Steer analysis

Table 6.41: Revenue growth (With Downside Impacts) CAGR (%) for TP2: Karbylu

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY26	FY26-FY28	FY23-FY33
CJV	20.4%	16.2%	11.3%	12.3%	11.80%
Mini LCV	20.4%	16.2%	11.3%	12.3%	11.81%
Bus	15.4%	14.8%	9.9%	8.9%	9.70%
LCV	12.0%	10.9%	6.7%	7.0%	7.04%
2A	11.8%	10.8%	6.8%	6.6%	6.95%
3A	13.3%	12.9%	8.7%	8.8%	8.88%
MAV	14.5%	14.1%	9.8%	9.9%	9.99%
OSV	13.2%	12.9%	8.7%	8.8%	8.88%
Total	**17.2%**	**14.6%**	**10.0%**	**10.7%**	**10.47%**

Source: Steer analysis

Summary outlook

6.39 The Asset serves a largely tourism-driven passenger traffic and the regional economy of the Mangalore-Bangalore corridor including petroleum and agriculture. Passenger traffic driven by local and regional movements connecting key urban centres of the Bengaluru region with Mangalore, Udupi and Hassan. The Asset serves as the key getaway and primary route to reach the western coast of Karnataka – with temples, hills and beaches - for tourism, business and leisure travellers. Goods traffic consist of consumption-based commodities in light goods vehicles and bullet tankers carrying petroleum-related products. Two bottling plants – one each of BPCL and HPCL located on the Asset – and the Mangalore port/petroleum refinery generate these movements. Historical traffic growth analysis across most vehicle types – both passenger and goods – show very healthy growth rates.

6.40 The road network that the Asset is part of is well-established and the ongoing improvements to the Shiradi Ghat section and tunnel between Hassan and Mangalore bode well for the overall level of service of the corridor. Given the commodities being carried are essential in nature, serve the demand of the larger Bengaluru region and the continued growth of services and the tourism sector in Bengaluru and Karnataka, we believe that growth of the whole region in the coming years will continue to result in a healthy growth of both passenger and goods traffic on the Asset.

6.41 Given the overall positive outlook, the forecasts overall for the FY22-FY33 period in terms of PCU levels translate to traffic growth rates of 6.2% and 6.0% CAGR. The total AADT is estimated to cross 49,000 (TP1) and 37,000 (TP2) respectively, in the final year of concession FY33.

6.42 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be risks associated with assumptions and the forecasts using them as summarised below.

6.43 With regards to the long-term background growth, we see the following risk:

- Though the CA does not explicitly state the capacity of the Asset, we understand from our experience that 40,000 is the design limit for four-laned roads in NHAI concessions. The overall PCUs are estimated to cross 40,000 in FY27 at TP1 Doddakarenahalli and in FY31 at TP2 Karbylu and this could imply the need for capacity augmentation i.e. six-laning. This is expected to improve the levels of service, improves capacity and further support the continued traffic growth on the Asset.
- The nascent recovery from the pandemic could be subdued due to stronger lockdowns being implemented and traffic growth not sustaining in the coming months. However, a strong recovery of traffic was observed in FY22 once the nationwide lockdown was relaxed. This included pent-up demand from the lockdown period giving a major boost to traffic in FY21.
- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure has been a major comeback in the second part of FY22 resulting in increased activity in the corridor.

6.44 With regards to impacts, we see the following risks:

- Positive impact due to the proposed Peripheral Ring Road in FY26 would depend on timely implementation of the construction.

6.45 Overall, we have a positive outlook for the region largely driven by the ongoing growth in Bengaluru's global a fast-growing IT services sector and the associated increase in disposable income resulting in growth of the tourism industry on Karnataka's western coast including hills, temples and beaches. We believe the strong historical traffic growth and stable regional economy of tourism, petroleum, agriculture and consumption-based goods will continue to drive healthy sustained long-term growth in both passenger and goods traffic on the Asset.

Appendices

Top 10 OD pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Doddakarenahalli

Table A.1: CJV top 10 OD pair shares at TP1 Doddakarenahalli

	OD Pair	Share
1.	Hassan Area-Bangalore City	14.4%
2.	Kunigal Area-Bangalore City	10.9%
3.	Mangaluru City-Bangalore City	4.4%
4.	Bangalore City-Bangalore City	4.1%
5.	Chikmagalur-Bangalore City	3.8%
6.	Magadi Area-Bangalore City	3.6%
7.	Kunigal Area-Nelamangala Area	3.5%
8.	Mysore City-Bangalore City	3.0%
9.	Magadi Area-Nelamangala Area	2.8%
10.	Hassan Area-Nelamangala Area	2.5%

Source: Steer analysis of OD data

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Doddakarenahalli

	OD Pair	Share
1.	Hassan Area-Bangalore City	15.1%
2.	Mangaluru City-Bangalore City	14.4%
3.	Yadiyuru Area-Bangalore City	9.5%
4.	Hassan Area-Nelamangala Area	3.2%
5.	Kunigal Area-Bangalore City	2.8%
6.	Yadiyuru Area-Nelamangala Area	2.8%
7.	Yadiyuru Area-Rest of South TN	2.1%
8.	Mangaluru City-Nelamangala Area	2.1%
9.	Bangalore City-Bangalore City	2.1%
10.	Udupi-Bangalore City	2.1%

Source: Steer analysis of OD data

TP2 Karbylu

Table A.3: CJV top 10 OD pair shares at TP2 Karbylu

	OD Pair	Share
1.	Hassan Area-Bangalore City	14.5%
2.	Mangaluru City-Bangalore City	11.8%
3.	Chikmagalur-Bangalore City	4.7%
4.	Nagamangala Area-Bangalore City	4.1%
5.	Belluru Area-Bangalore City	3.5%
6.	Channarayapattana Area-Bangalore City	2.5%
7.	Kodagu-Bangalore City	2.0%
8.	Bangalore City-Bangalore City	1.8%
9.	Udupi-Bangalore City	1.8%
10.	Hassan Area-Nelamangala Area	1.7%

Source: Steer analysis of OD data

Table A.4: MAV and OSV top 10 OD pair shares at TP2 Karbylu

	OD Pair	Share
1.	Mangaluru City-Bangalore City	16.8%
2.	Hassan Area-Bangalore City	7.7%
3.	Mangaluru City-Nelamangala Area	6.8%
4.	Mangaluru City-Magadi Area	4.1%
5.	Shimoga-Bidadi Area	3.9%
6.	Mangaluru City-Bidadi Area	3.5%
7.	Mangaluru City-Tumkur	3.1%
8.	Shimoga-Magadi Area	2.9%
9.	Channarayapattana Area-Yadiyuru Area	2.3%
10.	Mangaluru City-Kolar	2.3%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY33, until four years after the expected close of the concession period in FY37. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Forecasts for final (background + impacts) growth rates (%), TP1 Doddakarenahalli

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	17773	1368	1297	1292	769	404	652	9	**23564**	**30825**
FY23	19467	1498	1381	1318	782	422	689	10	**25567**	**33080**
FY24	21189	1631	1471	1345	796	440	729	10	**27611**	**35390**
FY25	22890	1762	1566	1372	811	459	771	11	**29640**	**37695**
FY26	24819	1900	1665	1399	825	479	815	12	**31914**	**40255**
FY27	26677	2043	1764	1426	839	498	860	12	**34119**	**42748**
FY28	28613	2191	1867	1451	854	519	907	13	**36414**	**45336**
FY29	30625	2345	1972	1477	868	540	956	14	**38796**	**48018**
FY30	32742	2507	2081	1502	883	561	1007	14	**41297**	**50827**
FY31	34976	2678	2194	1528	897	583	1060	15	**43932**	**53781**
FY32	37332	2858	2313	1554	912	606	1115	16	**46706**	**56884**
FY33	39814	3048	2435	1580	927	630	1173	17	**49623**	**60139**

Source: Steer analysis

Table B.2: Forecasts for final (background + impacts) growth rates (%), TP2 Karbylu

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total	PCU
FY22	13388	1039	922	1072	604	363	652	5	**18045**	**24250**
FY23	14576	1131	975	1094	614	378	689	5	**19463**	**25885**
FY24	15818	1227	1031	1116	625	395	728	6	**20946**	**27597**
FY25	17088	1326	1089	1138	636	412	770	6	**22466**	**29353**
FY26	18514	1430	1149	1161	648	430	815	6	**24153**	**31287**
FY27	19900	1537	1209	1183	659	447	860	6	**25802**	**33183**
FY28	21344	1649	1270	1204	670	466	907	7	**27517**	**35150**
FY29	22845	1765	1333	1225	682	485	956	7	**29297**	**37189**

FY30	24424	1887	1397	1246	693	504	1006	7	**31166**	**39322**
FY31	26091	2016	1464	1268	704	524	1059	8	**33134**	**41565**
FY32	27849	2152	1533	1289	716	544	1115	8	**35206**	**43918**
FY33	29700	2295	1605	1310	727	565	1172	8	**37383**	**46386**

Source: Steer analysis

Revenue forecasts

B.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY33.

Table B.2: Forecasts for annual revenue (INR crores), TP1 Doddakarenahalli

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	23.0	2.0	2.9	4.6	3.5	3.3	5.4	0.1	**44.8**
FY23	28.4	2.4	3.4	5.2	4.0	3.8	6.2	0.1	**53.5**
FY24	33.7	2.8	4.0	5.7	4.4	4.3	7.2	0.1	**62.3**
FY25	38.3	3.2	4.5	6.1	4.7	4.7	7.9	0.2	**69.6**
FY26	43.3	3.6	5.0	6.6	5.1	5.2	8.9	0.2	**77.8**
FY27	48.9	4.1	5.6	7.1	5.5	5.7	9.9	0.2	**86.8**
FY28	56.2	4.7	6.2	7.6	5.8	6.3	11.0	0.2	**97.9**
FY29	62.2	5.2	6.8	8.0	6.2	6.8	12.1	0.2	**107.5**
FY30	68.8	5.8	7.5	8.5	6.5	7.4	13.3	0.3	**117.9**
FY31	77.5	6.5	8.2	9.0	6.9	8.0	14.5	0.3	**130.9**
FY32	85.6	7.2	9.0	9.6	7.4	8.7	16.0	0.3	**143.8**
FY33	94.6	7.9	9.8	10.1	7.8	9.4	17.4	0.3	**157.3**

Source: Steer analysis

Table B.3: Forecasts for annual revenue (INR crores), TP2 Karbylu

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	18.8	1.5	2.2	4.0	2.9	3.1	5.5	0.1	**38.0**
FY23	23.0	1.8	2.6	4.5	3.2	3.5	6.3	0.1	**45.1**
FY24	27.2	2.2	3.0	5.0	3.6	4.0	7.3	0.1	**52.4**
FY25	30.9	2.5	3.4	5.4	3.8	4.3	8.1	0.1	**58.5**
FY26	34.9	2.8	3.8	5.7	4.1	4.8	9.1	0.1	**65.2**
FY27	39.4	3.1	4.1	6.2	4.4	5.3	10.1	0.1	**72.7**
FY28	45.4	3.6	4.6	6.6	4.7	5.8	11.2	0.1	**82.0**
FY29	50.2	4.0	5.0	7.0	5.0	6.3	12.4	0.1	**89.9**
FY30	55.5	4.4	5.4	7.4	5.3	6.8	13.6	0.1	**98.6**
FY31	62.7	5.0	5.9	7.9	5.6	7.4	14.9	0.1	**109.4**
FY32	69.2	5.5	6.5	8.4	5.9	8.0	16.3	0.1	**120.0**

FY33	76.4	6.1	7.0	8.8	6.3	8.6	17.8	0.2	**131.2**

Source: Steer analysis

Table B.7: Averaged annual forecast revenue- Asset level

	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	20.9	1.7	2.6	4.3	3.2	3.2	5.4	0.1	**41.4**
FY23	25.7	2.1	3.0	4.8	3.6	3.6	6.3	0.1	**49.3**
FY24	30.4	2.5	3.5	5.4	4.0	4.1	7.3	0.1	**57.3**
FY25	34.6	2.8	3.9	5.7	4.3	4.5	8.0	0.1	**64.0**
FY26	39.1	3.2	4.4	6.2	4.6	5.0	9.0	0.1	**71.5**
FY27	44.1	3.6	4.8	6.6	4.9	5.5	10.0	0.1	**79.8**
FY28	50.8	4.2	5.4	7.1	5.3	6.0	11.1	0.2	**90.0**
FY29	56.2	4.6	5.9	7.5	5.6	6.5	12.2	0.2	**98.7**
FY30	62.2	5.1	6.5	7.9	5.9	7.1	13.4	0.2	**108.2**
FY31	70.1	5.7	7.1	8.4	6.2	7.7	14.7	0.2	**120.2**
FY32	77.4	6.3	7.8	9.0	6.7	8.3	16.2	0.2	**131.9**
FY33	85.5	7.0	8.4	9.4	7.0	9.0	17.6	0.3	**144.2**

C Data collection exercise

C.1 In order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7-day TVC counts

Table C.1: TVC counts at TP1

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
18-01-2021	18,114	1,524	2,021	1,394	555	384	570	8	24,570
19-01-2021	14,917	1,536	2,081	1,272	670	474	737	7	21,694
20-01-2021	15,426	1,600	2,206	1,258	588	496	768	12	22,354
21-01-2021	14,880	1,472	2,088	1,247	622	464	772	13	21,558
22-01-2021	16,460	1,514	2,240	1,318	602	491	810	12	23,447
23-02-2021	25,867	1,540	2,379	1,393	619	469	692	14	32,973
24-02-2021	31,320	1,356	2,094	1,508	352	332	667	6	37,635

Source: Steer analysis of TVC data

Table C.2: TVC counts at TP1

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
18-01-2021	13,188	1,084	1,539	1,206	337	313	436	5	18,108
19-01-2021	10,579	1,108	1,578	1,071	417	326	643	5	15,727
20-01-2021	11,206	1,139	1,666	1,031	431	440	694	7	16,614
21-01-2021	10,072	1,081	1,582	1,029	376	364	714	9	15,227
22-01-2021	11,497	1,128	1,659	1,062	418	396	739	3	16,902
23-02-2021	19,958	1,099	1,846	1,165	408	389	709	5	25,579
24-02-2021	23,817	1,145	2,038	1,312	375	336	669	3	29,695

Source: Steer analysis of TVC data

TVC vs TMS comparison

Table C.3: TVC and TMS WADT

Toll Plaza	Source	CJV+ Mini LCV	LCV	Bus	2 Axle	3 Axle+ MAV	OSV	Total
TP1	TVC	21,075	2,158	1,341	573	1,161	10	26,319
	TMS	19,463	2,996	1,290	751	1,146	-	25,646
TP2	TVC	15,443	1,701	1,125	395	1,024	5	19,693
	TMS	14,301	2,401	1,068	537	1,025	-	19,332

Source: Steer analysis of TVC data

Zone list

Table C.4: Zone list

Zone No	Zone name	State
1	Rest of India	Andaman & Nicobar Island
2	Rest of North AP	Andhra Pradesh
3	Anantapur	Andhra Pradesh
4	Kuppam Area	Andhra Pradesh
5	Y.s.r.	Andhra Pradesh
6	Rajahmundry City	Andhra Pradesh
7	Guntur	Andhra Pradesh
8	Vijayawada North City	Andhra Pradesh
9	Kurnool	Andhra Pradesh
10	Sri Potti Sriramulu Nellore	Andhra Pradesh
11	Prakasam	Andhra Pradesh
12	West Godavari	Andhra Pradesh
13	Visakhapatnam Port	Andhra Pradesh
14	Rest of Krishna	Andhra Pradesh
15	Rest of Chittoor	Andhra Pradesh
16	North East India	Arunanchal Pradesh
17	Bangladesh	Bangladesh
18	Bhutan	Bhutan
19	East Bihar	Bihar
20	Rest of West Bihar	Bihar
21	Gaya	Bihar

Zone No	Zone name	State
22	Chandigarh	Chandigarh
23	Rest of Chhattisgarh	Chhattisgarh
24	Bailadilla City	Chhattisgarh
25	Bilaspur City	Chhattisgarh
26	Bhilai City	Chhattisgarh
27	Dadara & Nagar Havelli	Dadara & Nagar Havelli
28	Daman & Diu	Daman & Diu
29	Goa	Goa
30	Pipavav Port	Gujarat
31	Rest of Gujarat	Gujarat
32	Jamnagar Port	Gujarat
33	Mundra Port	Gujarat
34	Surat Port	Gujarat
35	Kandla Port	Gujarat
36	Rest of Haryana	Haryana
37	Gurgaon City	Haryana
38	Panipat City	Haryana
39	North India	Himachal Pradesh
40	Bokaro City	Jharkhand
41	Rest of Jharkhand	Jharkhand
42	Hazaribagh City	Jharkhand
43	Jamshedpur City	Jharkhand
44	Bagalkot	Karnataka
45	Soladevanhalli Area	Karnataka
46	Belgaum	Karnataka
47	Bellary City	Karnataka
48	Rest of Bellary	Karnataka
49	Bidar	Karnataka
50	Bijapur	Karnataka
51	Chamrajnagar	Karnataka
52	Chikkaballapura	Karnataka
53	Chikmagalur	Karnataka
54	Chitradurga	Karnataka
55	Mangaluru City	Karnataka
56	Davanagere	Karnataka
57	Dharwad	Karnataka

Zone No	Zone name	State
58	Gadag	Karnataka
59	Gulbarga	Karnataka
60	Sakleshpur Area	Karnataka
61	Haveri	Karnataka
62	Kodagu	Karnataka
63	Kolar	Karnataka
64	Koppal	Karnataka
65	Krishnarajpete Area	Karnataka
66	Rest of Mysore	Karnataka
67	Raichur	Karnataka
68	Sankighatta Area	Karnataka
69	Shimoga	Karnataka
70	Yadavani Area	Karnataka
71	Udupi	Karnataka
72	Uttara Kannada	Karnataka
73	Yadgir	Karnataka
74	Mysore City	Karnataka
75	Pittekoppalu Area	Karnataka
76	Mandya	Karnataka
77	Nelligere Area	Karnataka
78	Karbylu Toll Plaza	Karnataka
79	Kadaballi Area	Karnataka
80	Chunchanahalli Area	Karnataka
81	Doddajataka Area	Karnataka
82	Bairasandra Area	Karnataka
83	Huliyar Area	Karnataka
84	Tumkur	Karnataka
85	Doddamadure Area	Karnataka
86	Hulical Area	Karnataka
87	Channapatna Area	Karnataka
88	Tumakuru Area	Karnataka
89	Bangalore Rural	Karnataka
90	Magadi Area	Karnataka
91	Lanca Toll Plaza	Karnataka
92	Gudemaranahalli Area	Karnataka
93	Tattekere Area	Karnataka

Zone No	Zone name	State
94	Talekere Area	Karnataka
95	Herur Area	Karnataka
96	Kunigal Area	Karnataka
97	Nagamangala Area	Karnataka
98	Doddaballapura Area	Karnataka
99	Ramanagara	Karnataka
100	Sira Area	Karnataka
101	Tiptur Area	Karnataka
102	Madhugiri Area	Karnataka
103	Chikkanayakanahalli Area	Karnataka
104	Hebburu Area	Karnataka
105	Turuvekere Area	Karnataka
106	Kodinagasandra Area	Karnataka
107	Ungra Dodderi Area	Karnataka
108	Gororu Banavadi Area	Karnataka
109	Soluru City	Karnataka
110	Maruru Kudur Area	Karnataka
111	Kalari Area	Karnataka
112	Sankenapura Area	Karnataka
113	Huliyurdurga Area	Karnataka
114	Chowdanakuppe Area	Karnataka
115	Kannagatta Area	Karnataka
116	Chakenahalli Area	Karnataka
117	Chabbanahalli Area	Karnataka
118	Belluru Area	Karnataka
119	Arakalagud Area	Karnataka
120	Hassan Area	Karnataka
121	Arasikere Area	Karnataka
122	Channarayapattana Area	Karnataka
123	Belur Area	Karnataka
124	Holenarasipur Area	Karnataka
125	Rest of Ramanagara	Karnataka
126	Beechanahalli Area	Karnataka
127	Malavalli Area	Karnataka
128	Maddur Area	Karnataka
129	Bidadi Area	Karnataka

Zone No	Zone name	State
130	Ramanagara Area	Karnataka
131	Srirangapatna Area	Karnataka
132	Mandya Area	Karnataka
133	Panemangalore Area	Karnataka
134	Putturu Sulva Area	Karnataka
135	Mudigere Area	Karnataka
136	Uppinangady Area	Karnataka
137	Yadiyuru Area	Karnataka
138	Hoskote Area	Karnataka
139	Devanahalli Area	Karnataka
140	Nelamangala Area	Karnataka
141	Rest of Bangalore West	Karnataka
142	Bangalore City	Karnataka
143	Rest of Bangalore South	Karnataka
144	Rest of Bangalore North	Karnataka
145	Rest of Bangalore East	Karnataka
146	Hirisava Area	Karnataka
147	Rest of Kerala	Kerala
148	Kochi Port	Kerala
149	Kannur	Kerala
150	Kasaragod	Kerala
151	Kozhikode	Kerala
152	Malappuram	Kerala
153	Palakkad	Kerala
154	Thrissur	Kerala
155	Wayanad	Kerala
156	Rest of West Madhya Pradesh	Madhya Pradesh
157	Rest of East Madhya Pradesh	Madhya Pradesh
158	Rest of Central Madhya Pradesh	Madhya Pradesh
159	Balaghat City	Madhya Pradesh
160	Bhopal	Madhya Pradesh
161	Indore City	Madhya Pradesh
162	NW Maharashtra	Maharashtra
163	Central Maharashtra	Maharashtra
164	Rest of Nagpur Region	Maharashtra
165	Rest of East Maharashtra	Maharashtra

Zone No	Zone name	State
166	SW Maharashtra	Maharashtra
167	Mumbai City	Maharashtra
168	Pune	Maharashtra
169	Nagpur City	Maharashtra
170	Myanmar	Myanmar
171	NCT of Delhi	NCT of Delhi
172	Nepal	Nepal
173	Rest of Odisha	Odisha
174	Rayagada City	Odisha
175	Paradip Port	Odisha
176	Rourkela City	Odisha
177	Pakistan	Pakistan
178	Puducherry	Puducherry
179	Punjab	Punjab
180	Rest of East Rajasthan	Rajasthan
181	Rest of West Rajasthan	Rajasthan
182	Jaipur City	Rajasthan
183	Jodhpur City	Rajasthan
184	Udaipur City	Rajasthan
185	Ariyalur	Tamil Nadu
186	Chennai City	Tamil Nadu
187	Coimbatore City	Tamil Nadu
188	Rest of Coimbatore	Tamil Nadu
189	Cuddalore	Tamil Nadu
190	Dharmapuri	Tamil Nadu
191	Dindigul	Tamil Nadu
192	Erode	Tamil Nadu
193	Kancheepuram	Tamil Nadu
194	Rest of South TN	Tamil Nadu
195	Karur	Tamil Nadu
196	Denkanikottai Area	Tamil Nadu
197	Namakkal	Tamil Nadu
198	Perambalur	Tamil Nadu
199	Pudukkottai	Tamil Nadu
200	Salem	Tamil Nadu
201	Thanjavur	Tamil Nadu

Zone No	Zone name	State
202	The Nilgiris	Tamil Nadu
203	Thiruvallur	Tamil Nadu
204	Thiruvarur	Tamil Nadu
205	Tuticorin Port	Tamil Nadu
206	Tiruchirappalli	Tamil Nadu
207	Tiruppur City	Tamil Nadu
208	Rest of Tiruppur	Tamil Nadu
209	Tiruvannamalai	Tamil Nadu
210	Tirupattur Area	Tamil Nadu
211	Viluppuram	Tamil Nadu
212	Nagappattinam	Tamil Nadu
213	Hosur Area	Tamil Nadu
214	Uthangarai Area	Tamil Nadu
215	Shoolagiri Area	Tamil Nadu
216	Krishnagiri Area	Tamil Nadu
217	Ambur Area	Tamil Nadu
218	Vellore Area	Tamil Nadu
219	Rest of Telangana	Telangana
220	Hyderabad City	Telangana
221	Khammam	Telangana
222	Agra City	Uttar Pradesh
223	Agra	Uttar Pradesh
224	Rest of UP	Uttar Pradesh
225	Allahabad	Uttar Pradesh
226	Kanpur Nagar City	Uttar Pradesh
227	Mathura City	Uttar Pradesh
228	Moradabad City	Uttar Pradesh
229	Rest of West Uttar Pradesh	Uttar Pradesh
230	Varanasi City	Uttar Pradesh
231	Rest of Uttarakhand	Uttarakhand
232	Hardwar City	Uttarakhand
234	Rest of West Bengal	West Bengal
235	Kolkata City	West Bengal
236	BCPL Plant Solur	Karnataka
237	Mangalore Port	Karnataka
238	Hesaraghatta	Karnataka

Direction wise commodity distribution

Table C.5: Commodity distribution (towards Hassan) at TP1

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	16%	11%	13%	14%
Construction	7%	7%	1%	4%
Stone	1%	2%	1%	1%
Groceries	7%	2%	5%	2%
Minerals	-	-	-	-
Manufacturing	22%	12%	13%	14%
Petroleum	13%	37%	38%	40%
Miscellaneous	11%	9%	9%	8%
Machinery	-	-	-	-
Container	1%	-	-	1%
Empty	22%	20%	18%	17%
Sand	-	-	-	-
Cement				
Ceramic	-	-	-	-
Rubber	2%	1%	1%	1%
Clay	-	-	-	-
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.6: Commodity distribution (towards Bangalore) at TP1

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	36%	26%	33%	20%
Construction	5%	4%	5%	8%
Stone	1%	0%	1%	-
Groceries	5%	4%	4%	4%
Minerals	-	-	-	-
Manufacturing	21%	29%	21%	25%
Petroleum	12%	18%	28%	40%
Miscellaneous	2%	1%	-	1%
Machinery	-	-	-	-
Container	0%	-	-	-
Empty	14%	16%	7%	3%

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Sand	-	-	-	-
Cement	3%	2%	-	1%
Ceramic	-	-	-	-
Rubber	4%	1%	-	-
Clay	-	-	-	-
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.7: Commodity distribution (towards Hassan) at TP2

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	30%	12%	15%	5%
Construction	10%	16%	29%	32%
Stone	1%	2%	3%	4%
Groceries	10%	12%	2%	3%
Minerals	0%	-	-	-
Manufacturing	17%	19%	10%	25%
Petroleum	8%	18%	21%	25%
Miscellaneous	10%	4%	6%	2%
Machinery	-	-	-	-
Container	1%	1%	1%	-
Empty	9%	12%	10%	4%
Sand	-	-	-	-
Cement	3%	3%	16%	19%
Ceramic	-	-	-	-
Rubber	3%	4%	4%	1%
Clay	-	-	-	-
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Table C.8: Commodity distribution (towards Bangalore) at TP2

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Agriculture	38%	24%	42%	18%
Construction	6%	11%	6%	8%
Stone	0%	3%	3%	2%
Groceries	9%	8%	3%	3%

Commodity Category	Mini LCV + LCV	2A Truck	3A Truck	MAV + OSV
Minerals	-	-	-	-
Manufacturing	9%	9%	14%	20%
Petroleum	10%	30%	23%	42%
Miscellaneous	4%	9%	3%	1%
Machinery	-	-	-	-
Container	0%	1%	-	-
Empty	23%	3%	5%	5%
Sand	-	-	-	-
Cement				
Ceramic	-	-	-	-
Rubber	0%	1%	1%	-
Clay	-	-	-	-
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis of OD data

Trip length frequency

Table C.9: Trip length frequency at TP1

Distance range	Car	Mini Bus	Bus	Mini LCV	LCV	2A Truck	3A Truck	MAV	OSV
0-65 km	19%	14%	10%	22%	13%	11%	9%	4%	10%
65-300 km	63%	65%	64%	61%	62%	61%	52%	59%	40%
300-500 km	13%	16%	21%	8%	16%	17%	25%	27%	29%
500-1000 km	3%	4%	4%	5%	6%	7%	12%	6%	19%
>1000 km	2%	2%	1%	3%	2%	3%	3%	4%	1%

Source: Steer analysis of OD data

Table C.10: Trip length frequency at TP2

Distance range	Car	Mini Bus	Bus	Mini LCV	LCV	2A Truck	3A Truck	MAV	OSV
0-65 km	7%	7%	3%	11%	7%	4%	11%	4%	24%
65-300 km	60%	53%	60%	70%	62%	55%	47%	32%	36%
300-500 km	28%	33%	34%	16%	26%	30%	30%	54%	36%
500-1000 km	4%	7%	2%	2%	4%	8%	9%	8%	4%
>1000 km	1%	1%	1%	1%	1%	3%	4%	3%	0%

Source: Steer analysis of OD data

D Impact analysis

GJC comparison

D.1 Present below are the Generalised Journey Cost (GJC) comparisons for each of the impacts assumed for the Asset.

D.2 Please find below the table showing GJC comparison before and after upgrade on the Asset.

Table D.1: GJC comparison for level of service improvement

	via Asset	via Asset after upgrade
	CJV	CJV
Existing Toll rates	-	124
Length	56	43
GJC	565	464

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Chanda Malhotra

Reviewer/approver

Shipra Bhatia

Other contributors

Vaibhav Gupta, Aditya Karan

Distribution

Client: Cube Highways Pte Ltd Steer:

Version control/issue number

V1.0

Date

April 2022

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence
Western UP Tollway Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence Western UP Tollway Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited . This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Content

Disclaimer ..... **vi**

Glossary Items ..... **viii**

1 Introduction **10**

The assignment 10

Our approach 11

Evolution of COVID-19 pandemic in India in FY21 and FY22 12

Contents of this Report 14

2 The Asset **15**

Introduction 15

Strategic network 15

Concession and tolling details 16

Key Economic activities 18

Alternate routes 18

3 Traffic Description **20**

Introduction 20

Historical trends 20

Data collection and validation 27

Key findings of the TVC data analysis 28

Key findings of origin-destination analysis 30

Conclusions 36

4 Socio Economic Context **38**

Introduction 38

Population growth 38

Economic growth 39

5 Traffic growth analysis **41**

Introduction 41

Estimation of background elasticities 41

Forecasts for background elasticities 46

Forecasts for growth drivers 46

6 Forecasts: Base year AADT and Impacts 48

Introduction 48

Seasonality Correction factors 49

Base year FY22 AADT estimates 49

Analysis of potential impacts 50

Revenue forecasting assumptions 53

Traffic and Revenue forecasts 55

Upside and Downside Cases 57

Traffic and Revenue Forecasts-Upside case 58

Traffic and Revenue Forecasts-Downside case 59

Summary outlook 61

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 13

Figure 2.1: Asset location in the regional network context 15

Figure 2.2: Asset context 16

Figure 2.3: Typical cross-section and toll plazas on the Asset. 17

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- Siwaya 22

Figure 3.2: Month on Month traffic recovery vs FY20 23

Figure 3.3 ETC penetration: Siwaya toll plaza 25

Figure 3.4: Ticket-segmentation for CJV at TP1 Siwaya 26

Figure 3.5: Ticket-segmentation for MAV at TP1 Siwaya 26

Figure 3.6: WADT at TP1 28

Figure 3.7: Comparison between TVC and TMS daily traffic data on TP1 29

Figure 3.8 Comparison between vehicle shares from TVC and TMS WADTs 29

Figure 3.9: Zonal influence at TP1 32

Figure 3.10 Internal-external distribution at TP1 33

Figure 3.11: Commodity distribution at TP1 (Total) 34

Figure 3.12: Commodity distribution at TP (towards Muzaffar Nagar) 35

Figure 3.13: Commodity distribution at TP1 (towards Meerut) 35

Figure 3.14: Trip length distribution TP1 36

Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP 39

Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP 40
Figure 5.1: Relationship between CJV traffic and Uttar Pradesh's GSDP 43
Figure 5.2: Relationship between LCV+2A+Bus combined traffic and Uttar Pradesh's GSDP ... 44
Figure 5.3: Relationship between 3A+MAV combined traffic and India's GDP 45
Figure 5.4: GDP-GSDP forecast 47
Figure 6.1: Alternate routes and Asset route shown against the regional network context 51
Figure 6.2: Traffic forecasts (with impacts) traffic CAGR (%) for TP Siwaya 55
Figure 6.3: Revenue forecast (INR crores) for TP Siwaya 56
Figure 6.4: Revenue forecast CAGR (%) for TP Siwaya 56
Figure 6.5: Traffic and growth rates for forecast PCUs – Base and With Impacts 57

Tables

Table 1.1: Scope of work and sources of data 10
Table 2.1: Summary of concession 17
Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022 17
Table 2.3: PCU factors 19
Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Siwaya 20
Table 3.2: Historical YoY growth rates and CAGR by vehicle class at TP1 – Siwaya 21
Table 3.3: Historical revenue evolution by class (in INR crores): 22
Table 3.4: Typical ticket types sold at NHAI plazas 24
Table 3.5: Timeline of national ETC implementation 24
Table 3.6: %age of Traffic via FastTag, Mar 2022 25
Table 3.7: Historical ticket segmentation at TP1 Siwaya 27
Table 3.8: Data collection schedule 27
Table 3.9: Sample rates for OD data 30
Table 3.10: Zone aggregations for zonal influence analysis 30
Table 3.11: Aggregate commodity categories 33
Table 4.1: CAGR of population in India 38
Table 4.2: Population Growth in India (2001 – 2011) 39
Table 5.1: Vehicle wise growth and CAGR (%) at Siwaya toll plaza 41
Table 5.2: Split between individual vehicle types 42

Table 5.3: Identified growth drivers to model traffic growth 42

Table 5.4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth 46

Table 6.1: Key intermediate and final outputs in the forecast 48

Table 6.2: Seasonality correction factors for TP1 Siwaya 49

Table 6.3 Monthly MADT and Adopted AADT for FY22 - TP1 Siwaya 50

Table 6.4: List of network/other developments 51

Table 6.5: Ongoing recovery of sand movement 52

Table 6.6: Details of Ganga Expressway (Phase I) 53

Table 6.7: Diversion impact due to Ganga Expressway 53

Table 6.8: WPI growth forecast assumptions 54

Table 6.9: Forecast toll segmentation, FY22 onwards 54

Table 6.10: Revenue reconciliation summary for Feb 2022 55

Table 6.11: Traffic forecasts (with impacts) AADT forecast for TP Siwaya 55

Table 6.12: Summary of Macro Assumptions for upside and downside cases 57

Table 6.13: Traffic forecast (With Upside Impacts) for TP1 58

Table 6.14: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1 58

Table 6.15: Revenue forecast (With Upside Impacts) for TP1 (In Cr) 58

Table 6.16: Revenue growth (With Upside Impacts) CAGR (%) for TP1 59

Table 6.17: Traffic forecast (With Downside Impacts) for TP1 59

Table 6.18: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1 60

Table 6.19: Revenue forecast (With Downside Impacts) for TP1 (In Cr) 60

Table 6.20: Revenue growth (With Downside Impacts) CAGR (%) for TP1 60

Appendices

A Top 10 OD pairs

B Detailed Forecasts

C Data Collection Exercise

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (referred to as 'Client' hereafter) has commissioned Steer Davies Gleave India Private Limited (hereafter called 'Steer') for a traffic due diligence to be carried out on Meerut-Muzaffarnagar Western UP Toll Road (hereafter called 'Asset').

1.2 Our scope of work for the traffic and revenue forecasts process includes:

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by the Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset

Scope of work	Data source
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on calculations provided in toll notification published by NHAI, and WPI line based on forecasts provided by the client

1.3 This report presents our draft T&R forecasts.

Our approach

1.4 The approach employed by Steer in the preparation of these forecasts was developed to take advantage of existing knowledge of the Asset and available data from various sources made available by the Client as well as publicly sourced. It follows well-established practices for forecasting ongoing traffic growth on existing/brownfield Assets.

1.5 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset; and
- identifying how and why that traffic is likely to change in the future.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the regions served by the Asset that might drive baseline traffic growth, and the impact of any relevant network changes which might cause a diversion of traffic to or from the Asset.

1.7 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining from FY12 to FY22.
  - Concession agreement and toll notifications
  - Previous studies
- Steer-commissioned TVC counts from 20th to 26th March 2021
- Steer conducted OD surveys on behalf of the client in September 2019
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.8 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.

- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the asset against our Steer knowledge base (e.g., similar asset types in the same state or on the same corridor), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.
- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes major network and other impacts including change in toll rates and more. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India, the Central government announced a nationwide 25-day lockdown on 24th March 2020 which was extended for another three weeks until May 3rd 2020. Further extensions until May 17th 2020 and again until May 31st 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all National Highways in India was stopped between 25th March and 20th April. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

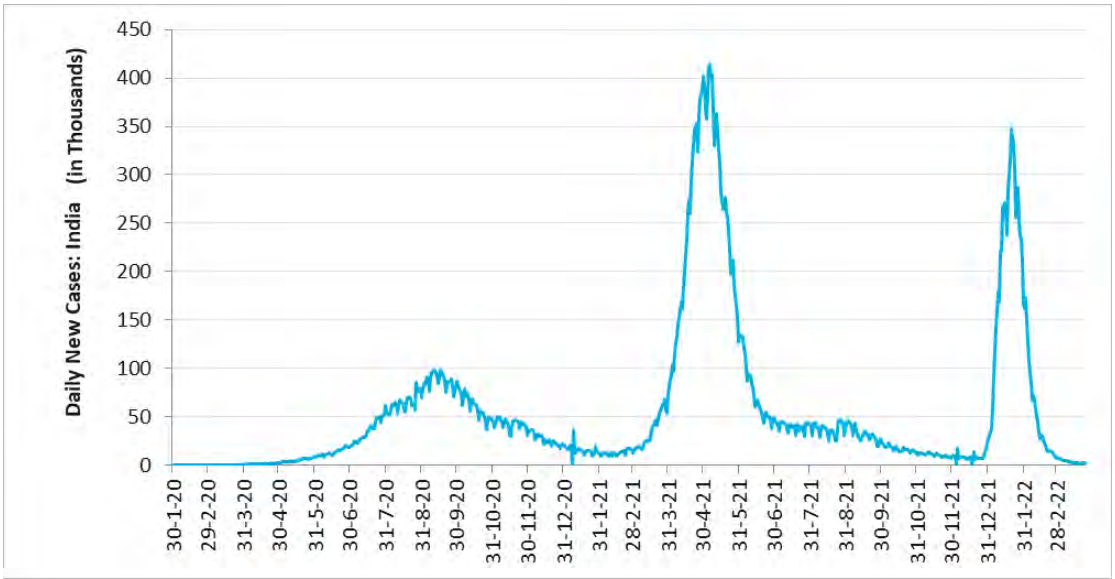
1.11 Data from various roads across the country indicates that the largest impact on MAV traffic was experienced between the months of March 2020 to May 2020, with rest of the FY21 showing MAV volumes par FY20 levels. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, and as well as, underlying long-term growth trends in various sectors of the economy which are contributing

to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to 14th October 2021.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.14 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for one quarter. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.15 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19, but was less severe in comparison to fatality rate, and hence the resultant

lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave.

1.16 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network, especially in inter-state bus service. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.17 The report has been divided into six chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence ;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset, and summarises our approach and results on estimating background traffic demand growth; and,
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

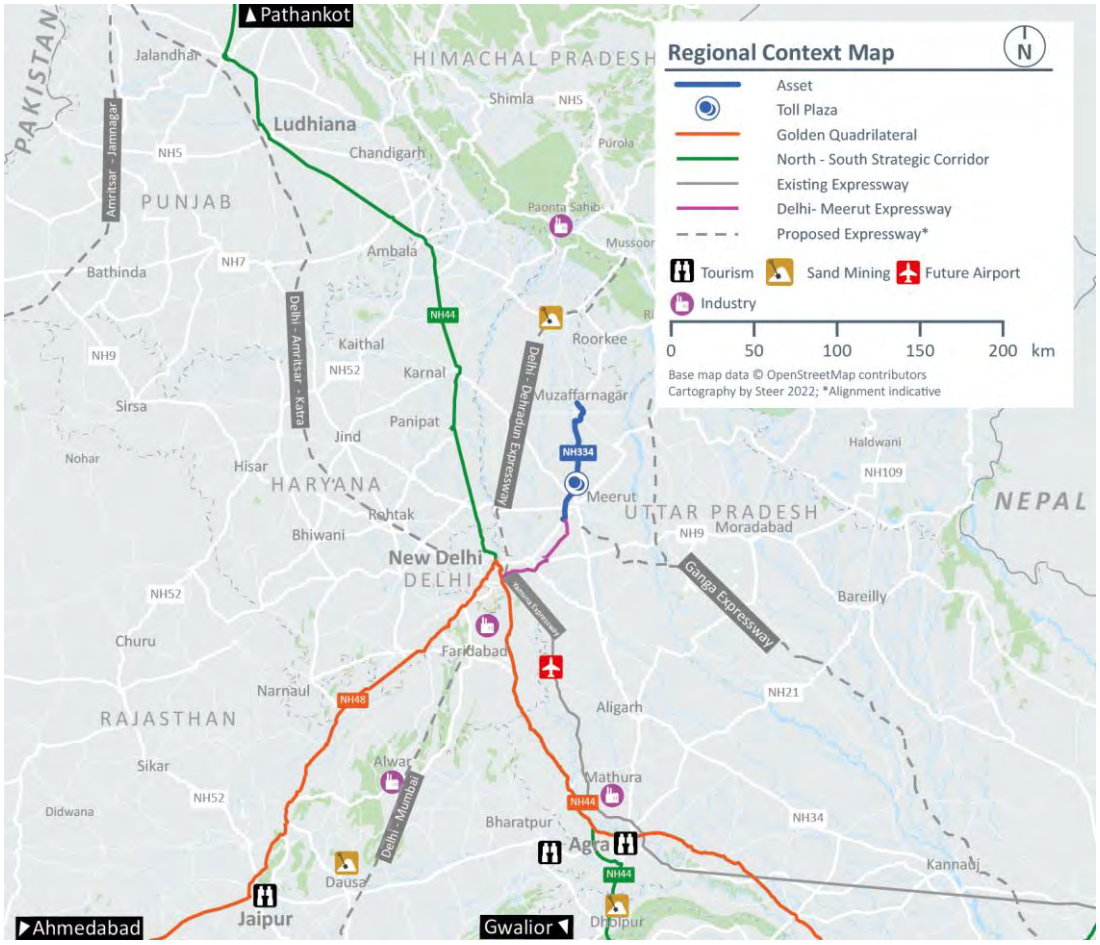
Introduction

2.1 This chapter provides a description of the Asset, based on primary data (from site visits), and our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in western Uttar Pradesh (UP), connecting the cities of Meerut and Muzaffarnagar. The figure below shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



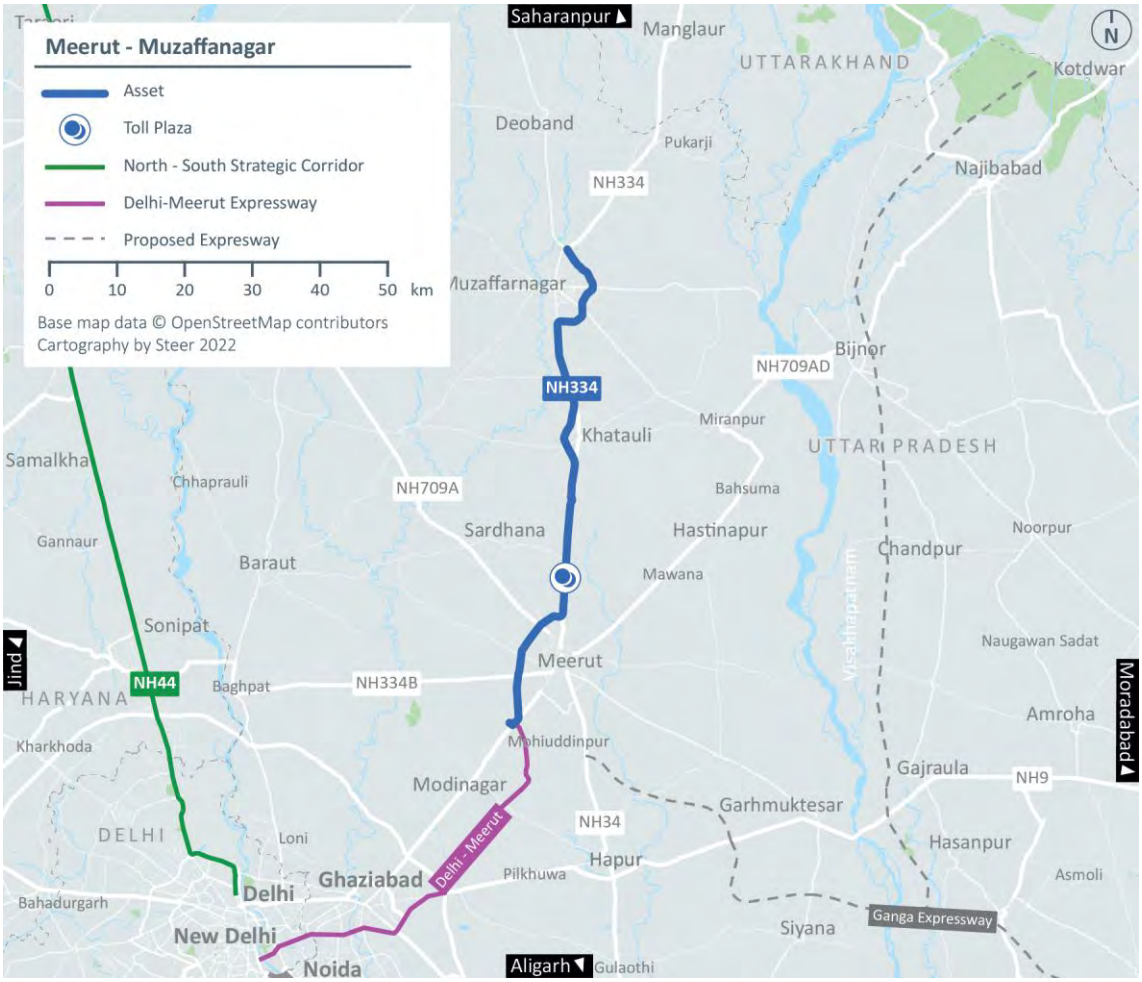
Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to two different types of strategic movements:

- **Short-distance trips** by locals travelling within the National Capital Region (NCR) for work, leisure or short trips. This region is made up of contiguous urban settlements which are largely co-dependent on each other for exchanging goods and services.
- **Medium-distance trips** on the Asset which mostly have one end of their trip in Uttarakhand. This is because the Asset is the primary route connecting Delhi NCR to the popular tourist destinations of Uttarakhand. Increased traffic volumes can be observed on the Asset closer to weekends, as people from Delhi and nearby areas travel to Uttarakhand for leisure, tourism and business purposes.

2.4 The Asset is a 77.8-Km four-lane toll road which forms a part of the NH 334 in Uttar Pradesh. This Asset has one toll plaza, namely, Siwaya (TP1) at Km 76.0, which lies close to Meerut (approximately 10 km from the city). The following figure provides a closer view of the Asset in the context of its immediate surroundings and location of toll plaza.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plaza on the Asset has been operational since April 2011 and the Client took over operations in FY16. There are six years left in the concession period. Though March 2026 was the end of the concession period as per the original concession, FY27 is now expected to be

the end of the period considering claims for demonetisation and COVID-19-related impacts. The following table presents a summary of the Asset.

Table 2.1: Summary of concession

	Particulars
State	Uttar Pradesh
Highway and lane configuration	NH 334 four lane
Toll plazas	• TP1: Siwaya
Length (Km) as per concession agreement	• 77.80 Km
Commencement of operations	• TP1: April 2011
Operated by Client since	FY16
Concession period	15 years
Last year of concession	FY26

Source: Client data

2.6 Figure 2.3 shows a typical cross-section of the Asset and its toll plaza.

Figure 2.3: Typical cross-section and toll plazas on the Asset.

Source: Steer site visit

2.7 The tolls on the Asset are collected for the following vehicle categories with rates as shown in the following table. The toll plazas have dedicated FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable July 2021 to June 2022

Type of Vehicle	Single Journey Fee
CJV	95
LCV	165
Bus/Truck	335
3A/MAV	540

Type of Vehicle	Single Journey Fee
HCM/EME/OSV	540

Source: NHAI Revision of User fee Rate w.e.f 01.07.2021

2.8 The Asset currently issues tickets including single, local commercial and local personal under NHAI concession. There are no return and monthly tickets issued on the Asset. The local commercial and local personal ticket categories are discounted single entry tickets for trips within 20kms and 10kms respectively. Further, detailed information on this have been provided in Chapter 3 of the report.

Key Economic activities

2.9 Uttar Pradesh is the most populous state in India and is largely an agrarian state with agriculture being a major source of employment and livelihood. According to the 2011 census, approximately 50% of all workers are dependent on agriculture for livelihood.

Tourism

2.10 Given that the Asset provides a key link to major religious and tourists destinations in Uttarakhand such as Haridwar, Mussoorie and Rishikesh, the major economic activity along the Asset is mostly tourism-focussed. Several wayside amenities, restaurants and hotel chains are located along the Asset, with tourism being the biggest driver of passenger traffic growth.

Sandmining and industry

2.11 Modinagar is an important industrial town on the periphery of the Asset and is traditionally known for sugar mills that generate employment and revenue for the region. Also, Uttarakhand and Haridwar, in particular are developing regions wherein the government is actively investing in a number of industrial parks through its arm, State Industrial Development Corporation of Uttarakhand Limited (SIDCUL) which further attracts traffic movements plying on the Asset.

2.12 Sandmining is another activity which is based just north of the Asset along the banks of river Yamuna in Saharanpur and had contributed to traffic movements on the Asset until FY15 after which regulatory developments on sand mining led to a drop in traffic share carrying construction-related commodities. The ban has since been lifted in August 2018 and new mining licences have started being issued as per understanding gained from our site visits. It is reported that new mines have started operations starting February 2019 onwards and it is expected that these sites will continue to recover from the ban for a few more years, resulting in an overall increase in sandmining traffic on the Asset.

Alternate routes

2.13 The major competitor to the Asset is the Upper Ganga Canal (UGC) road which connects Muradnagar to Khatauli (and further north up to Uttarakhand) and especially helps light vehicles (CJV, LCVs) to bypass the toll plaza and the congested Muradnagar-Modinagar-Meerut feeder stretch to the Asset. The alternate is a decent-quality two-lane road without paved shoulders, initially developed by the state government to facilitate religious pilgrimage to Rishikesh/Haridwar and further north.

2.14 Another possible alternate route between Delhi NCR region and Uttarakhand is the Delhi-Baghpat-Shamli-Saharanpur section of NH 709B. Although there have been plans for expansion to four lanes, progress has been slow with the southern one (Delhi-Shamli) out of

three packages operational now with work ongoing on the other two. Since the concession ends by FY27 therefore no impact has been considered on the Asset. For destinations off Haridwar in Uttarakhand, the Asset continues to remain the preferred route even after the existing upgrade on the Delhi-Shamli section due to faster exits out of Delhi through the Delhi-Meerut Expressway. Therefore, no major impact is expected due to the completion of construction of the remaining two stretches.

2.15 Delhi-Saharanpur- Dehradun Expressway[1] is another potential alternate to the Asset under NHAI concession. This 210km proposed expressway is 6-12 laned access-controlled corridor under Bharatmala Pariyojana. The expressway is under land acquisition stage and is expected to get completed by FY26. For Package 1 and 2 the contract has been awarded for construction. Since the concession of Asset completes in FY27, therefore the impact of this expressway is not considered in the traffic and revenue forecast of the Asset.

2.16 Additionally, an option of micro-diversion exists for road users around the toll plaza, east of the Asset wherein a local road was partially upgraded under the Pradhan Mantri Gram Sadak Yojana and at present, several users (especially cars) bypass the toll plaza and use this local road instead. Further, the traffic on the local road was observed to have increased after the compulsory implementation of FASTag as car users who have not installed FASTag on their vehicles bypass the toll plaza to avoid paying penalty charge. However, this road has now crossed capacity of 4,000 PCUs and is not expected to have further diversions.

2.17 Chapter 6 provides a discussion and estimation of potential impacts due to these alternate routes.

PCU factors considered for reporting

2.18 Please refer the PCU factors considered in the below table as per IRC64 1990. Based on the discussion with client, for reporting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5 as defined in IRC64 1990.

Table 2.3: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
Mini LCV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.71
OSV	4.5

Source: Steer analysis and IRC64,1990

[1] Delhi Dehradun Expressway: Status, Route Map & Tenders [2022] (themetrorailguy.com)

3 Traffic Description

Introduction

3.1 This chapter outlines the historical and current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic volume count (TVC) data. This includes data collected as a part of this study and previous studies of this Asset, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of traffic currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by the goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trends

3.4 The following table indicate the historical variation in traffic volume at the toll plaza, in terms of vehicle shares and total AADT.

3.5 In terms of vehicle composition, CJVs are the biggest contributor on the Asset with a share of over 70% since FY16, except for a slight dip in FY21 due to COVID-19. The high CJV volumes observed on the Asset is primarily due to the Asset lying on a tourism driven corridor which fetches high daily passenger trips between Delhi NCR and Uttarakhand. Further, the Asset repots combined Bus and 2A traffic, which are the second largest traffic contributor with over 10% trips.

Table 3.1: Historical evolution in AADT by vehicle class at TP1 – Siwaya

	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	11,807	12,905	13,635	15,124	15,765	17,502	18,067	17,228	15,920	11,691	20,562
LCV	2,127	2,215	2,557	2,664	2,594	2,520	2,333	1,684	1,264	1,050	1,007
2A/Bus	2,302	2,190	2,253	2,154	2,121	2,096	2,238	2,443	2,417	1,515	1,774
3A/MAV*	2,447	1,251	1,986	2,037	1,770	1,088	891	1,098	1,165	1,249	1,265
Total	**18,683**	**18,561**	**20,432**	**21,979**	**22,251**	**23,206**	**23,529**	**22,454**	**20,767**	**15,505**	**24,608**
PCU	**30,353**	**27,116**	**31,089**	**32,614**	**32,133**	**31,327**	**31,356**	**30,875**	**29,092**	**22,101**	**31,762**

Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A), For like to like comparison, *3A/MAV PCU is a weighted average of rigid trailer splits and 3A MAV splits taken from TVC conducted during data collection exercise.

3.6 Share of MAVs on the Asset has been flat with around 5% of total traffic. There has been a fall in share of LCVs during the last 5 years due to shift happening between LCV and 2A, and some mini-LCV counted under LCV category being now reclassified under the CJV category post implementation of FASTag.

3.7 The historical vehicle wise year on year (YoY) growth rates are presented in the table below:

Table 3.2: Historical YoY growth rates and CAGR by vehicle class at TP1 – Siwaya

YoY (%)	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
CJV	11.0%	3.2%	(4.6%)	(7.6%)	(26.6%)	75.9%	3.8%	0.2%	13.6%
LCV	(2.8%)	(7.4%)	(27.8%)	(25.0%)	(16.9%)	(4.1%)	(6.3%)	(16.4%)	(10.7%)
2A/Bus	(1.2%)	6.8%	9.2%	(1.1%)	(37.3%)	17.1%	0.6%	3.3%	(14.3%)
3A/MAV	(38.5%)	(18.1%)	23.2%	6.2%	7.2%	1.3%	(8.9%)	(9.9%)	4.2%
Total	**4.3%**	**1.4%**	**(4.6%)**	**(7.5%)**	**(25.3%)**	**58.7%**	**1.3%**	**(1.7%)**	**8.9%**
PCU	**(2.5%)**	**0.1%**	**(1.5%)**	**(5.8%)**	**(24.0%)**	**43.7%**	**(0.5%)**	**(2.5%)**	**4.5%**

Source: Steer analysis of TMS data provided by client

3.8 The CAGR for this Asset was comprised of a negative 0.7% PCU level during the FY12-20 period and negative 2.6% during the FY16-20 period however between FY20-22 the Asset has recorded positive 4.5% PCU CAGR primarily driven by growth in CJV and MAV category, key reasons for the traffic growth profile is presented below.

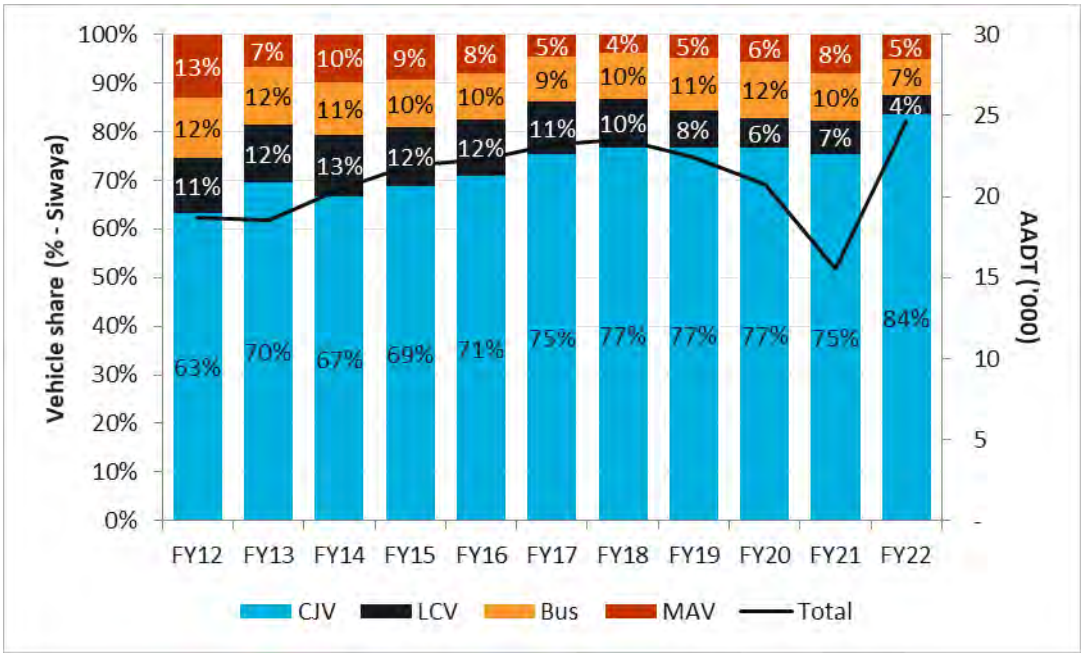
- The Upper Ganga Canal and a local village road providing diversion around the toll plaza which diverted car traffic and later lighter goods vehicles away from the Asset from FY18 through FY20. Starting April 2021, the Delhi Meerut Expressway[2] has been commissioned resulting in significant LOS improvement and providing direct uninterrupted connectivity to Meerut. Therefore, the CJV volumes have picked up significantly on the Asset in FY22 as compared to FY20. Further, part of this growth has also been achieved due to the preference for personal mobility post COVID-19, and the non-resumption of bus and train networks.
- Heavy trucks experienced loss due to the ban on sandmining from FY16 through FY18. However, these have started showing recovery in FY19 and FY20 due to new licences being given out for sandmining in the Saharanpur region, which now contribute to a positive outlook for this Asset. The impact of these past trends on the outlook of traffic growth has been discussed in further detail in further chapters. MAV's continue to exhibit positive growth trend in FY22 as well, in spite of COVID-19 related disruptions in FY21 and FY22.
- Due to COVID-19 the bus networks have still not come back to pre-COVID-19 levels, once the impact of COVID-19 related restrictions reduce it is expected that the Bus volumes will return to the levels seen in FY19/FY20 and more.
- The LCV- 2A category has historically been affected by classification issues because of similar size and look of the vehicle. In the recent years the preference of 2A trucks is increasing as well. This has resulted in the recent years for traffic numbers to show more 2A's than LCV. However, since buses are also included within the 2A category, the 2A LCV switch is not visible here.

[2] https://www.livemint.com/news/india/delhi-to-meerut-in-just-45-minutes-delhi-meerut-expressway-opens-for-public-11617251762196.html

3.9 Overall, the Asset saw steady and healthy growth from FY14 to FY18 but decline in growth in FY19 and FY20. This decline in growth over the FY19 and FY20 period was a result of significant slowdown in the economy observed over seven quarters starting FY19 up to Q3 FY20. Traffic volumes have recovered especially in CJV category primarily because of opening of Delhi Meerut Expressway. Resumption of sand mining activity in the region has aided growth in the MAV category.

3.10 The figure below presents the vehicle shares as they have evolved from FY12 upto FY22.

Figure 3.1: Historical evolution in vehicle shares and reported AADT for TP1- Siwaya



Source: Steer analysis of the Client data (MAV includes 3A and Bus includes 2A, FY21 data includes the operational days for April 2020, FY22 includes full year data till Mar'22)

3.11 The table below presents the reported historical revenue of the Asset.

Table 3.3: Historical revenue evolution by class (in INR crores):

	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY17-20	CAGR FY20-22
Total	74.0	82.4	86.0	85.4	67.2	105.9	**4.9%**	**11.3%**

Source: Steer analysis of the Client data

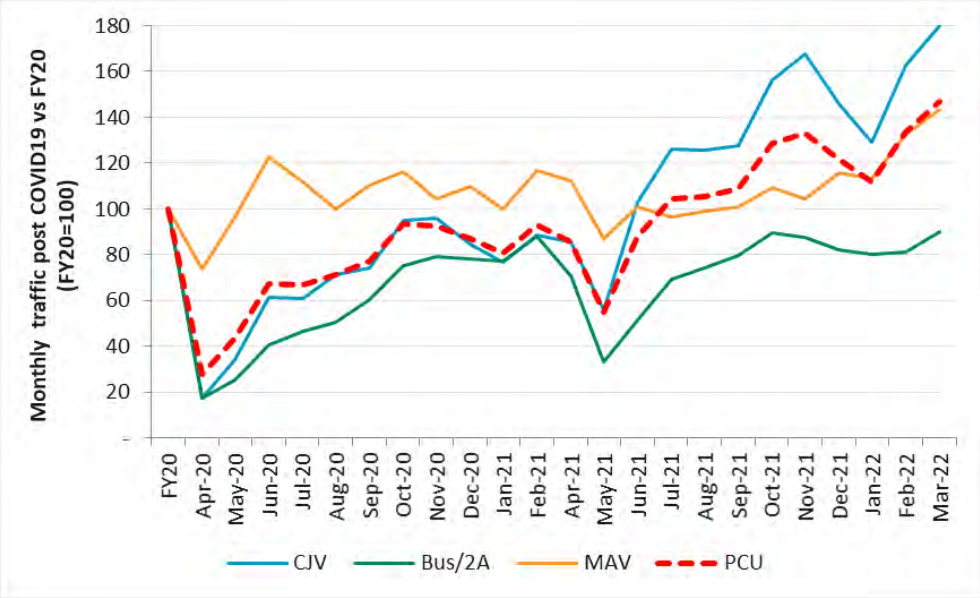
3.12 As we can see from the above table, revenue receipts from the CJV category have increased significantly in FY22 due to increase in traffic volumes appearing post commissioning of the Delhi-Meerut Expressway. LCV has seen a decline, whereas minor increase in revenue has been registered in revenue receipts from MAV category in FY22 compared to FY20.

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.13 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. 2nd wave of COVID-19 resulted

in regional lockdowns in Q1 and Q2 FY22, while the 3rd wave of COVID-19 impacted traffic volumes in Q4 of FY22. The evolution of traffic FY20 onwards is presented in the figure below:

Figure 3.2: Month on Month traffic recovery vs FY20



Source: Steer analysis of the Client data

3.14 As we can see from the figure above, the Asset reached the FY20 PCU levels, only in June-21 when the DME was operational, and 2nd wave of COVID-19 related restrictions were lifted. Since then, the CJV volumes have increased significantly on a monthly basis peaking to 60% higher than FY20 volumes in March 2022. The impact of 2nd wave of COVID-19 is evident in April and May 2021, with a much larger impact on passenger vehicles (CJV, Buses) as compared to goods traffic. The goods traffic on this Asset wasn't much impacted by the COVID-19 as seen in the above chart where MAV volume are similar to FY20 levels.

Toll Frequencies

3.15 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some Assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.16 Understanding the toll frequency gives insights into the nature of the traffic. CJVs generally have higher shares of return or local personal passes, while heavy trucks mostly have single tickets since they travel longer distance. However, this varies from Asset to Asset or even toll plaza to toll plaza. The Assets catering to short distance local traffic generally observes high share of return or other local monthly passes while the Assets catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.17 However, on this Asset since return and monthly passes are not available, 90% of the tickets issued are single. Primarily, the traffic which is not eligible for local personal and commercial

passes have single ticket as the only option, which explains high share of single traffic on the Asset, as discussed in the next section.

3.18 The following are different types of tickets being sold at the plaza of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Local Personal	Discounted single entry monthly pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. The pass allows single entry only.
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

3.19 In addition to the above ticket categories, a special category pass of "Local Monthly" is also being sold on the Asset. This pass has been issued by the toll plazas individually and the toll plaza is deciding on the toll for such special passes.

3.20 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of Asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

FASTag implementation

3.21 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.5: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.22 FY21 had multiple disruptions in traffic patterns related to the pandemic. There was also significant change in ticket segmentation observed across several toll roads around the country due to the imposition of mandatory use of FASTag, the electronic toll payment mechanism mandated by NHAI. This resulted in shares of users paying by FASTag jump significantly across all vehicle categories. To encourage that nearly all toll plaza users shift to FASTag, there was also a penalty for cash payers introduced. The final deadline for mandatory

use of FASTag was set for 15th February 2021 which has had the desired impact of over 95% of toll revenue collection now being collected through FASTag across the NHAI toll plazas. This has also increased the operational efficiency of toll plazas significantly as well as improved the traffic and revenue reporting standards due to limited use of cash through manual means at toll plazas.

3.23 The increased use of FASTag in FY20-21 ensured efficient tolling operations as well as increased compliance. Moreover, with better management due to FASTag the combined share of exemption and violations reported under CJV category as shown in section below have decreased by 4-5% in FY22 in comparison to FY19. By March 2022, FASTag penetration increased significantly across various vehicle types. The table below presents the reported percentage of traffic via FASTag.

Table 3.6: %age of Traffic via FastTag, Mar 2022

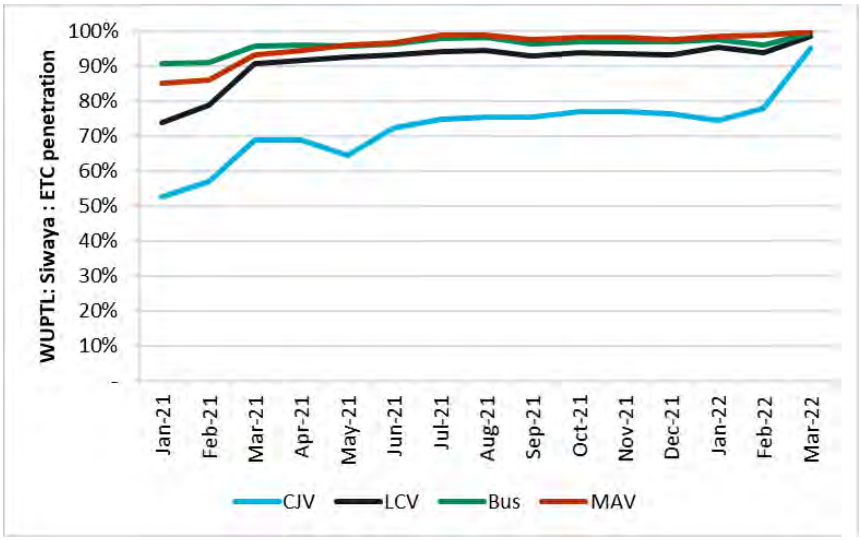
Toll Plaza	CJV	LCV	Bus	MAV
Siwaya toll plaza	95%	98%	99%	100%

Source: Steer Analysis

3.24 As we can see from the table above by March FY22 most of the vehicle types across the toll plaza were reporting more than 95% FASTag penetration, with MAVs reporting 100%. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time. Also, on this Asset Bus and 2A traffic historically are reported combined which is split using TVC shares for the purpose of traffic and revenue forecast.

3.25 The figure below illustrates the evolution of ETC penetration on the Asset.

Figure 3.3 ETC penetration: Siwaya toll plaza

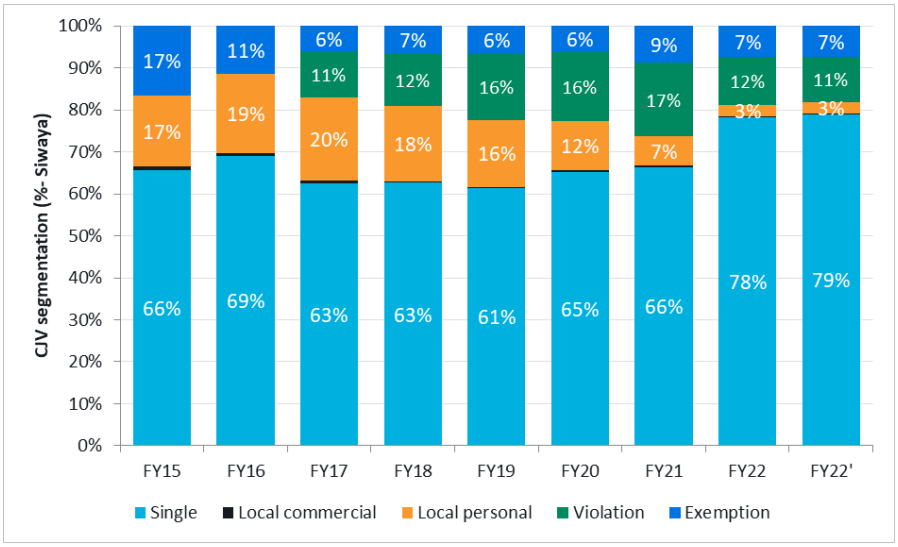


Source: Steer analysis of the Client data

3.26 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as local/return/monthly and cash users were only allowed to buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in ETC penetration, it was observed that traffic patterns have begun to return to their initial segmentation.

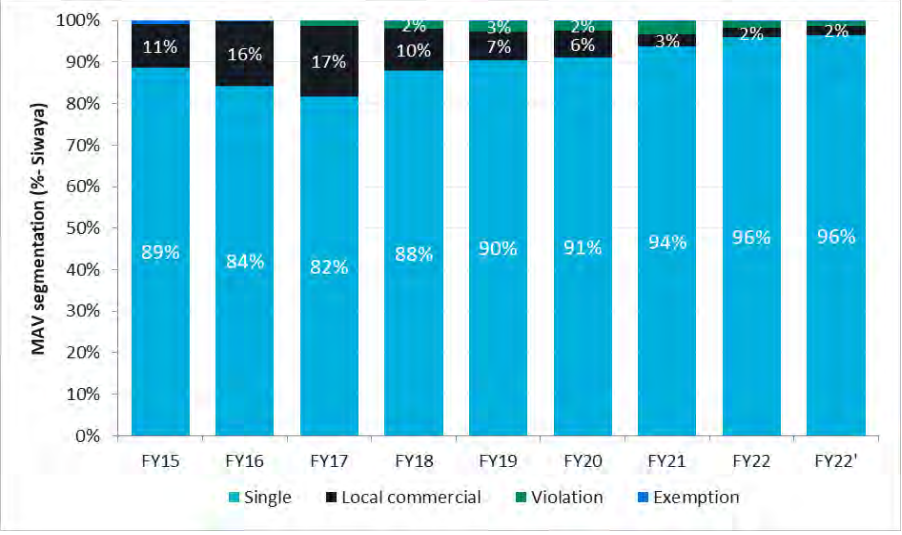
3.27 The following figures provide the toll segmentation for the historical years at TP1 Siwaya for CJV and MAV while the table provides the same for the remaining vehicle types.

Figure 3.4: Ticket-segmentation for CJV at TP1 Siwaya



Source: Steer analysis of the Client data
** FY22 is the annual level segmentation* **FY22' is the averaged Oct-Mar segmentation*

Figure 3.5: Ticket-segmentation for MAV at TP1 Siwaya



Source: Steer analysis of the Client data, **FY22 is the annual level segmentation, *FY22' is the averaged Oct-Mar segmentation*

3.28 As can be seen in the following figure and table, in FY21 the share of single tickets was 66% for CJVs, with the remainder made up of 17% violations, 9% exemptions and 7% local personal. The share of exemptions observed on this Asset is in line with our observations on similar urban Assets across the region. Also, such high violation share reported is in line with the Asset being urban in nature which generally has high non-paying CJV traffic. Also, we believe that the increase of exemptions from FY17 (6%) to FY21 (9%) is linked to network diversions over the past three years. With alternate roads reaching capacity and diversion equilibrium in FY20, the exemptions are expected to stabilise in the near future.

3.29 With increasing ETC penetration on the Asset, the combined share of exemption and violation on the Asset has dropped by 4-5% compared to FY19 levels. Moreover, it has been observed that the share of local personal trips have dropped by 9% in FY22 after FASTag implementation. This could be due to reduction in local passes issued by operators which are not in accordance with the concession agreement.

3.30 MAVs are observed to have high share of single tickets, with the share of MAVs buying single tickets reaching as high as 95% in FY21 and FY22. The high share of single ticket type is due to other tickets such as return and monthly being not available as per the toll notification. A small and gradually decreasing proportion buys local commercial with upto 2% of used buying the local commercial pass. As expected, there is a negligible share of violations for MAVs. The ticket segmentation of other vehicle types is presented in the table below.

Table 3.7: Historical ticket segmentation at TP1 Siwaya

LCV	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
Single	95%	95%	94%	94%	92%	93%	96%	95%	95%
Local commercial	3%	4%	4%	4%	3%	2%	1%	1%	1%
Local personal	0%	0%	0%	0%	0%	0%	0%	0%	0%
Violation	0%	0%	1%	1%	2%	4%	1%	2%	2%
Exemption	2%	1%	1%	2%	2%	1%	1%	1%	1%
Bus/2A									
Single	97%	96%	97%	97%	97%	97%	96%	97%	97%
Local commercial	2%	2%	1%	1%	1%	1%	1%	1%	1%
Violation	-	-	1%	1%	2%	2%	2%	2%	2%
Exemption	1%	2%	0%	0%	0%	0%	1%	1%	1%

Source: Steer analysis of the Client data

Data collection and validation

Overview

3.31 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset, comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.8: Data collection schedule

TP1#	7-day videography based TVC			1 day OD survey	
	Start date	End date	Time (hrs)	Start date	End date
TP1	20-Mar-2021	26-Mar-2021	0000-2359	11-Sept-2019	12-Sept-2019

Source: Steer analysis

3.32 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative

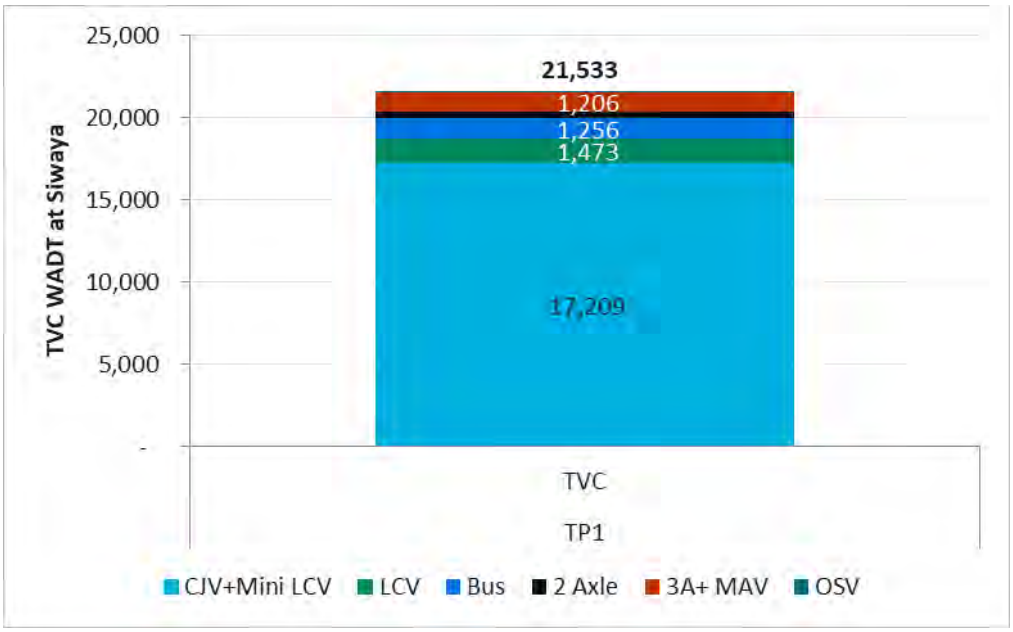
TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at each toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.33 Taking an average of the seven-day TVC counts (18-24th January 2021, 0000-2359 hours), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Figure 3.6: WADT at TP1



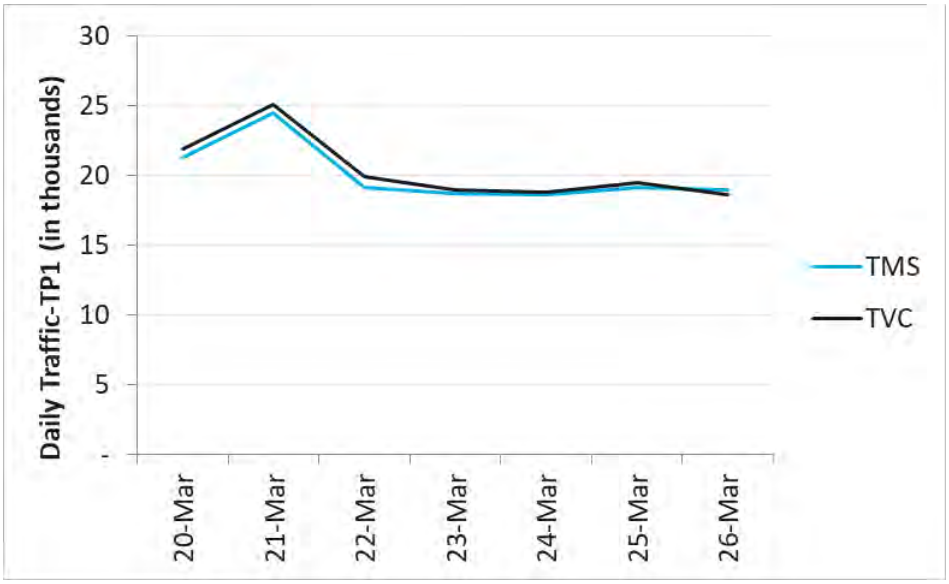
Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.34 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those particular days, as supplied by the Client.

3.35 The following figures show the comparison between the daily traffic observed by TVC and TMS at TP1 Siwaya. As shown in the figures below, TVC and TMS show a close fit overall and the differences are within the acceptable range of variation.

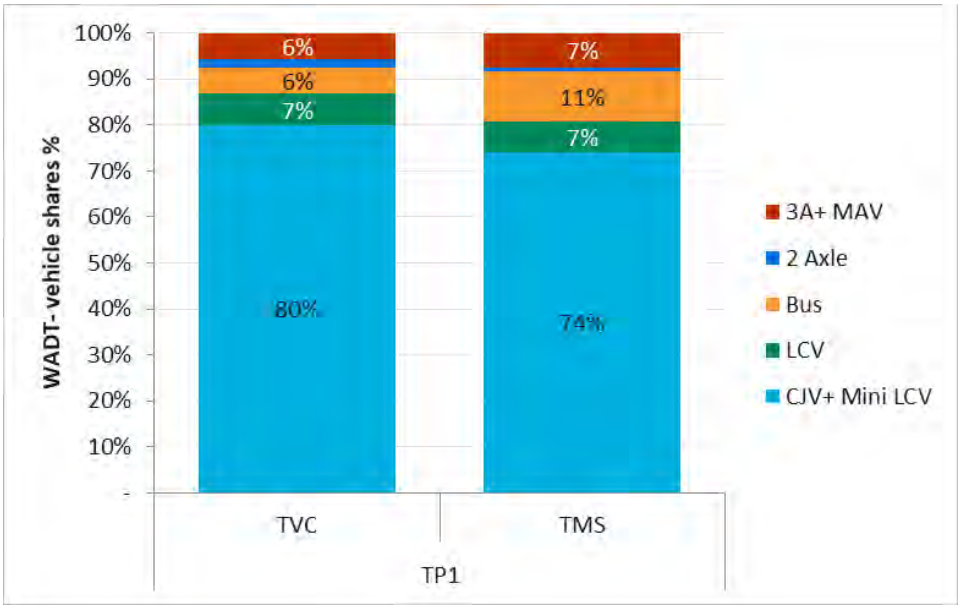
Figure 3.7: Comparison between TVC and TMS daily traffic data on TP1



Source: Steer analysis of TVC and Client TMS data

3.36 The figure below compares the shares of vehicle types on the Asset, between TVC and TMS data. As this shows, there is a slight difference at the vehicle category level, which can be attributed to common misclassification of vehicles and their categories specially between CJV, Mini-LCV, LCV and 2A.

Figure 3.8 Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.37 Given the overall good fit of the data at an WADT level and minimal variation between the TVC and TMS data for the largest revenue generator, CJVs and MAVs are within reasonable limits, giving us the confidence that the base year traffic calculated using the Client data forms a robust base year traffic estimate.

Key findings of origin-destination analysis

Overview

Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. The OD analysis presented here is based on data collected on behalf of the Client in September 2019. More recent OD surveys were not undertaken as this Asset has a long operational history and we did not believe material changes in these patterns would have occurred during this period.

3.38 We have analysed the regional drivers of demand based on the following analyses:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.39 While zonal analysis and listing of top OD pairs help us to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported. Trip length distribution shows 'how far' vehicles and people travel, and goods get transported. This set of analyses is used to estimate the key drivers of traffic and aids in forecasting assumptions around traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.40 Sample rates help understand the reliability of OD data. They are calculated by dividing the OD samples captured by the traffic counts (based on the TVC data) during the same time period. The table below presents the sample rates for key vehicle type aggregations at both toll plazas. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.9: Sample rates for OD data

Vehicle category	TP1
Car	32%
Bus	48%
LCV	65%
MAV	65%
Total	46%

Source: Steer analysis of OD data

Zone categories

3.41 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.10: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	On or very close to the Asset.

Aggregate Zone	Description
Immediate area of influence (IAOI)	Fall within two districts from the Asset, roughly up to about 75-150 km from the Asset.
Rest of Uttar Pradesh	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Uttarakhand	Uttarakhand.
Central NCR	Delhi, Gurgaon, Noida.
Rajasthan	Rajasthan.
Gujarat and Maharashtra	Gujarat or Maharashtra.
Punjab, HP, J&K	Punjab, Himachal Pradesh and Jammu & Kashmir
Haryana	Haryana
South India	Andhra Pradesh, Tamil Nadu, Karnataka, Kerala
Madhya Pradesh	Madhya Pradesh.
East and Northeast India	West Bengal, Orissa and Northeast Indian states
Outside India	Nepal, Bhutan, Bangladesh.

Source: Steer analysis

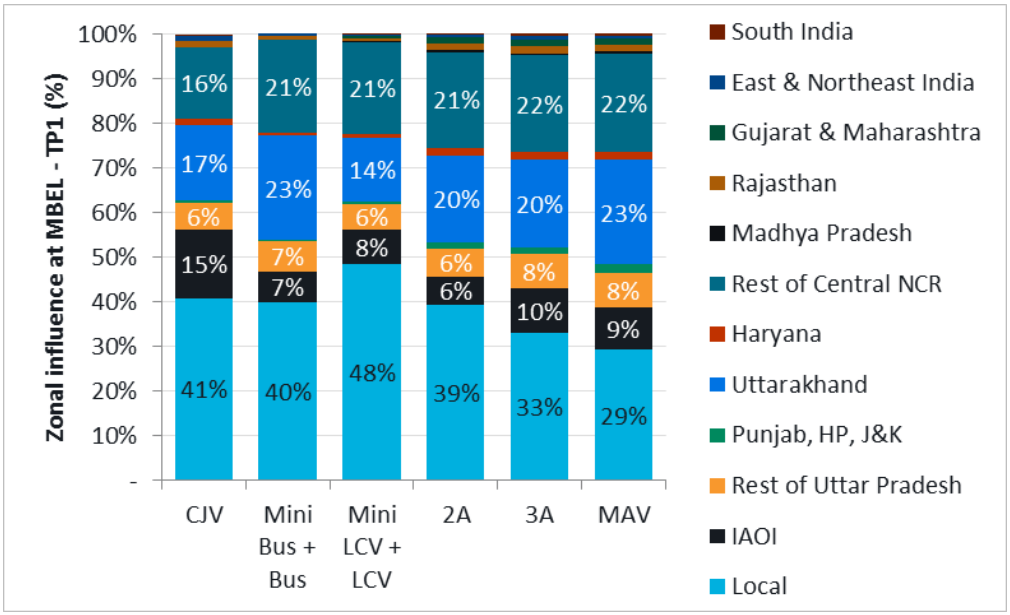
Zonal influence

3.42 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[3] at TP1 of this Asset aggregated based on zonal aggregation listed in the previous sub-section. Please note that zonal influence is analysed on trip ends and not trips.

3.43 The figure below presents the zonal influence on various vehicle types the toll plaza. We can see that 'local' trips make up the largest share for all vehicle types. Generally smaller vehicles see a higher share of local trips than Trucks and MAVs. The highest share of local trips can be attributed to Mini LCVs + LCVs (48%). On the other hand, 3A/MAVs see the lowest proportion of local trips (29%), with a comparable proportion of trips from Uttarakhand. Beyond the local area, all vehicle types see relatively high proportions of trips from Uttarakhand and the Rest of Central NCR (both occupying approximately 20% for all vehicle types).

[3] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad is 50% since one trip end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.9: Zonal influence at TP1



Source: Steer analysis of OD data

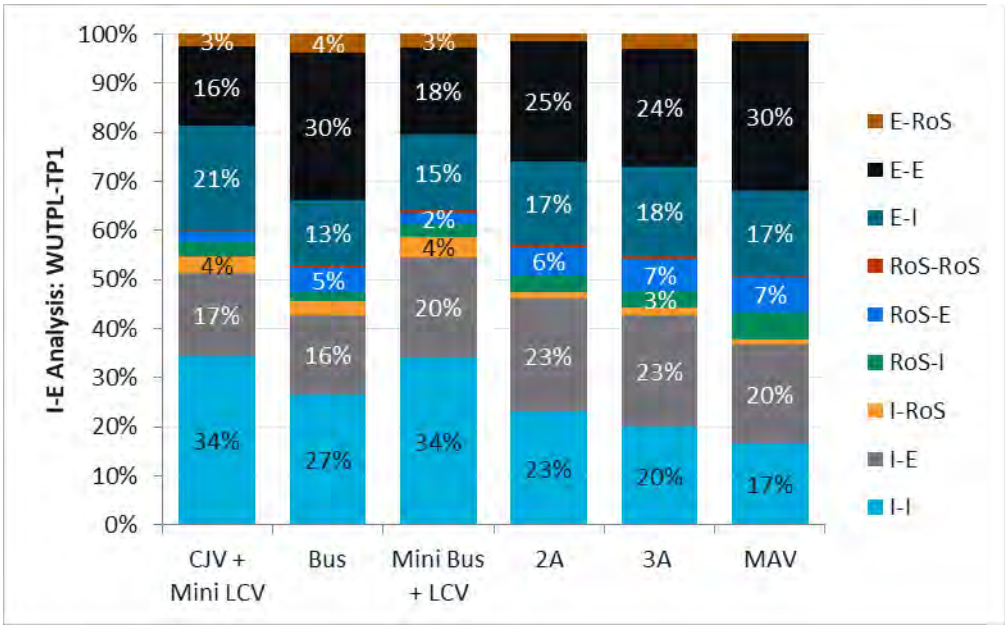
Internal External analysis

3.44 Internal-External analysis helps in identifying the trips which have both the origin and destination on or near the Asset i.e local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e. through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e. lying on the Asset, while 'External' zones are areas lying outside the state.

3.45 Figure 3.10 figure below shows the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation.

3.46 We can see that E-E trips represent 30% for MAVs, but a smaller share of 16% for CJVs and Mini LCVs. In particular, CJVs and LCVs show a good mix of trips representing all four cases, however, the other vehicle classes tend to have a more dominant share (about 40% and more), dedicated to E-E trips. A significant part of these E-E trips are between Delhi or other states and Uttarakhand and are expected to continue being made on the corridor, given the strategic accessible location of the tourist state in relation to Delhi and UP.

Figure 3.10 Internal-external distribution at TP1



Source: Steer analysis of OD data

Commodity distribution

3.47 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of these aggregate commodity categories.

Table 3.11: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	

Commodity Description	Code	Combined codes used for charts
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN
Miscellaneous (Parcel, Courier, House hold items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN

Source: Steer analysis

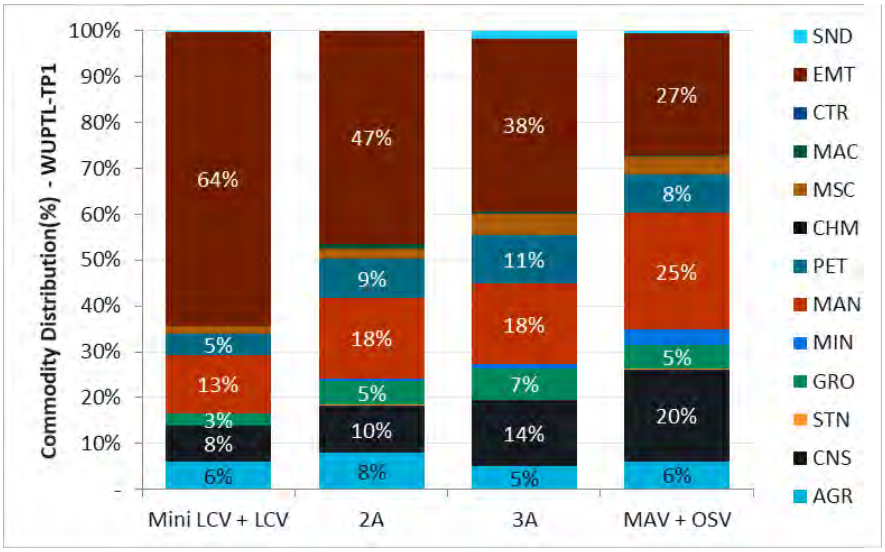
3.48 The figure below presents the commodity distribution for goods vehicles at this toll plaza. As also observed during our site visits, we see that a significant number of vehicles are "Empty". There is a significant share of Automobiles being transported along this corridor, along with Chemicals. Overall, Manufactured products make up the top aggregate category at this toll plaza.

3.49 The reason that Manufactured products have such a high share in commodities can be attributed to presence of several small manufacturing units and small industries along the Asset road, and other industries that have been setup in Uttarakhand.

3.50 Construction material makes up 20% of traffic volume for MAVs on this Asset. As was observed from the site visit and background research, though sand volumes have not reached the levels they were at before the ban on sandmining, these trucks carry construction-related material (including sand) from Saharanpur, Dadri and other mining regions and supply to Delhi NCR region for various construction needs.

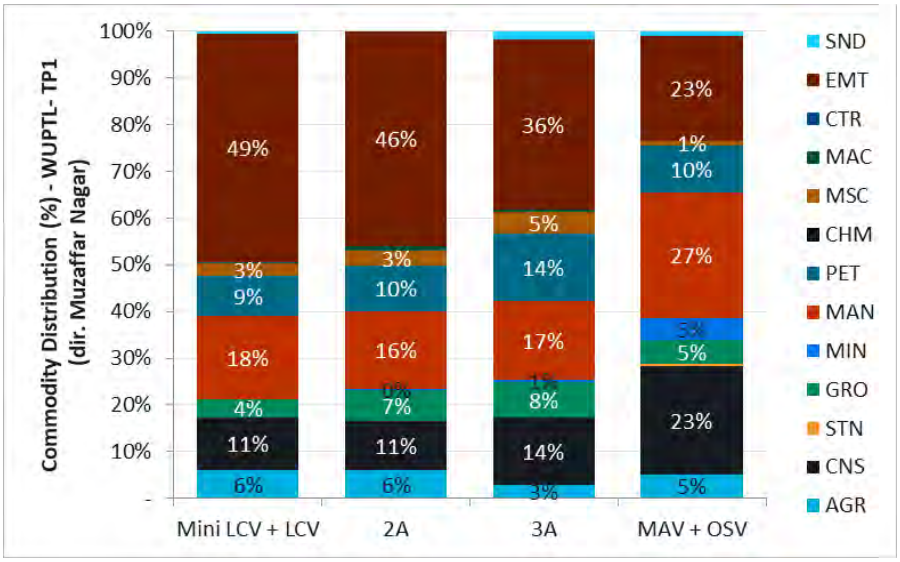
3.51 Looking by direction you can see from the charts below that a smaller proportion of vehicles going towards Muzaffar Nagar are Empty than those going towards Meerut. Aside from the different proportions of Empty vehicle, the most significant difference is that those travelling towards Muzaffar Nagar have a greater share of Construction materials (23% compared to 15%).

Figure 3.11: Commodity distribution at TP1 (Total)



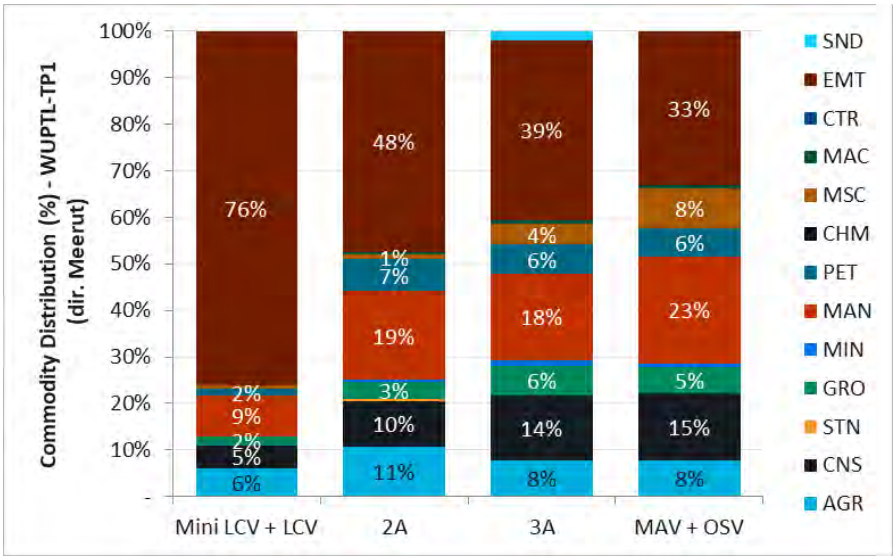
Source: Steer analysis of OD data

Figure 3.12: Commodity distribution at TP (towards Muzaffar Nagar)



Source: Steer analysis of OD data

Figure 3.13: Commodity distribution at TP1 (towards Meerut)



Source: Steer analysis of OD data

Trip length analysis

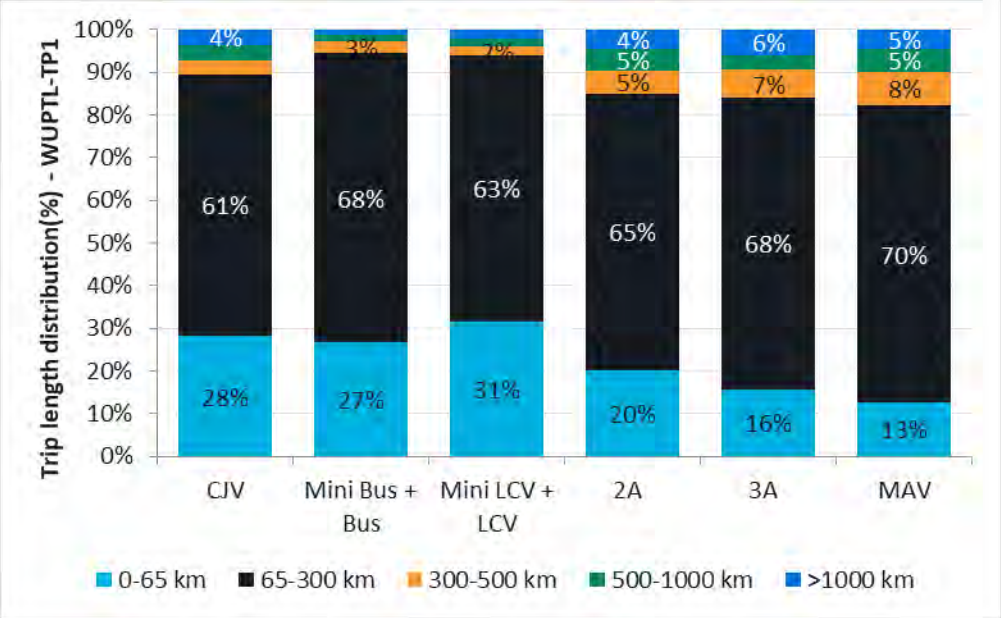
3.52 Trip-length distribution provides the distance-based profile of various vehicle types. This helps to validate assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[4]

3.53 As can be seen in the figure below, there are minimal long-distance (considered as >500km) movements, even for heavier vehicle categories. The majority of trips for all vehicle categories are between 65-300-km long, which is the average distance between Central NCR and Uttarakhand. Generally, smaller vehicles have shorter distances (0-65km) compared to goods-carrying heavy vehicles. For example, 28% of CJVs make trips less than 65-km long, while 13% of MAVs make trips of that length.

3.54 This helps in supporting the fact that this Asset has a more urban profile, with relatively shorter trips and a higher percentage of CJVs. A 60-70% share of trips covering between 65-300-Km supports our observations and understanding that this Asset generally caters to the regional urban demand between the contiguous population centers that lie along it.

Figure 3.14: Trip length distribution TP1



Source: Steer analysis of OD data

Conclusions

3.55 In summary, in FY22 the Asset had an AADT of 24,600 at TP1 Siwaya. Looking at the vehicle shares of this Asset, the dominant vehicle class is CJVs, holding 80% of the vehicle class share. Traffic has shown significant recovery starting FY22 when the Delhi-Meerut expressway was commissioned resulting in improved connectivity to Delhi. MAV's have also grown in the recent years driven by increase in sand mining traffic as one of the key reasons.

3.56 The OD analysis found that in terms of zonal influence, local (with trip end on Asset), Uttarakhand and the rest of Central NCR are dominant zones. This is expected given the

[4] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

Asset's location, and the industrial, employment and tourism generators and attractors in these zones. The key commodities transported on the Asset are Manufactured products and Construction materials, with a significant share of Empty vehicles showing the influence of short-distance trips serving the regional economy.

3.57 Looking at the internal and external distribution, I-I and E-E trips are dominant, holding the greatest share for all vehicle classes. I-I, I-E and E-I trips are considered to be captive to the Asset with one trip end lying on it. E-E trips are expected to continue being made on the corridor, given the strategic accessible location of the tourist state in relation to Delhi and UP. The trip length analysis validates this conclusion, finding a majority of the trips (60%+) travelling between 65-300km.

3.58 Overall, the analysis of historical traffic, TVC counts, and OD survey data conducted on the Asset confirm the understanding from the site visits that the Asset has a tourism and urban nature for CJVs and light goods vehicle, with primary goods movement involving sugar industries, agriculture, and sandmining. Tourism movement majorly includes destinations in Uttarakhand while industries include sugar mills and sandmining in the western UP region.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and,
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Uttar Pradesh (containing the Asset), compared to that of the country. Overall, urbanisation is seen at both the state and national levels, as shown by the fact that the rural population is growing slower than the urban population. Uttar Pradesh has grown at a rate which is similar to the country average, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Uttar Pradesh	166	132	35	200	155	44	1.8%	1.7%	2.6%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of urbanisation, and the dynamic nature of local population migration (both of which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

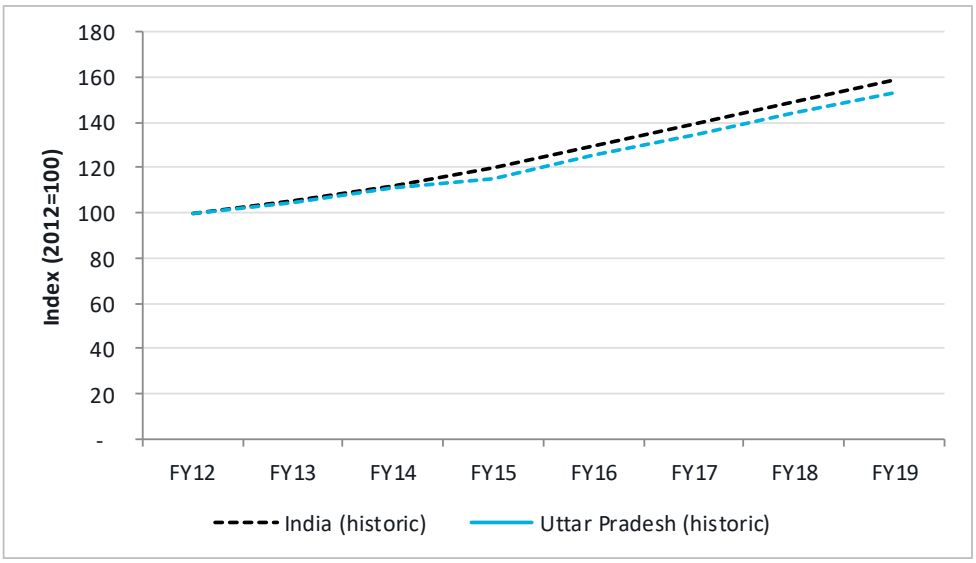
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Uttar Pradesh has been lagging that of the country. The state contributes approximately 8% to India's GDP. The following figures illustrate the evolution of Uttar Pradesh's GSDP.

Figure 4.1: Evolution of Uttar Pradesh's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

Economic activity in the state

4.9 Uttar Pradesh is the most populous state in India with a population of ~200 million people. The state has a large pool of skilled, semi-skilled and unskilled labour. Uttar Pradesh is also considered the largest consumer base in the country.

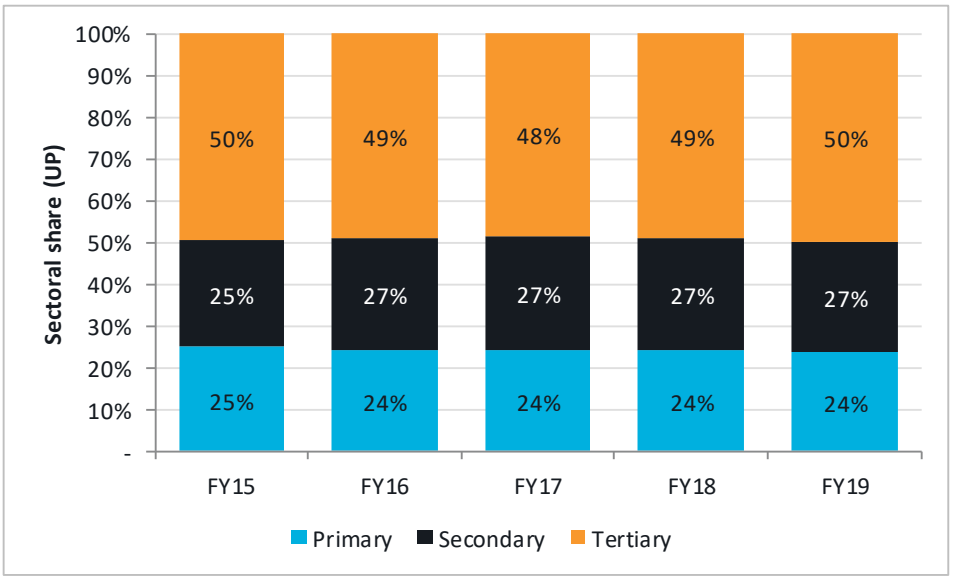
4.10 The tertiary sector has the highest sectoral contribution to the state GDP followed by the secondary and primary sectors, with shares remaining stable during the past five years.

4.11 The tourism and transport sector constitute a majority of the state's tertiary sector. Uttar Pradesh is considered a favoured tourist destination in India, with key tourist attractions being Agra, Varanasi, Mathura and Prayagraj. In 2018, the state attracted the second highest domestic tourist arrivals in the country with 285 million visits. The state holds third position in the country in foreign tourist arrivals with over 3.78 million[5].

4.12 In terms of secondary sector, the state has key industrial areas in Khurja (Ceramic); Moradabad (Metals); Meerut, Bareilly, Mirzapur and Lucknow (Handloom & Handicrafts); and Kanpur and Noida (Leather and tannery). The state also has an oil refinery in Mathura, operated by Indian Oil Corporation.

4.13 Uttar Pradesh has very fertile Gangetic land with a large share of population dependent upon agriculture sector for the livelihood. The key primary industries in the state include food processing, crop production and horticulture. The state is mainly known for production of wheat, sugarcane, potato and mango.

Figure 4.2: Sectoral contribution to Uttar Pradesh's GSDP



Source: Central Statistics Organisation

[5] http://tourism.gov.in/sites/default/files/Other/India%20Tourism%20Statistics%20at%20a%20Glance%202019.pdf

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 To understand historical traffic trends in relation to these growth drivers, we have carried out regression analysis to determine the historical relationship between traffic belonging to each major vehicle category and its macroeconomic growth drivers at each toll plaza. The traffic demand is the dependent variable while the one or more identified growth drivers are the independent or explanatory variables.

5.4 Typically, passenger and light commercial vehicle traffic like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state in which the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because the majority of light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore are more closely related to GDP growth.

Estimation of background elasticities

5.5 Elasticities, in the case of traffic growth, are the relationships between traffic growth and the growth in growth drivers of traffic. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.6 Following the brief note on historical trends shown in Chapter 3, we now delve deeper into results of the historical growth analysis for each major vehicle type. The table below shows the historical CAGRs on the Asset by vehicle type.

Table 5.1: Vehicle wise growth and CAGR (%) at Siwaya toll plaza

YoY (%)	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
CJV	11.0%	3.2%	(4.6%)	(7.6%)	(26.6%)	75.9%	3.8%	0.2%	13.6%
LCV	(2.8%)	(7.4%)	(27.8%)	(25.0%)	(16.9%)	(4.1%)	(6.3%)	(16.4%)	(10.7%)
2A/Bus	(1.2%)	6.8%	9.2%	(1.1%)	(37.3%)	17.1%	0.6%	3.3%	(14.3%)
3A/MAV	(38.5%)	(18.1%)	23.2%	6.2%	7.2%	1.3%	(8.9%)	(9.9%)	4.2%

YoY (%)	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY12-20	CAGR FY16-20	CAGR FY20-22
Total	**4.3%**	**1.4%**	**(4.6%)**	**(7.5%)**	**(25.3%)**	**58.7%**	**1.3%**	**(1.7%)**	**8.9%**
PCU	**(2.5%)**	**0.1%**	**(1.5%)**	**(5.8%)**	**(24.0%)**	**43.7%**	**(0.5%)**	**(2.5%)**	**4.5%**

Source: Steer analysis of Client TMS data

5.7 As the TMS data did not provide a breakup between the individual vehicle categories for the toll categories 2A/Bus and 3A/MAV, we have used TVC data of FY21, as discussed in Chapter 3, to estimate the splits in FY22. The following table presents the splits which have also helped in the elasticity estimation. However, in our regression analysis, we have used the combined traffic as data for historical years which were available only in combined form.

Table 5.2: Split between individual vehicle types

Vehicle type (for toll)	Vehicle type (for growth)	Share (%)
Bus/2A	Bus	77%
	2A	23%
3A/MAV	3A	33%
	MAV	67%

Source: Steer analysis of independent TVC data

5.8 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

Table 5.3: Identified growth drivers to model traffic growth

Vehicle type	GDP India
Car	GSDP Uttar Pradesh
LCV	GSDP Uttar Pradesh
Bus	GSDP Uttar Pradesh
2A	GSDP Uttar Pradesh
3A	GDP India
MAV	GDP India

Source: Steer analysis of Client data

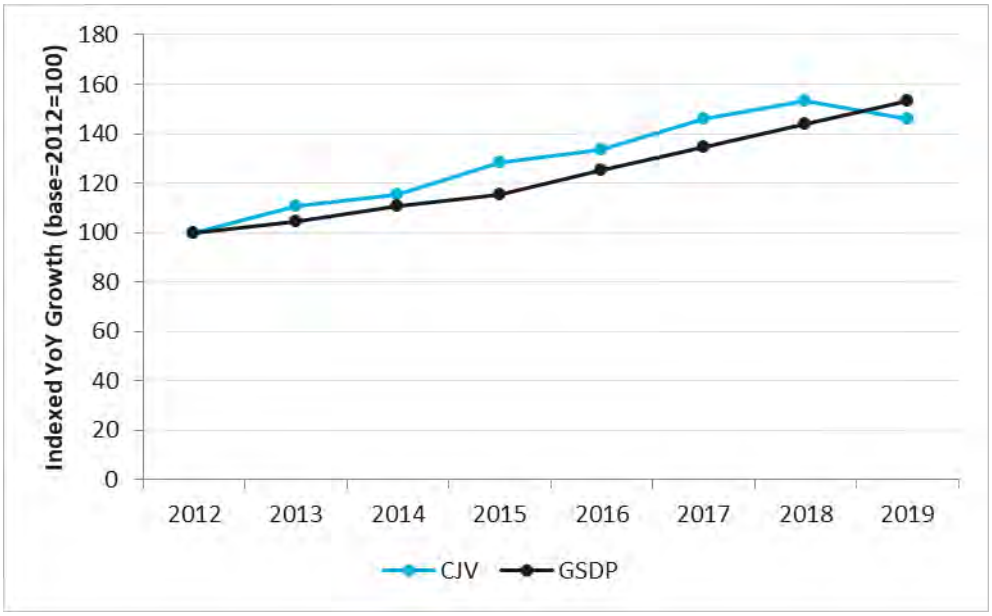
5.9 Please note that given that the recent historical period of tolling is chequered with several impacts due to network developments and a ban on sandmining, especially for commercial vehicles, only a few unaffected years were available for the regression analysis. This, along with the understanding gained of changes in the ecosystem of the traffic growth drivers, is the reason for differences between the derived and assumed elasticities.

5.10 Further, FY21 and FY22 have been impacted by COVID-19 related restrictions and the traffic volumes on the Asset were significantly impacted during the travel restrictions imposed during the first, second and third wave of COVID-19. Hence, FY21 and FY22 have not been considered while undertaking the regression analysis.

CJV

5.11 We can see from the OD data that the CJVs primarily cater to regional movements related to work and tourism within the Delhi NCR region, western Uttar Pradesh and Uttarakhand. More than 80% trips have one end in Uttar Pradesh. We have therefore taken GSDP of Uttar Pradesh to be the growth driver to model the growth of CJV traffic. The following figure shows the relationship between indexed values of CJV traffic and Uttar Pradesh's GSDP.

Figure 5.1: Relationship between CJV traffic and Uttar Pradesh's GSDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.12 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in GSDP/GDP (i.e. suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows. This assumption is very contextual and subject to change as there are changes in economic policies of government and overall economic stability nationally and globally.

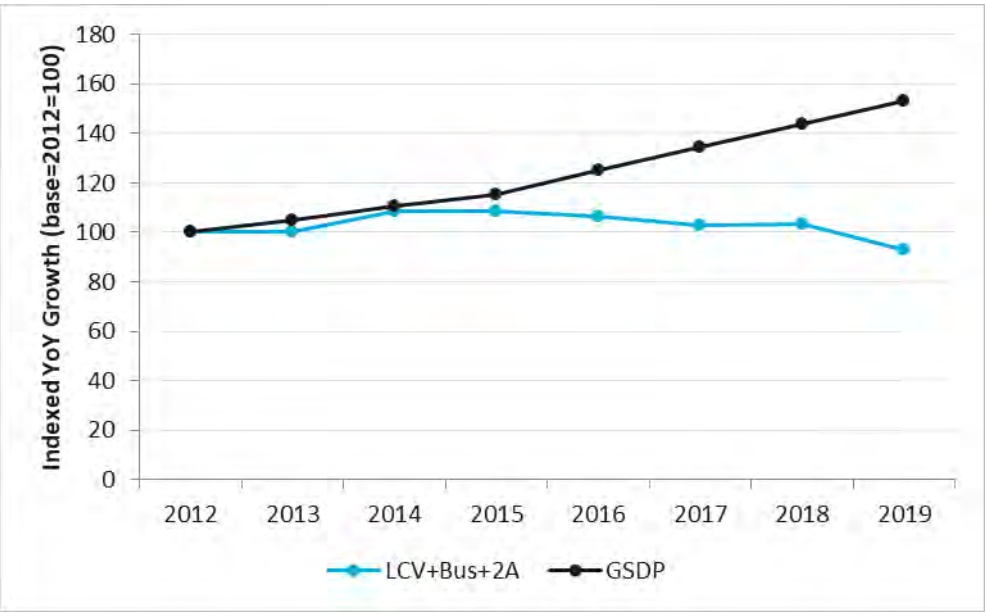
5.13 Historically, the CJV traffic on the Asset has shown positive growth until FY18. FY19 and FY20 show negative growth due to diversions on to Upper Ganga Canal (UGC) road and the local road bypassing Siwaya toll plaza ('micro-diversion road'). However, corridor-level traffic growth analysis and current traffic demand on UGC and micro-diversion roads indicate that equilibrium has been attained without any further loss away from the Asset. With the completion of recently constructed Delhi-Meerut expressway, we had positive growth in overall traffic. With regards to the recovery from the COVID-19 lockdown impact, the shift from public transport to passenger choices is expected to sustain as user perceptions of preferring personal vehicle in the medium term will continue driving CJV growth.

5.14 The regression analysis suggests that between FY13 and FY18 traffic has grown with a background traffic growth elasticity of 0.9 with respect to GSDP on the Asset. Taking note of the positive outlook for passenger traffic on the Asset, driven by improved connectivity for business and leisure trips, and a benchmark toll road in the region, we have assumed a forecast background elasticity of 1.0 for CJV going forward.

LCV, 2A and Bus

5.15 Compared to heavy vehicles like 3A and MAV, LCV, 2A and Bus have more regional movements within the state - Uttar Pradesh in this case as seen in the OD data analysis. More than 90% of LCVs and 80% of 2A trucks have one of their trip ends in Uttar Pradesh. We have therefore taken GSDP of Uttar Pradesh to be the growth driver to model growth of LCV, 2A and Bus traffic. The LCV and 2A were combined due to similar behaviour along with shifts in traffic between the two categories and potential classification issues while tolling. The following figure shows the relationship between indexed values of LCV+2A+Bus combined traffic and Uttar Pradesh's GSDP.

Figure 5.2: Relationship between LCV+2A+Bus combined traffic and Uttar Pradesh's GSDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.16 During the period from FY12 to FY15, LCV growth on the Asset was positive. However, from FY16 onwards, the growth has been increasingly negative. This is due to availability of the improved UGC road and micro-diversion road as an alternative route, until capacity was breached in these alternatives in FY20. However, as seen in the table, the growth rates on 2A and Bus combined show good growth in FY18 and FY19. We believe this is because of a combination of events – one being the shift in growth from LCV to 2A, and the other being the diversion on to alternative roads.

5.17 Regression analysis suggests that when observing growth in FY14 and FY15, LCV+2A+Bus combinedly showed an elasticity of 0.6 with respect to GSDP of Uttar Pradesh. Please note these were much earlier years in the history of tolling before impacts affected traffic. Besides, though we do believe from our experience of working on similar Assets across India and in the vicinity that LCV will continue to grow, it will be at a lower rate compared to larger vehicle types like 2A. This is because in the past three years, we see that growth rates of LCVs indicate lower preference compared to 2A – other roads show that the latter has shown recovery from the declining trend in years before.

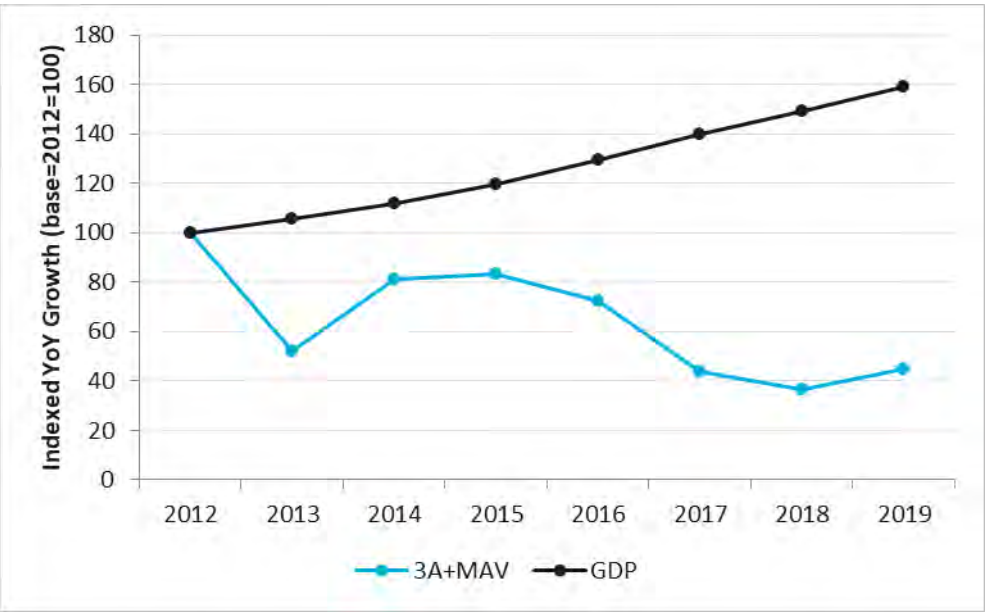
5.18 Around 50% of the bus trips have one end on the Asset or around it. Based on our experience across the country, buses in corridors with tourism-driven passenger growth show moderate elasticities of 0.4 to 0.6.

5.19 Based on benchmark elasticities from other toll roads, we have therefore assumed a forecast elasticity of 0.2, 0.4 and 0.45 for LCV, Bus and 2A respectively, with respect to GSDP of Uttar Pradesh.

3A/MAV Trucks

5.20 Compared to lighter trucks like LCV and 2A, 3A and MAV have more national or long-distance movements covering several states. Given that manufacturing-related commodities tend to take prominence in their commodity distribution which means that traffic growth in 3A and MAV is dependent on industry demand-supply ecosystems spread across the country, therefore we have taken GDP as the growth driver to model the traffic growth in 3A and MAV. The following figure shows the relationship between indexed values of 3A+MAV combined traffic and India's GDP.

Figure 5.3: Relationship between 3A+MAV combined traffic and India's GDP



Source: Steer analysis of Client TMS data and publicly available GDP/GSDP data

5.21 Historically, though 3A+MAV combined traffic grew between FY13 and FY16, it shows negative growth between FY16 and FY19 due to the ban on sandmining in the Uttar Pradesh through orders by the Supreme Court of India and the National Green Tribunal. However, FY19 onwards, we see an ongoing recovery in the growth due to new licences being given out for sandmining in the Saharanpur region. Having decreased in volumes from more than 2,000 in FY15 to less than 900 in FY18, 3A + MAV combined have now increased to about 1,100 in FY19.

5.22 As discussed earlier in the chapter, the TMS system reports 3A and MAV traffic as a combined category. We have therefore taken a proportional split based on our TVC counts to provide an understanding of how 3A and MAV will grow relative to each other. We believe 3A to grow slower as compared to MAV, as there is an increasing preference seen for MAVs instead of 3As for long-distance movements. This is because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are likely certain commodities or movements which are best served by 3As.

5.23 With regards to the recovery from the COVID-19 lockdown impact, as discussed earlier in Chapter 3, MAVs have shown strong and quick recovery. Based on all the above observations, we have assumed elasticities of 0.45 and 0.55 for 3A and MAV trucks, respectively.

Forecasts for background elasticities

5.24 The below table presents a summary of the results of the regression analysis carried out on the historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.25 The forecast elasticities are assumed to remain constant over the concession period as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.4: Derived elasticities from regression analysis and assumed forecast elasticities for background growth

Vehicle type	Growth driver	TP1 Siwaya			
		History		Forecast	
		Derived elasticity	Years considered	Assumed forecast elasticity	Evolution of elasticity
Car	GSDP Uttar Pradesh	0.90	FY14 through FY18	1.00	No change
LCV#	GSDP Uttar Pradesh	0.60	FY14, FY15, FY18	0.20	No change
Bus#	GSDP Uttar Pradesh			0.40	No change
2A#	GSDP Uttar Pradesh			0.45	No change
3A#	GDP	1.30*	FY15	0.45	No change
MAV#	GDP			0.55	No change

Source: Steer analysis of Client data *elasticity not representative #regression was run on LCV-2A-bus and 3A-MAV combinedly

Forecasts for growth drivers

5.26 Following the discussion in Chapter 4 on the nature of economic activity in the state of Uttar Pradesh, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. In particular, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.27 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts.

5.28 After the last period of economic slowdown in FY11-FY12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 4%. Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing Assets, lower manufacturing outputs and lower rural consumption.

5.29 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client and shown in figure below.

5.30 Based on that, GDP is forecast to grow by 7.0% between FY23 and FY26 and gradually tapering just below 6.0% by FY40. The concession for the Asset ends in FY27.

5.31 The India GDP growth provided by the Client is in line with other independent forecasts available form from independent sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are higher than the forecasts provided by sources like OECD and EIU.

5.32 State GSDP

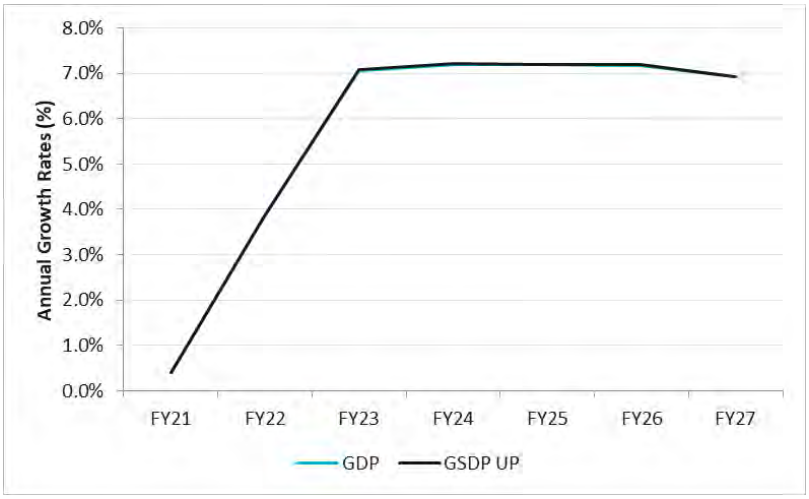
5.33 As per Client projections, Uttar Pradesh's GSDP growth assumes to be in line with the national GDP throughout the concession period. This assumption is considered to be reasonable as UP is observed to be on a trajectory of infrastructure development that is expected to induce growth both in the short and medium term. The state now already has the largest network of expressways in the country – access-controlled highways that provide very high levels of service and is expected to further surge ahead with new expressway developments expected to serve hithero-less developed regions.

5.34 There are significant investments expected to take place as part of the state's plan and Uttar Pradesh is expected to receive a significant proportion of these investments, given its leading position in industrial investments. The higher expected GSDP growth rate across the concession period could be achieved if such investments were realised as they are expected to give an additional boost to Uttar Pradesh's state economy.

5.35 In the long term, we believe that as other smaller state economies of India catch up with the national economic growth, the gap between growth rates of larger state economies, such as Gujarat, Maharashtra and Karnataka, and the national GDP growth rate will start reducing.

5.36 The chart below shows the forecast growth lines for GDP and Uttar Pradesh GSDP.

Figure 5.4: GDP-GSDP forecast



Source: GDP forecast provided by Client, GSDP projections based on historical GSDP wrt to India GDP

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on estimated and assumed base growth rates in the previous chapter, this chapter first deals with the forecasting assumptions around base year AADT and potential impacts on traffic growth on the Asset. Later, it also presents the assumed toll segmentation, trip factors and evolution of toll rates for the concession period which are used to estimate the traffic and revenue forecast. In the final section, the chapter summarises the traffic growth rates for the concession length.

6.2 The following table lists key intermediate and final outputs that have been presented in chapter 5 and 6.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date AADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Historical elasticities with respect to growth drivers	Chapter 3, 5, Appendix B
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5
	Impact growth rates and staging	Impacts	Asset v/s alternate route costs for ongoing/upcoming network and other developments	Chapters 2, 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer

6.3 All traffic is presented as AADT by vehicle category at each plaza, for financial years (April-March). All revenue is presented in Rupees (nominal terms). Since FY26 is the last year of concession, we have presented our forecasts until FY26 in this chapter and in the Appendices.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied the monthly traffic and seasonality – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. This averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 The seasonality factors assumed for individual vehicle types are shown in the table below.

Table 6.2: Seasonality correction factors for TP1 Siwaya

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.91	0.88	0.73	1.12	1.16	1.22	1.04	0.98	1.11	1.11	0.99	0.97
LCV	0.93	0.91	0.91	1.10	1.09	1.01	0.98	0.98	1.06	1.10	1.00	0.99
2A/ Bus	0.98	0.93	0.95	1.18	1.03	1.00	0.98	0.95	1.04	1.04	1.01	0.99
3A/MAV	0.99	1.01	0.94	1.16	1.07	0.93	0.91	1.00	0.95	0.99	1.00	1.16

Source: Steer analysis of Client historical TMS data

Base year FY22 AADT estimates

6.8 As discussed earlier in chapter 1 and in section 3.11, The second wave of COVID-19 infections peaked in the northern half of the country in the months of April and May 2021. The tourist centres of Dehradun, Mussoorie, Rishikesh, Haridwar had implemented strict COVID-19 related protocols for tourists. As a result, a significant reduction in tourism travel was recorded during that period. Therefore, the traffic volumes on the Asset were impacted during Q1FY22.

6.9 In Q2FY22, the traffic gradually returned to normal as the impact of second wave weaned away. Further, an above normal monsoon in Q2FY22 resulted in a higher drop in traffic volumes as compared to normal monsoon periods.

6.10 The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes. However, the impact was short lived but had witnessed significant impact on CJV and Bus volumes.

6.11 Further, we believe that the traffic levels observed during the October 2021 to March 2022 period when seasonally adjusted, were representative of normalised traffic on the Asset and

not a result of temporary shifts or impacts. Only in the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below:

Table 6.3 Monthly MADT and Adopted AADT for FY22 - TP1 Siwaya

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted (FY22*)
CJV	24,670	26,448	23,015	20,385	25,662	28,407	26,081
LCV	1,176	1,079	1,103	998	1,158	1,169	1,131
2A/ Bus	2,144	2,103	1,974	1,921	1,944	2,157	2,045
3A/MAV	1,261	1,206	1,335	1,311	1,531	1,657	1,391
Total	**29,252**	**30,836**	**27,427**	**24,615**	**30,295**	**33,390**	**30,649**
PCU	**37,221**	**38,540**	**35,201**	**32,171**	**38,518**	**42,353**	**38,717**

Source: Steer analysis , FY22* for CJV and Bus is averaged Oct-Mar (excluding Jan) due to 3rd wave COVID-19 impact. 3A/Mav PCU is a weighted average of 3A, MAV splits arrived from TVC counts and Rigid trailer splits

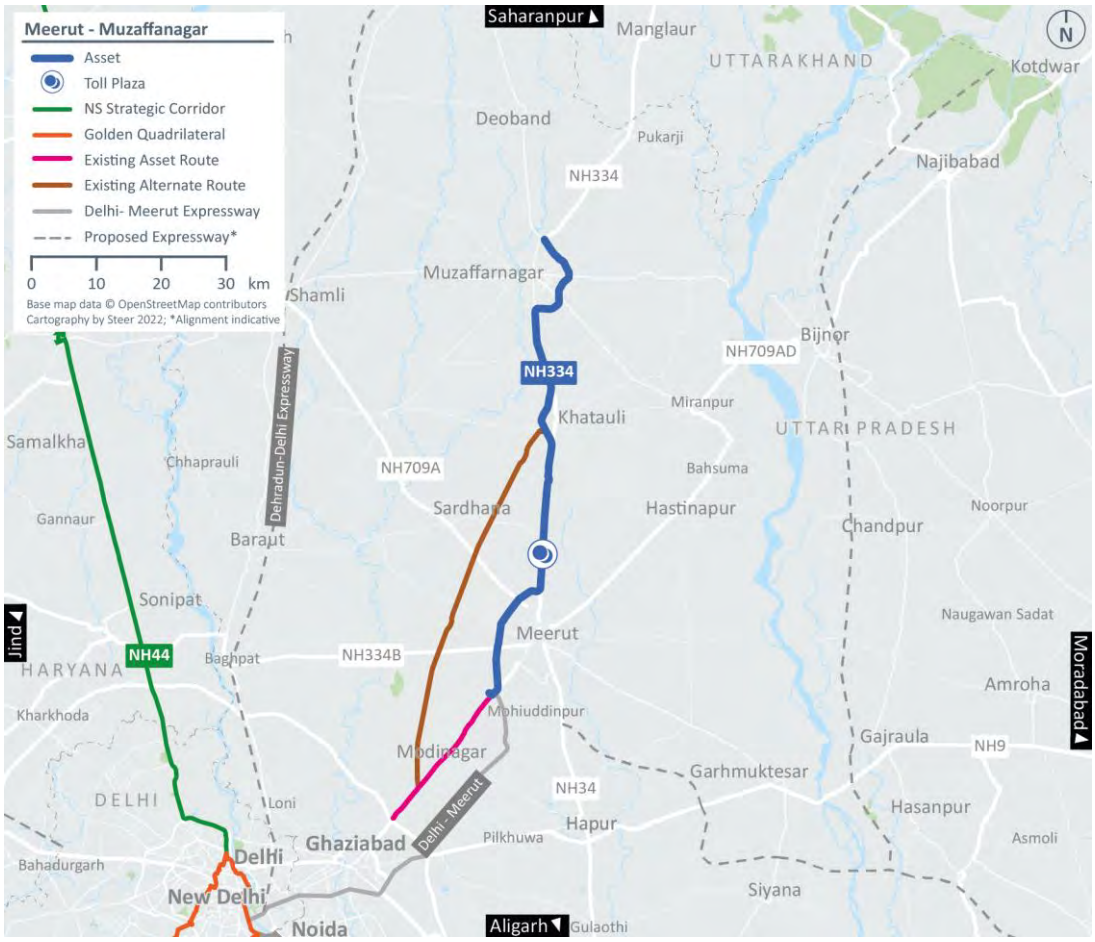
Analysis of potential impacts

Alternate routes and improvements

6.12 The section below details the impacts which we believe would affect traffic on the Asset during the concession period. As discussed earlier in Chapter 2, to assess the impacts on the Asset, whether positive or negative, we have studied developments (alternate roads, feeder roads and regulatory) in the surrounding road network.

6.13 The map below shows the road network surrounding the Asset.

Figure 6.1: Alternate routes and Asset route shown against the regional network context



Source: Steer analysis and cartography

6.14 The following table presents the network/other developments, corresponding alternate/feeder routes, year of completion and indicative direction of impact on the Asset.

Table 6.4: List of network/other developments

S. No.	Development	Route affected	Year of completion	Impact (+/-)
1.	Ongoing recovery from ban on sandmining	Vehicles carrying sand	FY23-FY24	+ve
2.	Ganga Expressway	Asset route: Haridwar-Asset-Ganga Expressway-Prayagraj Alternate route: Haridwar-Moradabad-Bareilly-Sitapur-Prayagraj	FY26	+ve
3.	Delhi- Saharanpur-Dehradun Expressway	Route: Delhi to Dehradun via Saharanpur	FY27 onwards	No impact

Source: Steer analysis *as per Client inputs

Impact assessment for network/other developments

6.15 As seen in the previous sub-section, the assessed impacts primarily fall into either the category of road network developments or development in other modes of transport. Under network developments, changes in the road network could be either brownfield (upgrade to existing road) or greenfield (development of new road). We typically assess impacts of the changes in costs and travel time on routes in these networks using binary logit models that compare generalised journey costs (GJC) between Asset and alternate routes. Under other developments, we typically use historical occurrences of the future event and benchmark observations from regional reference Assets. However, each case is dealt individually in its own network or industry context.

6.16 The subsections below include a narrative of each of the improvements, as listed in the table above, and impacts associated from each of these. While this section deals with impacts that have been considered in our forecasts, Appendices A (Queries) and C (Other Impacts) present Steer's responses to the Client on queries and on the list of impacts from the scope of works part of this commission.

Ongoing recovery from sandmining ban

6.17 Uttar Pradesh has several sandmining locations including Saharanpur and Dadri, apart from locations in neighbouring states like Yamuna Nagar in Haryana and Dholpur in Madhya Pradesh. The last eight years have seen a period of policy development starting FY12 and subsequent ban against illegal sandmining by a Supreme Court order in November FY18. This has affected the movement of sand on the Asset.

6.18 FY15 through FY18, we see cumulative drops of about 1,300 in 3A+MAV traffic, a significant majority of which is believed to be due to the ban on illegal sandmining. With licences being given out again, FY19 has shown recovery of 3A+MAV traffic. While about 10% of traffic is already estimated to be recovered by FY21, and further recovery in traffic volumes in FY22 as well, we believe the majority of the recoverable volumes related to sand mining traffic will start using the Asset by FY23 as more and more sand mines start operating. The table below presents the impact of recovery of sand mining traffic on the Asset.

Table 6.5: Ongoing recovery of sand movement

Vehicle type	Year of Impact
	FY23 Onwards
3A+MAV	+15% (3A+MAV)

Source: Steer analysis of OD data, client TMS data and publicly available information

Ganga Expressway

6.19 Ganga expressway is a greenfield six-laned expressway (expandable upto 8 lanes) of length 594 kms connecting Meerut to Prayagraj in the State of Uttar Pradesh. The expressway is expected to reduce travel time between NCR, Meerut and Prayagraj substantially and would help in decongesting the existing road network. This would be an access-controlled expressway and is proposed to have 17 entry/exit points. As on date upto 94% land acquisition has happened for the project. LOA has been awarded to the winning bidders and construction is expected to start soon. The expressway is divided in 4 different packages considered as 4 concessions as presented below:

Table 6.6: Details of Ganga Expressway (Phase I)

Package	Description of sections	Length (kms)	Expected timeline for completion	Awarded
Package 1	Meerut-Hapur (49 km) Hapur to Amroha (30 km) Amroha to Budaun (51 km)	130	FY25, operational by FY26	IRB Infrastructure Developers Ltd.
Package 2	Budaun villages Naglabarah to Binawar (52 km) Budaun-Shahjahanpur (47 km) Shahjahanpur-Hardoi (53 km)	152		Adani Enterprises Ltd.
Package 3	Hardoi- Unnao (156 km)	156		
Package 4	Hardoi-Prayagraj (157 km)	157		

6.20 Ganga expressway is proposed to extend to Tigri on the UP-Uttarakhand border in north and to Ballia near Varanasi in the east. This alignment would run parallelly to NH19 and would offer direct connectivity from the North to Varanasi and East.

6.21 As per its latest alignment, Delhi Meerut expressway is expected to intersect with Ganga Expressway which can provide an alternate faster route to traffic currently plying between Haridwar and north in Uttarakhand and Lucknow in eastern UP. Passenger traffic can therefore alternately travel from Haridwar through Muzaffarnagar and Meerut (Asset section) and further south eastwards through the Delhi-Meerut and Ganga Expressways to reach Prayagraj (Allahabad) with much higher levels of service and speeds.

6.22 Our estimates of the impact due to diversion from the Haridwar-Moradabad-Sitapur-Lucknow-Allahabad route are presented below:

Table 6.7: Diversion impact due to Ganga Expressway

Vehicle type	FY26
CJV	**+1.6%**

Source: Steer Analysis

Revenue forecasting assumptions

6.23 To forecast the revenues for a particular year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate. While toll segmentation provides the breakup of trips paying each ticket type, trip factors provide the conversion factor to convert from traffic (trips) to tickets sold. This section discusses assumptions related to toll segmentation, trip factors and toll rates for the forecast period.

Toll evolution

6.24 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is July) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.25 We have used actual toll rates from the FY22 toll notification to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.8: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23*	14.55%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI assumptions as shared by Client, *FY23 WPI as per the latest March 2022 WPI released by RBI

Toll segmentation and trip factors

6.26 We have analysed the historical toll plaza data split by toll categories and tick type to understand segmentation trends, as shown in Chapter 2. Implementation of FASTag and increased ETC penetration have to lead to a reduction in exemptions and violations. With FASTag implementation, the combined share of violation and exemption has reduced by 4-5% in CJVs, the biggest traffic contributor on this Asset.

6.27 The table below provides the toll segmentation assumed for the period of forecast. For the purpose of traffic and revenue forecast the average historical toll segmentation of Oct-Mar FY22 is assumed taking into consideration current exemption and violation reported. We believe with FASTag penetration stabilising and reaching upto 100% in MAVs and minimal impact of COVID-19 during these months, Oct-Mar FY22 segmentation provide us with stable toll segmentation which can be used for the forecast years.

Table 6.9: Forecast toll segmentation, FY22 onwards

Forecast	CJV/Mini-LCV	LCV	Bus/2A	3A/MAV
Single	79.01%	95.29%	96.88%	96.41%
Return	-	-	-	-
Monthly	-	-	-	-
Local commercial	0.15%	1.07%	0.66%	2.32%
Local personal	2.71%	-	-	-
Exemptions	7.35%	1.31%	0.92%	0.27%
Violations	10.78%	2.33%	1.53%	1.00%

Source: Steer analysis of Client TMS data

Revenue reconciliation

6.28 As part of the validation process to test our model, we have carried out a revenue reconciliation exercise where we compare actual reported revenue against the modelled revenue. For the Asset we have reconciled reported revenue for the month of Feb 2022 with the modelled revenue based on Feb 2022 MADT and forecast assumptions on toll segmentation, trip factors and toll rates.

6.29 The comparison, as shown in the table below, shows that modelled revenue overall is within a variation of 2% from the reported revenue. This gives us confidence that the revenues estimated using the traffic data in our forecasts are accurately representing the revenues being reported from the Asset.

Table 6.10: Revenue reconciliation summary for Feb 2022

Steer modelled daily revenue (INR cr)	Reported daily revenue (INR cr)	Difference (%)
0.35	0.36	0.01%

Source: Steer comparison between modelled and reported revenue for Feb 2022

Traffic and Revenue forecasts

6.30 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the concession period for the Asset. The table below presents the AADT/PCU forecast and CAGRs on this Asset. Further, Annexure B presents year-wise AADT, traffic growth rates and revenues for the forecast period.

Table 6.11: Traffic forecasts (with impacts) AADT forecast for TP Siwaya

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	24,548	26,284	28,178	30,208	32,894	35,172
Mini LCV	1,534	1,555	1,578	1,601	1,624	1,646
LCV	1,131	1,147	1,164	1,180	1,197	1,214
Bus	1,570	1,614	1,661	1,709	1,758	1,807
2A	475	490	506	522	539	556
3A	456	541	558	576	595	613
MAV	926	1,107	1,150	1,196	1,243	1,291
OSV	10	10	10	11	11	12
AADT	**30,649**	**32,748**	**34,805**	**37,003**	**39,861**	**42,310**
PCU's	**38,761**	**41,647**	**43,993**	**46,489**	**49,654**	**52,409**

Source: Steer analysis

Figure 6.2: Traffic forecasts (with impacts) traffic CAGR (%) for TP Siwaya

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
CJV	7.1%	7.2%	7.2%	8.9%	7.5%
Mini LCV	1.4%	1.4%	1.4%	1.4%	1.4%
LCV	1.4%	1.4%	1.4%	1.4%	1.4%
Bus	2.8%	2.9%	2.9%	2.9%	2.8%

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
2A	3.2%	3.2%	3.2%	3.2%	3.2%
3A	18.7%	3.2%	3.2%	3.2%	6.1%
MAV	19.5%	4.0%	4.0%	4.0%	6.9%
OSV	3.9%	4.0%	4.0%	4.0%	3.9%
AADT	**6.8%**	**6.3%**	**6.3%**	**7.7%**	**6.7%**
PCU's	**7.4%**	**5.6%**	**5.7%**	**6.8%**	**6.2%**

Source: Steer analysis

Figure 6.3: Revenue forecast (INR crores) for TP Siwaya

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	64.6	79.5	91.0	102.1	115.9	132.7
Mini LCV	4.0	4.7	5.1	5.4	5.7	6.2
LCV	6.3	7.3	7.9	8.6	9.2	9.7
Bus	18.1	21.0	23.2	25.3	27.4	29.6
2A	5.5	6.4	7.1	7.7	8.4	9.1
3A	8.5	11.4	12.6	13.8	15.0	16.3
MAV	17.2	23.3	26.0	28.6	31.4	34.3
OSV	0.2	0.2	0.2	0.3	0.3	0.3
Total	**124.4**	**153.8**	**173.1**	**191.9**	**213.3**	**238.2**

Source: Steer analysis

Figure 6.4: Revenue forecast CAGR (%) for TP Siwaya

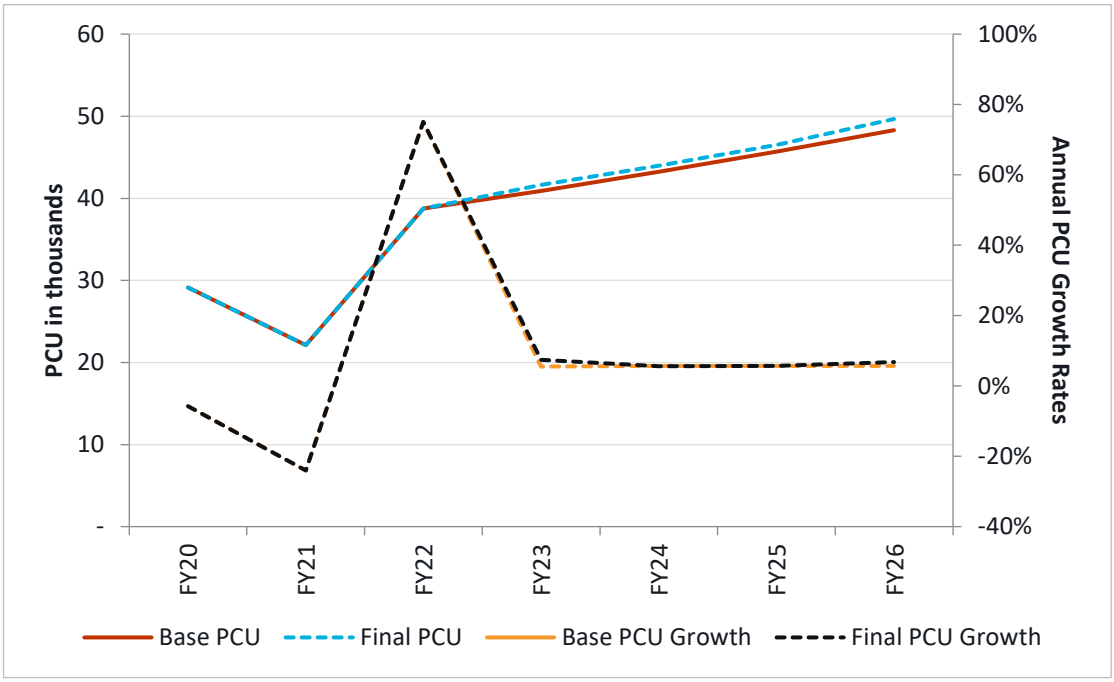
Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
CJV	23.0%	14.5%	12.2%	13.5%	15.5%
Mini LCV	16.5%	8.3%	6.2%	5.7%	9.0%
LCV	14.7%	8.8%	8.8%	6.8%	9.0%
Bus	16.5%	10.2%	9.3%	8.0%	10.4%
2A	16.9%	10.6%	9.7%	8.4%	10.8%
3A	34.3%	10.9%	9.1%	9.1%	13.9%
MAV	35.2%	11.7%	9.9%	9.9%	14.7%
OSV	17.6%	11.7%	9.9%	9.9%	11.6%
Total	**23.6%**	**12.6%**	**10.8%**	**11.2%**	**13.9%**

Source: Steer analysis

6.31 As presented in the table above, CAGRs (FY22-FY27) in terms of PCUs for the traffic forecasts (with impacts) growth rates are 6.2%, the corresponding CAGRs in terms of traffic being 6.7%. While the background growth is primarily driven by car growth, the major uplift in final growth

rates (as also seen in the chart below) is driven by two impacts in the FY22-FY23 period – recovery from ban on sandmining, diversion to the recently constructed Delhi-Meerut Expressway.

Figure 6.5: Traffic and growth rates for forecast PCUs – Base and With Impacts



Source: Steer analysis

Upside and Downside Cases

6.32 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.33 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.34 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.12: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
WUPTL	GDP/GSDP	+1% every year	-1% every year
WUPTL	WPI	+1% every year	-1% every year
WUPTL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.35 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.36 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.37 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.13: Traffic forecast (With Upside Impacts) for TP1

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	24,548	26,727	29,140	31,770	35,181	38,249
Mini LCV	1,534	1,561	1,589	1,618	1,647	1,676
Bus	1,131	1,151	1,172	1,193	1,215	1,236
LCV	1,570	1,626	1,684	1,745	1,808	1,871
2A	475	494	514	535	557	578
3A	456	545	567	590	614	638
MAV	926	1,117	1,173	1,231	1,292	1,354
OSV	10	10	11	11	12	12
AADT	**30,649**	**33,231**	**35,850**	**38,693**	**42,325**	**45,614**
PCU's	**38,761**	**42,201**	**45,183**	**48,406**	**52,433**	**56,120**

Source: Steer analysis

Table 6.14: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
CJV	8.9%	9.0%	9.0%	10.7%	9.3%
Mini LCV	1.8%	1.8%	1.8%	1.8%	1.8%
Bus	1.8%	1.8%	1.8%	1.8%	1.8%
LCV	3.6%	3.6%	3.6%	3.6%	3.6%
2A	4.0%	4.1%	4.1%	4.1%	4.0%
3A	19.6%	4.1%	4.1%	4.1%	7.0%
MAV	20.6%	5.0%	5.0%	5.0%	7.9%
AADT	**4.9%**	**5.0%**	**5.0%**	**5.0%**	**4.9%**
PCU's	**8.4%**	**7.9%**	**7.9%**	**9.4%**	**8.3%**

Source: Steer analysis

Table 6.15: Revenue forecast (With Upside Impacts) for TP1 (In Cr)

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	64.7	80.9	94.7	110.9	129.0	149.8
Mini LCV	4.0	4.7	5.2	5.6	6.0	6.6

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
Bus	6.4	7.4	8.3	8.9	9.6	10.4
LCV	18.1	21.2	23.9	26.2	28.9	31.9
2A	5.5	6.4	7.3	8.0	8.9	9.9
3A	8.5	11.6	13.1	14.5	16.0	17.7
MAV	17.4	23.7	27.0	30.2	33.8	37.5
OSV	0.2	0.2	0.2	0.3	0.3	0.3
Total Revenue	**124.8**	**156.1**	**179.7**	**204.6**	**232.7**	**264.2**

Source: Steer analysis

Table 6.16: Revenue growth (With Upside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY23-FY27
CJV	25.1%	17.1%	17.1%	16.4%	18.3%
Mini LCV	16.9%	9.3%	9.3%	7.0%	10.2%
Bus	15.1%	11.8%	7.2%	8.4%	10.2%
LCV	17.3%	12.6%	9.7%	10.5%	12.1%
2A	17.8%	13.1%	10.2%	11.0%	12.5%
3A	35.4%	13.1%	10.7%	10.8%	15.7%
MAV	36.5%	14.1%	11.7%	11.8%	16.7%
OSV	18.7%	14.1%	11.7%	11.8%	13.4%
Total	**25.1%**	**15.1%**	**13.9%**	**13.7%**	**16.2%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.38 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.39 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.17: Traffic forecast (With Downside Impacts) for TP1

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	24,548	25,889	27,335	28,862	30,953	32,604
Mini LCV	1,534	1,550	1,568	1,585	1,603	1,620
Bus	1,131	1,144	1,156	1,169	1,182	1,195
LCV	1,570	1,604	1,640	1,677	1,714	1,751
2A	475	487	499	511	524	537
3A	456	537	550	564	578	592
MAV	926	1,097	1,131	1,166	1,201	1,236
OSV	10	10	10	11	11	11
AADT	**30,649**	**32,318**	**33,890**	**35,545**	**37,767**	**39,546**

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
PCU's	**38,761**	**41,155**	**42,949**	**44,831**	**47,286**	**49,294**

Source: Steer analysis

Table 6.18: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
CJV	5.5%	5.6%	5.6%	7.2%	5.8%
Mini LCV	1.1%	1.1%	1.1%	1.1%	1.1%
Bus	1.1%	1.1%	1.1%	1.1%	1.1%
LCV	2.2%	2.2%	2.2%	2.2%	2.2%
2A	2.5%	2.5%	2.5%	2.5%	2.5%
3A	17.8%	2.5%	2.5%	2.5%	5.4%
MAV	18.5%	3.1%	3.1%	3.1%	5.9%
OSV	3.0%	3.1%	3.1%	3.1%	3.0%
AADT	**5.4%**	**4.9%**	**4.9%**	**6.3%**	**5.2%**
PCU's	**6.2%**	**4.4%**	**4.4%**	**5.5%**	**4.9%**

Source: Steer analysis

Table 6.19: Revenue forecast (With Downside Impacts) for TP1 (In Cr)

Vehicle Type	FY22	FY23	FY24	FY25	FY26	FY27
CJV	64.7	78.3	88.8	97.6	109.1	119.6
Mini LCV	4.0	4.7	5.1	5.4	5.6	5.9
Bus	6.4	7.4	8.0	8.5	9.0	9.5
LCV	18.1	20.9	22.8	24.3	26.1	27.9
2A	5.5	6.4	6.9	7.4	8.0	8.6
3A	8.5	11.4	12.5	13.3	14.3	15.2
MAV	17.4	23.3	25.8	27.6	29.6	31.8
OSV	0.2	0.2	0.2	0.2	0.3	0.3
Total Revenue	**124.8**	**152.5**	**170.3**	**184.5**	**202.0**	**218.8**

Source: Steer analysis

Table 6.20: Revenue growth (With Downside Impacts) CAGR (%) for TP1

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
CJV	21.1%	13.4%	9.9%	11.8%	13.1%
Mini LCV	16.1%	8.6%	5.3%	5.4%	8.0%
Bus	14.3%	9.0%	5.9%	6.0%	8.1%
LCV	15.8%	9.1%	6.8%	7.2%	9.1%
2A	16.1%	9.4%	7.1%	7.4%	9.4%
3A	33.4%	10.1%	6.4%	6.9%	12.3%

Vehicle Type	FY22-FY23	FY23-FY24	FY24-FY25	FY25-FY26	FY22-FY27
MAV	34.1%	10.7%	7.0%	7.5%	12.9%
OSV	16.6%	10.7%	7.0%	7.5%	9.8%
Total	**22.3%**	**11.6%**	**8.3%**	**9.5%**	**11.9%**

Source: Steer analysis

Summary outlook

6.40 Overall, the passenger traffic on the Asset has a mix of regional movement between urban agglomerations in Uttar Pradesh and Central NCR (Delhi) as well as tourism traffic to Uttarakhand. Goods traffic are driven by regional industries related to sugar mills and construction-related movement, which has demonstrated recovery since FY19 from a temporary ban on sandmining. Network-related developments on the Upper Ganga Canal (UGC) Road and the local micro-diversion road around Siwaya toll plaza have caused diversions away from the Asset/toll plaza. The commissioning of Delhi Meerut Expressway has resulted in a significant increase in traffic volumes in FY22.

6.41 Therefore, we see a positive outlook going forward for the region and the Asset given that it is the primary route on the tourism corridor connecting Delhi NCR with Uttarakhand – one of the key hill station states in Northern India with several destinations. Ganga Expressway, expected to be complete in FY26, is expected to cause a positive diversion to Asset route from Haridwar to Prayagraj by bringing in some traffic from the competing Moradabad-Bareilly-Sitapur route due to improved speeds and levels of service of the two expressways.

6.42 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be risks associated with assumptions and the forecasts using them as summarised below.

6.43 With regards to the long-term background growth, we see the following risks:

6.44 The nascent recovery from the pandemic could be subdued due to stronger lockdowns being implemented and traffic growth not sustaining in the coming months. However, a strong recovery of traffic was observed in FY21 once the nationwide lockdown was relaxed. This included pent-up demand from the lockdown period giving a major boost to traffic in FY21. It can be expected that a similar pattern, albeit to a much smaller extent, has repeated itself in FY22 with the first quarter being more subdued and the follow three quarters witnessing stronger recovery.

- The underlying strengthening and sustainability of the wider economic growth, particularly for sectors like tourism, hospitality, leisure has seen a major comeback in the second part of FY22 resulting in increased activity in the corridor.

6.45 With regards to impacts, we see the following risks:

- Sustained recovery of the sand movement would depend on the continued giving away of sandmining licences and consequent opening of mines.
- Positive diversion impact due to the Ganga Expressway would depend on completion of the expressway before end of the concession period.

6.46 Overall, we see a positive outlook for the region and the Asset, being the primary route of tourism for the NCR region and strong demonstrated recovery of sandmining traffic and COVID-19 lockdown impacts. The underlying growth drivers of the corridor are therefore strong and are expected to deliver sustained growth.

Appendices

A Top 10 OD pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at TP1 Siwaya. Please see this data for both CJVs and MAVs and OSVs combined below.

TP1 Siwaya

Table A.1: CJV top 10 OD pair shares at TP Siwaya

	OD Pair	Share
1.	Meerut City-Siwaya Area	6.6%
2.	Meerut City-Muzzaffarnagar City	5.4%
3.	Meerut City-Hardwar City	4.5%
4.	North NCT of Delhi-Hardwar City	4.3%
5.	Khatauli City-Meerut City	3.5%
6.	Meerut City-Saharanpur City	2.8%
7.	Meerut City-Roorkee City	2.7%
8.	Modinagar City-Siwaya Area	2.3%
9.	North NCT of Delhi-Muzzaffarnagar City	2.3%
10.	Modinagar City-Hardwar City	2.2%

Source: Steer analysis of OD data

Table A.2: MAV top 10 OD pair shares at TP Siwaya

	OD Pair	Share
1.	North NCT of Delhi-Hardwar City	9.1%
2.	Meerut City-Muzzaffarnagar City	8.2%
3.	North NCT of Delhi-Muzzaffarnagar City	4.7%
4.	Gaziabad City-Muzzaffarnagar City	4.7%
5.	North NCT of Delhi-Dehradun City	2.3%
6.	Meerut City-Hardwar City	2.0%
7.	Bulandshahr-Rest of Dehradun	1.8%
8.	Gaziabad City-Hardwar City	1.8%
9.	Faridabad City-Hardwar City	1.8%
10.	Modinagar City-Muzzaffarnagar City	1.8%

Source: Steer analysis of OD data

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY26. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Forecasts for final (background + impacts) AADT at TP Siwaya

Vehicle type	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total AADT	Total PCUs
FY22	24,548	1,534	1,131	1,570	475	456	926	10	30,649	38,761
FY23	26,284	1,555	1,147	1,614	490	541	1,107	10	32,748	41,647
FY24	28,178	1,578	1,164	1,661	506	558	1,150	10	34,805	43,993
FY25	30,208	1,601	1,180	1,709	522	576	1,196	11	37,003	46,489
FY26	32,894	1,624	1,197	1,758	539	595	1,243	11	39,861	49,654
FY27	35,172	1,646	1,214	1,807	556	613	1,291	12	42,310	52,409

Source: Steer analysis

Table B.2: Forecasts for final (background +impacts) AADT growth rates (%) at TP Siwaya

Vehicle type	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total AADT	Total PCUs
FY22	123.1%	123.1%	7.7%	35.7%	35.7%	11.5%	11.5%	11.5%	97.8%	75.1%
FY23	7.1%	1.4%	1.4%	2.8%	3.2%	3.2%	3.9%	3.9%	6.1%	5.5%
FY24	7.2%	1.4%	1.4%	2.9%	3.2%	3.2%	4.0%	4.0%	6.3%	5.7%
FY25	7.2%	1.4%	1.4%	2.9%	3.2%	3.2%	4.0%	4.0%	6.3%	5.7%
FY26	7.2%	1.4%	1.4%	2.9%	3.2%	3.2%	4.0%	4.0%	6.3%	5.7%

Source: Steer analysis

Revenue forecasts

B.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY26.

Table B.3: Forecasts for final (background + impacts) revenue at TP Siwaya

Vehicle type	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY22	64.7	4.0	6.4	18.1	5.5	8.5	17.4	0.2	**124.8**

Vehicle type	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
FY23	79.5	4.7	7.4	21.0	6.4	11.5	23.5	0.2	**154.2**
FY24	91.6	5.1	8.1	23.3	7.1	12.8	26.4	0.2	**174.6**
FY25	102.2	5.4	8.7	25.3	7.8	13.9	28.8	0.3	**192.4**
FY26	116.0	5.7	9.3	27.4	8.4	15.2	31.7	0.3	**213.9**
FY27	132.7	6.2	9.9	29.6	9.1	16.4	34.5	0.3	**238.9**

Source: Steer analysis

C Data Collection exercise

C.1 In order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7-day TVC counts

Table C.1: 7-day TVC counts at TP Siwaya

Date	CJV	Mini LCV	LCV	Bus	2A	3A	MAV	OSV	Total
18-01-2021	15,981	906	1,124	1,211	359	327	750	7	20,665
19-01-2021	14,791	957	1,512	1,256	361	432	898	9	20,216
20-01-2021	13,940	1,071	1,442	1,228	300	437	821	8	19,247
21-01-2021	14,664	1,123	1,472	1,254	417	343	763	10	20,046
22-01-2021	15,770	1,013	1,633	1,258	491	427	864	9	21,465
23-01-2021	18,403	1,038	1,650	1,315	395	432	817	12	24,062
24-01-2021	19,831	976	1,477	1,269	337	386	748	4	25,028

Source: Steer analysis

Table C.2: Consolidated WADT at TP Siwaya

Toll plaza	Source	CJV+ Mini LCV	LCV	Bus	2A	3A + MAV	OSV	Total
TP1	TVC	17,209	1,473	1,256	380	1,206	8	21,533
	TMS	11,882	1,058	1,761	153	1,185	-	16,039

Source: Steer analysis

Table C.3: 7-Day TVC count on Muradnagar UGC Junction

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
20/03/2021	11,022	639	1,123	28	183	209	317	1	13,522
21/03/2021	11,538	493	995	50	110	185	321	2	13,694
22/03/2021	9,731	633	838	38	242	214	253	3	11,952
23/03/2021	8,275	649	1,045	26	205	211	317	3	10,731
24/03/2021	8,744	657	1,030	23	255	233	267	3	11,212
25/03/2021	9,077	621	1,060	19	232	253	292	1	11,555

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
26/03/2021	10,199	680	1,164	47	232	235	283	8	12,848

Table C.4: 7-Day TVC count on Khatauli UGC Junction

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
20/03/2021	9,159	653	1,053	34	229	193	444	4	11,769
21/03/2021	8,633	566	1,033	49	135	192	493	1	11,102
22/03/2021	7,654	858	932	28	165	171	490	1	10,299
23/03/2021	6,804	653	1,078	27	226	192	528	4	9,512
24/03/2021	7,134	773	1,100	25	216	228	514	2	9,992
25/03/2021	7,529	735	1,079	24	231	246	437	1	10,282
26/03/2021	8,083	671	1,098	46	258	212	476	1	10,845

Table C.5: 7-Day TVC count on the Microdiversion

Date	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
20/03/2021	3,931	235	4	2	-	-	-	-	4,172
21/03/2021	4,534	210	3	-	1	-	-	-	4,748
22/03/2021	4,177	209	3	3	-	-	-	-	4,392
23/03/2021	3,779	222	1	2	-	-	-	-	4,004
24/03/2021	3,811	265	1	-	-	-	-	-	4,077
25/03/2021	3,924	227	-	1	-	-	-	-	4,152
26/03/2021	3,604	230	2	-	-	-	-	-	3,836

Source: Steer Analysis

Zone list

Table C.6: Zone list used for OD analysis

Zone No	Zone name	State
1	Rest of India	Andaman & Nicobar Island
2	Rajahmundry City	Andhra Pradesh
3	Rest of Andhra Pradesh	Andhra Pradesh
4	Vijayawada City	Andhra Pradesh
5	Visakhapatnam Port	Andhra Pradesh
6	Bhutan	Bhutan
7	Gaya	Bihar
8	Rest of Bihar	Bihar
9	Chandigarh	Chandigarh
10	Bailadilla City	Chhattisgarh
11	Bhilai City	Chhattisgarh
12	Bilaspur City	Chhattisgarh
13	Rest of Chhattisgarh	Chhattisgarh
14	Dadara & Nagar Havelli	Dadara & Nagar Havelli
15	Daman & Diu	Daman & Diu
16	Goa	Goa
17	Jamnagar Port	Gujarat

Zone No	Zone name	State
18	Kandla Port	Gujarat
19	Mundra Port	Gujarat
20	Pipavav Port	Gujarat
21	Rest of Gujarat	Gujarat
22	Surat Port	Gujarat
23	Ambala City	Haryana
24	Bhiwani	Haryana
25	Faridabad City	Haryana
26	Fatehabad	Haryana
27	Gurgaon City	Haryana
28	Hisar	Haryana
29	Jhajjar	Haryana
30	Jind	Haryana
31	Kaithal	Haryana
32	Karnal City	Haryana
33	Kurukshetra	Haryana
34	Mahendragarh	Haryana
35	Mewat	Haryana
36	Palwal	Haryana
37	Panchkula	Haryana
38	Panipat City	Haryana
39	Rest of Ambala	Haryana
40	Rest of Faridabad	Haryana
41	Rest of Gurgaon	Haryana
42	Rest of Karnal	Haryana
43	Rest of Panipat	Haryana
44	Rest of Rewari	Haryana
45	Rest of Sonipat	Haryana
46	Rest of Yamunanagar	Haryana
47	Rewari City	Haryana
48	Rohtak	Haryana
49	Sirsa	Haryana
50	Sonipat City	Haryana
51	Yamunanagar City	Haryana
52	Himachal Pradesh	Himachal Pradesh
53	Jammu & Kashmir	Jammu & Kashmir
54	Bokaro City	Jharkhand
55	Hazaribagh City	Jharkhand
56	Jamshedpur City	Jharkhand
57	Rest of Jharkhand	Jharkhand
58	Bangalore City	Karnataka
59	Bellary City	Karnataka
60	Rest of Karnataka	Karnataka
61	Kochi Port	Kerala
62	Rest of Kerala	Kerala
63	Alirajpur	Madhya Pradesh
64	Anuppur	Madhya Pradesh
65	Ashoknagar	Madhya Pradesh
66	Balaghat City	Madhya Pradesh

Zone No	Zone name	State
67	Barwani	Madhya Pradesh
68	Betul	Madhya Pradesh
69	Bhind	Madhya Pradesh
70	Bhopal	Madhya Pradesh
71	Burhanpur	Madhya Pradesh
72	Chhatarpur	Madhya Pradesh
73	Chhindwara	Madhya Pradesh
74	Damoh	Madhya Pradesh
75	Datia	Madhya Pradesh
76	Dewas	Madhya Pradesh
77	Dhar	Madhya Pradesh
78	Dindori	Madhya Pradesh
79	East Nimar	Madhya Pradesh
80	Guna	Madhya Pradesh
81	Gwalior	Madhya Pradesh
82	Harda	Madhya Pradesh
83	Hoshangabad	Madhya Pradesh
84	Indore City	Madhya Pradesh
85	Jabalpur	Madhya Pradesh
86	Jhabua	Madhya Pradesh
87	Katni	Madhya Pradesh
88	Mandla	Madhya Pradesh
89	Mandsaur	Madhya Pradesh
90	Morena	Madhya Pradesh
91	Narsimhapur	Madhya Pradesh
92	Neemuch	Madhya Pradesh
93	Panna	Madhya Pradesh
94	Raisen	Madhya Pradesh
95	Rajgarh	Madhya Pradesh
96	Ratlam	Madhya Pradesh
97	Rest of Balaghat	Madhya Pradesh
98	Rest of Indore	Madhya Pradesh
99	Rewa	Madhya Pradesh
100	Sagar	Madhya Pradesh
101	Satna	Madhya Pradesh
102	Sehore	Madhya Pradesh
103	Seoni	Madhya Pradesh
1033	Shahdol	Madhya Pradesh
104	Shajapur	Madhya Pradesh
105	Sheopur	Madhya Pradesh
106	Shivpuri	Madhya Pradesh
107	Sidhi	Madhya Pradesh
108	Singrauli	Madhya Pradesh
109	Tikamgarh	Madhya Pradesh
110	Ujjain	Madhya Pradesh
111	Umaria	Madhya Pradesh
112	Vidisha	Madhya Pradesh
113	West Nimar	Madhya Pradesh
114	Mumbai City	Maharashtra

Zone No	Zone name	State
115	Nagpur City	Maharashtra
116	Pune	Maharashtra
117	Rest of Maharashtra	Maharashtra
118	North East India	Mizoram
119	Central NCT of Delhi	NCT of Delhi
120	East NCT of Delhi	NCT of Delhi
121	Muradnagar Area	NCT of Delhi
122	New Delhi NCT of Delhi	NCT of Delhi
123	North East NCT of Delhi	NCT of Delhi
124	North NCT of Delhi	NCT of Delhi
125	South NCT of Delhi	NCT of Delhi
126	South West NCT of Delhi	NCT of Delhi
127	West NCT of Delhi	NCT of Delhi
128	Nepal	Nepal
129	Paradip Port	Odisha
130	Rayagada City	Odisha
131	Rest of Odisha	Odisha
132	Rourkela City	Odisha
133	Pakistan	Pakistan
134	Puducherry	Puducherry
135	Punjab	Punjab
136	Ajmer	Rajasthan
137	Alwar Area	Rajasthan
138	Banswara	Rajasthan
139	Baran	Rajasthan
140	Barmer	Rajasthan
141	Bharatpur	Rajasthan
142	Bhilwara	Rajasthan
143	Bikaner	Rajasthan
144	Bundi	Rajasthan
145	Chittaurgarh	Rajasthan
146	Churu	Rajasthan
147	Dausa	Rajasthan
148	Dhaulpur	Rajasthan
149	Dungarpur	Rajasthan
150	Ganganagar	Rajasthan
151	Hanumangarh	Rajasthan
152	Harsoli Area	Rajasthan
153	Jaipur City	Rajasthan
154	Jaisalmer	Rajasthan
155	Jalor	Rajasthan
156	Jhalawar	Rajasthan
157	Jhunjhunun	Rajasthan
158	Jodhpur City	Rajasthan
159	Karauli	Rajasthan
160	Kota	Rajasthan
161	Nagaur	Rajasthan
162	Pali	Rajasthan
163	Pratapgarh	Uttar Pradesh

Zone No	Zone name	State
164	Rajsamand	Rajasthan
165	Rest of Jaipur	Rajasthan
166	Rest of Jodhpur	Rajasthan
167	Rest of Udaipur	Rajasthan
168	Sawai Madhopur	Rajasthan
169	Sikar	Rajasthan
170	Sirohi	Rajasthan
171	Tonk	Rajasthan
172	Udaipur City	Rajasthan
173	Chennai City	Tamil Nadu
174	Coimbatore City	Tamil Nadu
175	Rest of Tamil Nadu	Tamil Nadu
176	Tiruppur City	Tamil Nadu
177	Tuticorin Port	Tamil Nadu
178	Hyderabad City	Telangana
179	Kothagudem City	Telangana
180	Rest of Telangana	Telangana
181	Agra City	Uttar Pradesh
182	Aligarh City	Uttar Pradesh
183	Allahabad	Uttar Pradesh
184	Ambedkar Nagar	Uttar Pradesh
185	Auraiya	Uttar Pradesh
186	Azamgarh	Uttar Pradesh
187	Baghpat Area	Uttar Pradesh
188	Bahraich	Uttar Pradesh
189	Ballia	Uttar Pradesh
190	Balrampur	Uttar Pradesh
191	Banda	Uttar Pradesh
192	Bara Banki	Uttar Pradesh
193	Baraut Area	Uttar Pradesh
194	Bareilly	Uttar Pradesh
195	Basti	Uttar Pradesh
196	Bhatipura Area	Uttar Pradesh
197	Bhokarhedi-KhaiKheri-Purquazi Area	Uttar Pradesh
198	Bijnor City	Uttar Pradesh
199	Budaun	Uttar Pradesh
200	Budhana Area	Uttar Pradesh
201	Bulandshahr	Uttar Pradesh
202	Chandauli	Uttar Pradesh
203	Charthawal Area	Uttar Pradesh
204	Chitrakoot	Uttar Pradesh
205	Dadri City	Uttar Pradesh
206	Dasna Area	Uttar Pradesh
207	Deoband-Nagal Area	Uttar Pradesh
208	Deoria	Uttar Pradesh
209	Etah	Uttar Pradesh
210	Etawah	Uttar Pradesh
211	Faizabad	Uttar Pradesh

Zone No	Zone name	State
212	Farrukhabad	Uttar Pradesh
213	Fatehpur	Uttar Pradesh
214	Firozabad	Uttar Pradesh
215	Gagalheri-Behat Area	Uttar Pradesh
216	GarhMukteshwar Area	Uttar Pradesh
217	Gaziabad City	Uttar Pradesh
218	Ghazipur	Uttar Pradesh
219	Gonda	Uttar Pradesh
220	Gorakhpur	Uttar Pradesh
221	Hamirpur	Uttar Pradesh
222	Hapur City	Uttar Pradesh
223	Hararfatehpur Area	Uttar Pradesh
224	Hardoi	Uttar Pradesh
225	Jalaun	Uttar Pradesh
226	Jani Area	Uttar Pradesh
227	Jansath-Jawan Area	Uttar Pradesh
228	Jarouda Area	Uttar Pradesh
229	Jaunpur	Uttar Pradesh
230	Jhansi	Uttar Pradesh
231	Jyotiba Phule Nagar	Uttar Pradesh
232	Kairana-Kandhla Area	Uttar Pradesh
233	Kannauj	Uttar Pradesh
234	Kanpur Dehat	Uttar Pradesh
235	Kanpur Nagar City	Uttar Pradesh
236	Kansiram Nagar	Uttar Pradesh
237	Kaushambi	Uttar Pradesh
238	Khatauli City	Uttar Pradesh
239	Kheri	Uttar Pradesh
240	Kushinagar	Uttar Pradesh
241	Lalitpur	Uttar Pradesh
242	Lucknow	Uttar Pradesh
243	Mahamaya Nagar	Uttar Pradesh
244	Maharajganj	Uttar Pradesh
245	Mahoba	Uttar Pradesh
246	Mainpuri	Uttar Pradesh
247	Mansurpur Area	Uttar Pradesh
248	Mataur Area	Uttar Pradesh
249	Mathura City	Uttar Pradesh
250	Mau	Uttar Pradesh
251	Mawana-Hastinapur Area	Uttar Pradesh
252	Meerut City	Uttar Pradesh
253	Miranpur Area	Uttar Pradesh
254	Mirzapur	Uttar Pradesh
255	Modinagar City	Uttar Pradesh
256	Modipuram City	Uttar Pradesh
257	Moradabad City	Uttar Pradesh
258	Muzzaffarnagar City	Uttar Pradesh
259	Najibabad City	Uttar Pradesh
260	Nanauta-RampurManiharan Area	Uttar Pradesh

Zone No	Zone name	State
261	Noida City	Uttar Pradesh
262	Pilibhit	Uttar Pradesh
263	Pilkhuwa Area	Uttar Pradesh
264	Rae Bareli	Uttar Pradesh
265	Rampur	Uttar Pradesh
266	Rest of Agra	Uttar Pradesh
267	Rest of Aligarh	Uttar Pradesh
268	Rest of Bijnor	Uttar Pradesh
269	Rest of Gautam Buddha Nagar	Uttar Pradesh
270	Rest of Kanpur Nagar	Uttar Pradesh
271	Rest of Mathura	Uttar Pradesh
272	Rest of Moradabad	Uttar Pradesh
273	Rest of Varanasi	Uttar Pradesh
274	RohanaKalan-Chhapar Area	Uttar Pradesh
275	Saharanpur City	Uttar Pradesh
276	Sakoti Area	Uttar Pradesh
277	Sant Kabir Nagar	Uttar Pradesh
278	Sant Ravi Das Nagar(bhadohi)	Uttar Pradesh
279	Sardhana-Dungar Area	Uttar Pradesh
280	Shahjahanpur	Uttar Pradesh
281	Shamli City	Uttar Pradesh
282	Shrawasti	Uttar Pradesh
283	Siddharth Nagar	Uttar Pradesh
284	Sitapur	Uttar Pradesh
285	Siwaya Area	Uttar Pradesh
286	Sonbhadra	Uttar Pradesh
287	Sultanpur	Uttar Pradesh
288	Unnao	Uttar Pradesh
289	Varanasi City	Uttar Pradesh
290	Ghaziabad	Uttar Pradesh
291	Almora	Uttarakhand
292	Bageshwar	Uttarakhand
293	Chamoli	Uttarakhand
294	Champawat	Uttarakhand
295	Dehradun City	Uttarakhand
296	Garhwal	Uttarakhand
297	Hardwar City	Uttarakhand
298	Nainital	Uttarakhand
299	Pithoragarh	Uttarakhand
300	Rest of Dehradun	Uttarakhand
301	Rest of Hardwar	Uttarakhand
302	Roorkee City	Uttarakhand
303	Rudraprayag	Uttarakhand
304	Tehri Garhwal	Uttarakhand
305	Udham Singh Nagar	Uttarakhand
306	Uttarkashi	Uttarakhand
307	Kolkata City	West Bengal
308	Rest of West Bengal	West Bengal

Source: Steer analysis

Direction-wise commodity distribution

Table C.7: Commodity distribution at TP Siwaya (towards Muzaffarnagar)

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
AGR	6%	6%	3%	5%
CNS	11%	11%	14%	23%
GRO	4%	7%	8%	5%
MIN	-	0%	1%	5%
MAN	18%	16%	17%	27%
PET	9%	10%	14%	10%
MSC	3%	3%	5%	1%
MAC	0%	1%	1%	-
EMT	49%	46%	36%	23%
SND	1%	-	2%	1%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.8: Commodity distribution at TP Siwaya (towards Meerut)

Category Code	Mini LCV + LCV	2A	3A	MAV + OSV
AGR	6%	11%	8%	8%
CNS	5%	10%	14%	15%
GRO	2%	3%	6%	5%
MIN	-	0%	1%	1%
MAN	9%	19%	18%	23%
PET	2%	7%	6%	6%
MSC	1%	1%	4%	8%
MAC	-	0%	1%	1%
EMT	76%	48%	39%	33%
SND	-	-	2%	-
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Trip length distribution

Table C.9: Trip length distribution at TP Siwaya

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
0-65 km	28%	27%	31%	20%	16%	13%
65-300 km	61%	68%	63%	65%	68%	70%
300-500 km	3%	3%	2%	5%	7%	8%
500-1000 km	4%	1%	2%	5%	3%	5%
>1000 km	4%	1%	2%	4%	6%	5%

Distance range	CJV	Mini Bus + Bus	Mini LCV + LCV	2A Truck	3A Truck	MAV
Total	100%	100%	100%	100%	100%	100%

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre, Vatika Triangle, MG Road, Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Chanda Malhotra

Reviewer/approver

Vaibhav Gupta/Shipra Bhatia

Other contributors

Aditya Karan

Distribution

Version control/issue number

V2.0

Date

April 2022

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence of Walayar Vadakkencherry Expressways Private Limited

Cube Highways Fund Advisors Private Limited
Our ref: 23741304
Client ref: Transit

steer

Final Report
April 2022

Project Transit: Traffic Due Diligence of Walayar Vadakkencherry Expressways Private Limited

Prepared by:

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India

+91 124 441 8650
www.steergroup.com

Prepared for:

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1, Sector 16, Noida- 201301 (UP, India)

Client ref: Transit
Our ref: 23741304

Steer has prepared this material for Cube Highways Fund Advisors Private Limited . This material may only be used within the context and scope for which Steer has prepared it and may not be relied upon in part or whole by any third party or be used for any other purpose. Any person choosing to use any part of this material without the express and written permission of Steer shall be deemed to confirm their agreement to indemnify Steer for all loss or damage resulting therefrom. Steer has prepared this material using professional practices and procedures using information available to it at the time and as such any new information could alter the validity of the results and conclusions made.

steer

Table of Contents

Disclaimer ..... **vi**

Glossary Items ..... **i**

1 Introduction **1**

The assignment 1

Our approach 2

Evolution of COVID-19 pandemic in India in FY21 and FY22 3

Contents of this Report 5

2 The Asset **6**

Introduction 6

Strategic network 6

Concession and tolling details 8

Key economic activities 9

PCU factor assumption for reporting 10

3 Traffic description **12**

Introduction 12

Historical trends 12

Impact of COVID-19 on traffic and subsequent recovery of traffic volumes 13

Toll Frequencies 14

Impact of FASTag implementation 15

Share of traffic by payment type 16

Primary Data Collection 17

Key findings of the TVC data analysis 18

WADT estimates 18

TVC v/s TMS analysis 18

Key findings of origin-destination analysis 20

Overview 20

Sample rates 20

Zone Categories 20

Zonal influence 21

Internal External analysis 22

Commodity distribution 23
Trip length analysis 25
Conclusions 26

4 Socio Economic Context 28
Introduction 28
Population growth 28
National Level 28
State Level 29
Economic growth 29
GDP and GSDP Growth 29
Economic activity in the state 30

5 Traffic growth analysis 31
Introduction 31
Estimation of background elasticities 31
CJV 33
Bus 33
LCV, 2A 34
3A/MAV Trucks 34
Forecasts for background elasticities 35
Forecasts for growth drivers 35
National GDP 35
State GSDP 36

6 Forecasts: Base year AADT and Impacts 37
Introduction 37
Seasonality Correction factors 38
FY22 AADT estimates 38
Analysis of potential impacts 39
Revenue forecasting assumptions 39
Trip factors 40
Toll segmentation 40
Toll evolution 40

Revenue reconciliation 41
Traffic and Revenue forecasts 42
Upside and Downside Cases 44
Traffic and Revenue Forecasts-Upside case 44
Traffic and Revenue Forecasts-Downside case 46
Target traffic and extension in concession period 47
Summary outlook 47

Figures

Figure 1.1: Daily Reported COVID-19 cases in India 4
Figure 2.1: Asset location in the regional network context 6
Figure 2.2: Asset context 7
Figure 2.3: Typical cross-sections and toll plazas on the Asset 8
Figure 3.1: Ticket-segmentation for CJV at TP Pampampallam 16
Figure 3.2: Ticket-segmentation for MAV at TP Pampampallam 17
Figure 3.3: Comparison between TVC and TMS daily traffic data on TP Pampampallam 19
Figure 3.4: Comparison between vehicle shares from TVC and TMS WADTs 19
Figure 3.5: Zonal influence at TP Pampampallam 22
Figure 3.6: Internal-external distribution at TP Pampampallam 23
Figure 3.7: Commodity distribution at TP Pampampallam (Total) 24
Figure 3.8: Commodity distribution at TP Pampampallam (towards Palakkad) 25
Figure 3.9: Commodity distribution at TP Pampampallam (towards Coimbatore) 25
Figure 3.10: Trip length distribution TP Pampampallam 26
Figure 4.1: Evolution of Kerala's state GDP and national GDP 29
Figure 4.2: Sectoral contribution to Kerala's GSDP 30
Figure 5.1: Relationship between CJV and Bus traffic with GSDP of Kerala and Tamil Nadu 33
Figure 5.2: Relationship between commercial traffic with GSDP of Kerala 34
Figure 5.3: GDP-GSDP forecast 36
Figure 6.1: Traffic and growth rates for forecast PCUs - Background and final, TP1 Pampampallam 43

Tables

Table 1.1: Scope of work and sources of data 1

Table 1.2: Timeline of national ETC implementation 3
Table 2.1: Summary of concession 8
Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022 9
Table 2.3: Cargo Handled, Kochi Port 10
Table 2.4: PCU factors 11
Table 3.1: Historical evolution in AADT by vehicle class at TP Pampampallam 12
Table 3.2: Historical YoY growth rates and CAGR by vehicle class at TP Pampampallam 13
Table 3.3: Historical revenue evolution (in INR Crore) at TP Pampampallam: 13
Table 3.4: Typical ticket types sold at NHAI plazas 15
Table 3.5: Timeline of national ETC implementation 15
Table 3.6: Percentage of Transactions via Fast Tag, Mar 2022 at TP Pampampallam 16
Table 3.7: Historic ticket segmentation at TP Pampampallam 17
Table 3.8: Data collection schedule 17
Table 3.9: WADT at TP Pampampallam 18
Table 3.10: Sample rates for OD data 20
Table 3.11: Zone aggregations for zonal influence analysis 20
Table 3.12: Aggregate commodity categories 23
Table 4.1: CAGR of population in India 28
Table 4.2: Population Growth in India (2001 – 2011) 29
Table 5.1: Historical vehicle-wise growth and CAGR (%) at TP Pampampallam 31
Table 5.2: Identified growth drivers to model traffic growth 32
Table 5.3: Adopted forecast elasticities for background growth 35
Table 6.1: Key intermediate and final outputs in the forecast 37
Table 6.2: Seasonality correction factors for TP1 Pampampallam 38
Table 6.3: Adopted AADT for FY22 (Oct-March, MADT) 39
Table 6.4: Estimated impact of tourism revival on the Asset 39
Table 6.5: Trip factors for the forecast years 40
Table 6.6: Forecast toll segmentation, FY22 onwards 40
Table 6.7: WPI growth forecast assumptions 41
Table 6.8: Revenue reconciliation summary for March 2022 41
Table 6.9: Forecast (background plus impacts) AADT for TP1 Pampampallam 42
Table 6.10: Forecast (background plus impacts) AADT CAGR (%) TP1 Pampampallam 42

Table 6.11: Forecast (background plus impacts) revenue (INR crores) forecast for TP1 Pampampallam 42
Table 6.12: Forecast (background plus impacts) revenue CAGR (%) for TP1 Pampampallam ... 43
Table 6.13: Summary of Macro Assumptions for upside and downside cases 44
Table 6.14: Traffic forecast (With Upside Impacts) for TP1: Pampampallam 44
Table 6.15: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Pampampallam 45
Table 6.16: Revenue forecast (With Upside Impacts) for TP1: Pampampallam (In Cr) 45
Table 6.17: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Pampampallam 45
Table 6.18: Traffic forecast (With Downside Impacts) for TP1: Pampampallam 46
Table 6.19: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Pampampallam 46
Table 6.20: Revenue forecast (With Downside Impacts) for TP1: Pampampallam (In Cr) 46
Table 6.21: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Pampampallam 47

Appendices

A **Top 10 OD Pairs**

B **Detailed forecasts**

C **Data collection exercise**

D **Impact analysis**

Disclaimer

This report has been produced for the sole benefit of Cube Highways Pte. Ltd. This Report (the "Report") is confidential and disclosed only for information purposes, and it may not be relied upon by any party other than the Client or a Party to a Reliance Letter, and Steer: a) makes no warranty, expressed or implied, with respect to the use of any information or methods disclosed in this Report; and b) assumes no liability with respect to the use of any information or methods disclosed in this document. Any such party by its acceptance or use of this Report releases Steer from any liability for direct, indirect, consequential, or special loss or damage whether arising in contract, warranty, express or implied, tort or otherwise.

The Report is based on standard professional efforts, and information available to us at the time the review took place and is subject to time and budget constraints of the Report's scope of work. This Report, information and statements contained herein, are all based on third party data provided to us, or sourced by us, and Steer has not sought to establish the reliability of the data, except as specifically stated in the Report. Steer bears no responsibility for the results of any actions taken on the basis of third-party data.

Certain forward-looking statements in the Report are estimates based on interpretations or assessments of information available at the time of writing. The Report is thus to be viewed as an assessment that is time-relevant, specifically referring to conditions at the time of the review. Steer undertakes no obligation to update the Report for any reason.

While the estimates contained in the Report are not precise forecasts, they do represent, in our view a reasonable expectation of the future, based on information we have been provided with or sourced. However, the estimates necessarily rely on numerous assumptions and judgements, and circumstances may occur over the timeframe of the project that go counter to these assumptions and judgements and that affect the project's realized revenues. Actual events may differ from those assumed, and events are subject to change. Therefore, Steer makes or provides no warranty, whether implied or otherwise, as to the accuracy of forward-looking information presented. Further, it is important to note that forecasts presented represent long term growth profiles; the results for individual time periods may vary from forecasted values.

Traffic Consultant developed the relationships in the models used to produce the forecasts for the projects based on data available through March 2022. Since March 2020, the outbreak of the virus known as COVID-19 has spread throughout the world and has been defined by the World Health Organization as a "pandemic". As of the date of distribution of the Reports, the COVID-19 outbreak is having a material impact on global economic and political affairs including having a significant impact on all the transportation industries, including toll road traffic, where in particular vehicle volumes have fallen in response to quarantine and self-care measures that governments have been imposing as a response to the different waves of infection rates in different parts of the country. The situation remains dynamic and is subject to significant change. In this challenging context, Traffic Consultant has produced base forecasts (directly produced from models using a combination of pre-COVID-19 and post-COVID-19 views) with a view on a possible scenario for the traffic forecasts based on an assumption of recovery from the COVID-19-related traffic decrease. However, it is important to note that this is only one view, and there continues to remain uncertainty as to the short-term, intermediate or prolonged effects of and responses to the COVID-19 pandemic on the projects. All of these effects could impact the COVID-19-related aspects of the Reports.

As a result, no assurance can be provided by Traffic Consultant that the scenarios and assumptions Traffic Consultant has identified will prove to be accurate. Given the uncertainty inherent in this unprecedented pandemic, Traffic Consultant advises that all readers of the Reports consider the Reports in the context of their own assessment of the COVID-19 outbreak and its current and potential impacts before making final decisions related to the projects.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THE LIABILITY OF THE TRAFFIC CONSULTANT FOR ANY LOSS, DAMAGE, COST OR EXPENSE SUFFERED OR INCURRED BY ALL PERSONS OR ENTITIES AND FOR ALL CLAIMS RESPECTING ITS WORK PERFORMED IN CONNECTION WITH THE ISSUE OR THE REPORTS IS HEREBY LIMITED IN THE AGGREGATE TO THE AMOUNT OF FEES ACTUALLY PAID BY THE CLIENT TO THE TRAFFIC CONSULTANT IN RESPECT OF THE REPORTS AND CONNECTED SERVICES.

Glossary Items

Acronym	Meaning
2A/ Truck	2 Axle/ Truck
3A	3 Axle
AADT	Annual Average Daily Traffic
BOT	Build Operate Transfer
CAGR	Compound Annual Growth Rate
CJV	Cars / Jeeps / Vans
COD	Commercial Operations Date
DPR	Detailed Project Report
ETC	Electronic Toll Collection, also referred to as FASTag
FY	Financial Year
GDP	Gross Domestic Product
GSDP	Gross State Domestic Product
HAM	Hybrid Annuity Model
HCM/ EME	Heavy Commercial Vehicles/ Earth Moving Machinery
IE reports	Independent Engineers' reports
IHMCL	Indian Highway Management Company Limited
INR	Indian Rupees
InvIT	Infrastructure Investment Trust
km	Kilometer
LCV/ LGV	Light Commercial Vehicles/ Light Goods Vehicle
LMV	Light motor vehicles
MADT	Monthly average daily traffic
MAV	Multi Axle Vehicle
NH	National Highway
NHAI	National Highways Authority of India
NHIIMPL	National Highways Infra Investment Managers Private Limited
NSDP	National State Domestic Production
OD	Origin Destination
OSV	Over sized vehicles
PCU	Passenger Car Unit; it is a measure of standard vehicle unit to convert all vehicle classes to a single unit by using PCU factors to compute total traffic on an asset.
Q1	Quarter 1 of financial year, from April to June
Q2	Quarter 2 of financial year, from July to September
Q3	Quarter 3 of financial year, from October to December
Q4	Quarter 4 of financial year, from January to March
RNP	Registered Number Plate
SCF	Seasonality Correction Factor

Acronym	Meaning
SH	State Highway
T&R	Traffic and Revenue
TMS	Traffic Management System
TVC	Traffic Volume Count
WADT	Weekly average daily traffic
YTD	Year to Date
FY21N	FY21 normalized AADT estimated on the basis of Q4FY21 traffic volume
FY22*	FY22* is estimated using Oct-Mar MADT's normalising them with respective seasonality for those months to get estimated AADT

1 Introduction

The assignment

1.1 Cube Highways Fund Advisors Private Limited (the "Client") has commissioned Steer Davies Gleave India Private Limited ("Steer") for a traffic and revenue due diligence to be carried out on Walayar Vadakkencherry Expressways Private Limited (the "Asset").

Table 1.1: Scope of work and sources of data

Scope of work	Data source
• Review of historical Traffic Management System (TMS) data, Vendor reports and documents	Provided by client
• Historical analysis and forecasts for baseline growth, including – Background growth, – Seasonality	Historical toll plaza data provided by Client and benchmarks from assets in the vicinity wherever long time series historical data was not available
• Validation of TMS data using independent Traffic Volume Counts (TVC) counts • Validation of Revenue reported in FY22	• TMS data provided by Client • TVC counts independently undertaken by Steer • Revenue reconciliation using toll plaza traffic and ticket type data to calculate revenue and reconciling it with toll plaza reported revenue.
• OD analysis to understand growth drivers – Zonal influence and top OD pairs – Commodity distribution – Trip length distribution	Origin Destination surveys undertaken by Steer
• Analysis of upcoming network improvements and other developments, that may have future impacts on traffic	Secondary research and our in-house experience of working in the vicinity of the asset. Impact analysis based on Generalised Journey Cost spreadsheet-based analysis
• Historical revenue analysis and forecasts for revenue estimation, including – Toll segmentation and trip factors, – Overloading shares,	Calculated from historical data provided by Client
• Final traffic growth forecasts including baseline growth rates and potential future impacts	Elasticity based base growth and potential impacts from secondary research and our in-house experience of working in the vicinity of the asset
• Toll revenue estimation for the entire concession including toll evolution	Toll evolution based on toll notification published by NHAI and WPI line based on forecast published by Consensus and RBI (FY23)

Our approach

1.2 The approach employed by Steer in the preparation of traffic and revenue forecasts was developed to take advantage of existing knowledge of the Asset and available data. It follows well-established practices for forecasting ongoing traffic growth on an existing/brownfield Asset.

1.3 The analysis focused on two sets of issues, namely:

- understanding the traffic that is currently using the Asset (including the impact of COVID, and subsequent recovery); and
- identifying how and why that traffic is likely to change in the future.

1.4 To understand the current traffic on the Asset, we have analysed traffic data from multiple independent sources:

- Client-provided secondary data, including:
  - TMS data pertaining to six financial years (FY16-FY22) up to March 2022.
  - Concession agreement and toll notifications
  - Previous studies
- OD data collected on behalf of the Client; surveys conducted on 27-28 January 2021
- Steer-commissioned TVC counts from 27th January to 3rd February 2021
- Secondary research to understand plans for new developments and progress of ongoing developments on the Asset.
- Review of Concession agreement and toll notifications provided by client
- To arrive at the base position, Asset-wise traffic data required for analysis was used from the monthly traffic and revenue files shared by the client. To gain confidence in the traffic data, and validate the TMS data, 7 days (24 hours) traffic volume counts (TVC) were undertaken by an independent agency at all the toll plaza locations. The TMS data for the same dates was requested from the client which was then compared to the TVC data collected.
- Revenue Reconciliation: We undertook revenue reconciliation, by building up revenue from the traffic reported by each of the toll plaza and subsequently match it to the reported revenue using the prevalent toll rates and reported segmentation/toll-frequencies, this is a key part of our analysis to validate the segmentation/toll-frequency assumptions and the AADT reported for each of the toll plaza.

1.5 The estimation of future traffic demand on the Assets was undertaken through:

- Detailed assessment of the asset performance from traffic and revenue perspective based on the site visit observation, discussions with the toll plaza managers and client team.
- The OD survey data was cleaned and analysed to determine the key commodity drivers of the traffic on the asset. This information was further utilised in developing the views on the forecasts of traffic on this corridor. Outputs from OD data such as zonal influence, trip lengths, and commodity distribution are presented in this report.
- Developing a bespoke growth model for each asset/plaza/toll class to forecast year-on-year traffic growth from FY22 to the end of each concession period.
- Investigating the elasticity of historical traffic growth compared to state (GSDP) and national (GDP) growth. Where historical data is limited, we have benchmarked the asset against our Steer knowledge base (e.g., similar asset types in the same state), to derive appropriate elasticities
- Applying our elasticities to independent GDP/GSDP forecasts.

- Identifying and analysing the potential impacts of any relevant changes to the competitive position of each asset – these include impacts of changes to road network including expressways and opening of competitive modes of travel.
- Identifying and analysing any other potential impacts to traffic and revenue on each asset – these include axle load norms, FASTag implementation
- Considering changes in trends of segmentation over time and making suggestions for changes in exemptions in the future
- Preparing traffic and revenue forecast for the Asset for the complete length of concession. The analysis here includes the specific impacts of toll, network, or other exogenous factors specific to the asset. We have developed a set of forecasting assumptions for three scenarios: a base case and upside and downside scenarios.

1.6 To identify future changes in traffic, we have assessed the likely future socio-economic and demographic development of the region served by the Asset, and the impact of any relevant network changes which may cause considerable diversion of traffic to or from the Asset.

1.7 The Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 1.2: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side kept as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country.

Source: NHAI.gov.in and Wikipedia

1.8 Based on data shared for this Asset, we have observed an increasing penetration FASTag over the recent months and have included assumptions about its future growth in our forecasts for the Asset.

Evolution of COVID-19 pandemic in India in FY21 and FY22

1.9 In the light of the global COVID-19 pandemic spreading in India on 24 March FY20, the Central government announced a nationwide 25-day lockdown which was extended for another three weeks until 3rd May 2020. Further extensions until 17th May 2020 and again until 31st May 2020 featured relaxations in 'green' and 'orange' zones. Starting 8th June 2021, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States. The tolling across all highways in India was stopped between 25th March 2021 and 20th April 2021. These lockdowns resulted in significant disruptions to traffic, with a reduction in both commuting trips to work (as people were required to work from home or stay at home) and leisure trips (due to the closure of various entertainment venues, places of worship, tourist destinations, etc.). Goods movements, while still impacted, continued and were lesser impacted due to a need to supply essential goods such as food, grocery, etc.

1.10 The traffic volumes since then gradually started recovering on most Assets in India, with varying extent. By Q3 FY21 traffic levels were already at par FY20 AADT numbers and even higher in some cases. Q4 FY21 was largely unimpacted by COVID-19 and toll plazas reported stabilised traffic numbers for the quarter.

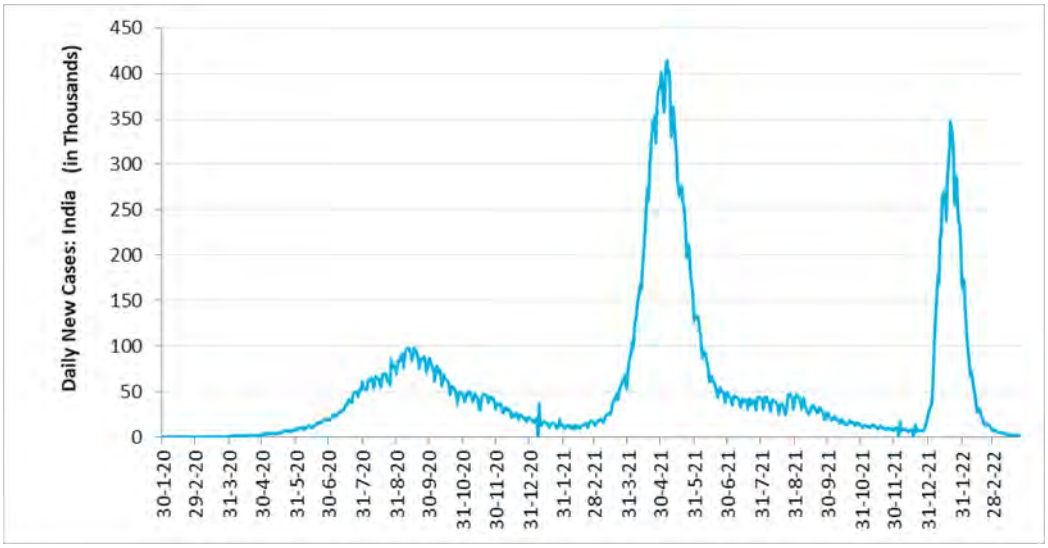
1.11 Data from various roads across the country indicates that the largest impact on traffic was experienced between the months of March 2020 and May 2020, with the rest of the months showing volumes surpassing FY20 levels for most months of FY21. It is important to note that FY20 itself was a subdued year due to the nosedive in Indian economic growth to its lowest in a decade (4.0% in FY20 relative to a FY10-20 average of 6.5%). The recovery of traffic in Q3 FY21 was being driven by two factors - a release of pent-up demand in certain vehicle categories, as well as, underlying long-term growth trends in various sectors of the economy which are contributing to the growth of commercial traffic across the road network. We believe that the pent-up demand was mostly confined until the October-November FY21 period which coincides with the Diwali festival related increase in traffic levels.

1.12 The traffic trends observed on most of the Indian toll roads during Q4 FY21, showed sustained traffic levels as were witnessed in Q3FY21, which reflected sustained demand revival in the Indian economy. These traffic levels reflected the longer-term trends of a strong economic recovery, in segments like auto manufacturing, road construction, energy consumption /production etc., being more stable and driving the growth over and above FY20 levels and are expected to continue as more segments of the economy, like hospitality, tourism, etc., recover fully from the pandemic.

1.13 During the last week of March 2021 onwards, another spike in COVID-19 cases was observed which gradually kept increasing to reach a peak value of 415,000 daily cases by 6th May 2021. The figure below presents the daily reported COVID-19 cases in India up-to February 2022.

1.14 Kerala has shown a different trend in the COVID-19 infections than some of the other states. Kerala contributed far lesser to cases in the first wave of lockdowns with a delayed surge in cases during the first wave. Similar trends have been observed during the second wave as well, with a delayed surge. Therefore, with a tourism-based economy these delayed surges coupled with local restrictions have affected traffic profile on the Asset.

Figure 1.1: Daily Reported COVID-19 cases in India



Source: Steer analysis, https://data.COVID-19india.org/

1.15 This second wave of COVID-19 was accompanied by various local and state level night curfews and lockdowns starting from April until end of June 2021. The second wave of COVID-19, although it had a higher infection rate, the movement of traffic and goods was not impacted by the same magnitude as during the first wave when the whole country went under strict lockdown for the first quarter. This can be attributed to the fact that almost all the restrictions during the second wave were localised or at state level. Moreover, there was no restriction on movement of goods vehicles and other services. As the industries and agricultural activities continued to operate, the truck traffic did not fall as steeply as it did in Q1 FY21. Since July 2021, the number of reported infections is reducing steadily and averaging below 30,000 cases per day in the months of October, November 2021.

1.16 The third wave of COVID-19 due to the highly infectious Omicron variant spread rapidly across the country in Jan 2022 and the peak of cases started declining by the second week of Feb 2022. The third wave of COVID-19 had a much higher infection rate than both earlier waves of COVID-19 but had less severe impact on fatality rate across the nation, and hence the resultant lockdowns were short-lived and had regional spread depending upon the infection rates in that area. The movement of traffic was impacted for a very short period, and most of the impact was seen in passenger vehicles, a trend also observed during the second wave.

1.17 Now that COVID-19 has had an impact on the travel behavior for over 24 months, there has been a behavioral shift of passengers towards personal mobility due to perceptions of safety and reduction of public transport services which we have observed across the road network especially in inter-state bus service. This shift is expected to sustain and continue in the short term. For example, once a family starts using a personal CJV for inter-urban travel to avoid public transport during the pandemic period over 1-2 years, it is likely that they continue using their personal vehicles even as the pandemic recedes. In our analysis around the short/medium-term impact of this pandemic, we have included assumptions around the above, as well as longer-term impacts of the pandemic.

Contents of this Report

1.18 The report has been divided into 6 chapters:

- Chapter 1 introduces the methodology and approach to undertake the traffic and revenue due diligence;
- Chapter 2 describes the key characteristics of the Asset and its surrounding road network, primarily based on site visits;
- Chapter 3 summarises the current and historical traffic on the Asset, including results from the TMS, TVC and OD analysis;
- Chapter 4 discusses the socio-economic context of the corridor and region/state containing the Asset, and summarises our approach and results on estimating background traffic demand growth; and,
- Chapter 5 summarises our approach and results on estimating background traffic demand growth; and
- Chapter 6 summarises our key forecasting assumptions, results of impacts analysis, and presents our traffic and revenue forecasts for the Asset.

2 The Asset

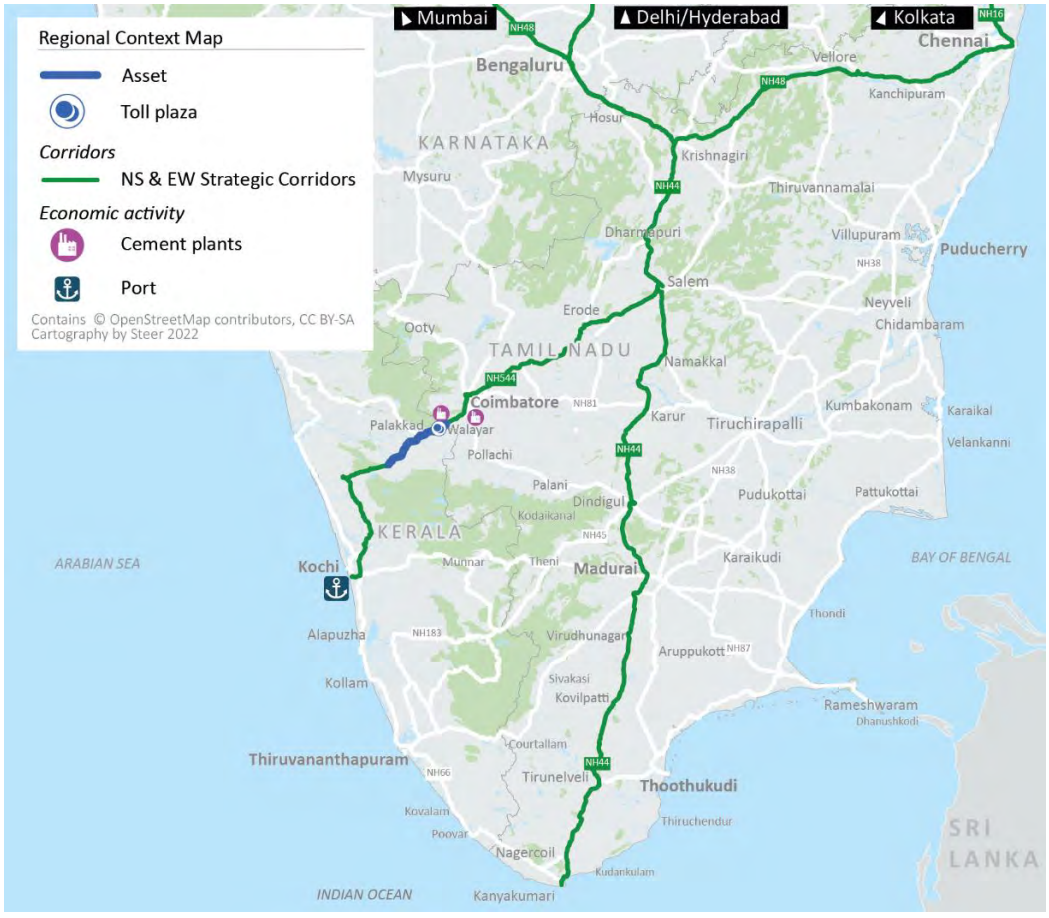
Introduction

2.1 This chapter provides a description of the Asset, based on observations and concession agreement and from site visit undertaken by Steer, our understanding of the region and network surrounding the Asset. We cover the strategic network context, followed by key economic activities and network developments around the Asset.

Strategic network

2.2 The Asset is situated in the state of Kerala, connecting Walayar, a town located on the Tamil Nadu-Kerala border and Vadakkancherry, a town in the Palakkad district of Kerala. The Asset is a section of the strategic NH 47 which serves as a key entry point to the State (Kerala) from its eastern end. The following figure shows the regional road network in which the Asset is located.

Figure 2.1: Asset location in the regional network context



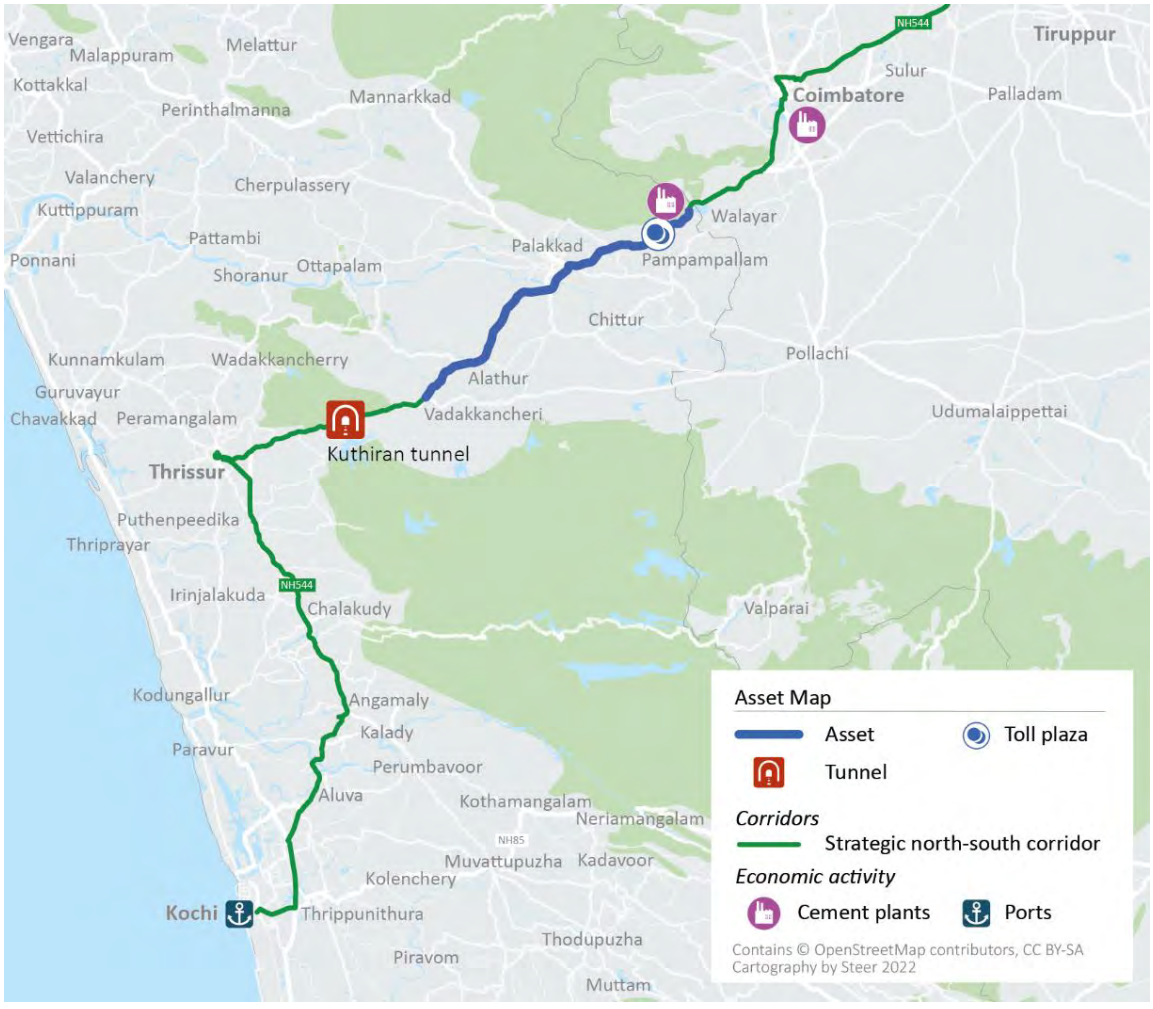
Source: Steer cartography using OpenStreetMap data

2.3 This Asset primarily caters to three different types of strategic movements:

- **Short-distance trips** undertaken largely by passenger vehicles for work/business trips wherein the movement is predominantly local between Walayar and other areas in the Palakkad district.
- **Medium-distance trips** made by both passenger and goods vehicles covering places such as Ernakulam/Kochi in Kerala, to Erode and Salem in Tamil Nadu.
- **Long-distance trips** predominantly by MAVs catering to Kerala's high demand for consumption goods and cement, from areas lying outside the state such as Chennai, Bangalore, Vijaywada etc.

2.4 The Asset is a 53.5 km toll road which forms a part of the NH 47, a key highway connecting the city Salem in Tamil Nadu to Kochi in Kerala. It is a four-lane road with one toll plaza, namely, Chullimada Hamlet (Pampampallam) at km 189.4 (closer to Walayar). The following figure provides a closer view of the Asset in the context of its immediate surroundings.

Figure 2.2: Asset context



Source: Steer cartography using OpenStreetMap data

Concession and tolling details

2.5 The toll plaza on the Asset has been operational since May 2015 and the Client took over its operations on 29th September 2020. There are 17 years remaining in the concession period which ends in FY38. The following table presents a summary of the concession.

Table 2.1: Summary of concession

	Particulars
State	Kerala
Highway and lane configuration	NH 47 four lane
Toll plazas	• TP1: Pampampallam
Length (km) as per concession agreement, applicable	• TP1: 53.5 km
Commencement of operations*	• May 2015
Operated by Client since	29th September 2020
Concession period	20 years
Last year of concession	FY38

Source: Client data

2.6 Figure 2.3 shows a typical cross-section of the Asset and its toll plazas.

Figure 2.3: Typical cross-sections and toll plazas on the Asset

Source: Steer site visit

2.7 Tolls on the Asset are collected for the following vehicle categories with rates as shown in the following table. The toll plazas have dedicated ETC/FASTag lanes for electronic tolling.

Table 2.2: Single toll rates on the Asset (INR), applicable April 2021 to March 2022

Type of Vehicle	Single Journey Fee
	TP1 Pampampallam
CJV	65
LCV	105
Bus/Truck	225
3A/MAV/ HCM/EME	350
OSV	425

Source: NHAI Revision of User fee Rate w.e.f 01.04.2021

Key economic activities

2.8 Kerala, a south Indian state surrounded by Tamil Nadu and Karnataka, is largely a consumption based and tourism centred economy which is dependent on other states for food grains, fruits and vegetables. It is known as the 'Land of Spices' and is a leading producer of pepper and cardamom accounting for 75% and 89% respectively of the country's production – where India is the third largest producer of pepper worldwide[1]. The state is a leader in rubber production and accounts for 75% of natural rubber produced in the country.[2]. Other items such as coffee, rice, coconut, tea, cashew, and spices also make up for a critical share in the state's agricultural output.

2.9 The rich culture and natural landscapes have put the state on the world map as a major tourist destination wherein this sector contributes to 10% in the state GSDP. The city of Thrissur which lies along the strategic north south corridor (see Figure 2.2) is a key tourist destination in the state and is a seat of culture hosting significant festivals.

2.10 The state also has 18 ports (1 Major port, 7 intermediate ports and 12 minor ports), with Kochi port being the largest port (freight handled). Kerala has a coastline of around 590 km.

2.11 Given Kerala has very limited entry points from the rest of the states, the Asset forms an integral part of NH 544 and is the only four laned national highway that provides connectivity and a point of entry into the state from Tamil Nadu. Some of the major settlements along the Asset include Walayar, Kanjikode, Palakkad, Alathur and Vadakkancherry whereas the long-distance traffic on the road serves cities in other states such as Coimbatore, Salem, Bangalore, and Chennai.

2.12 Construction industry contributes to significant share of Kerala's state economy. The state has a high demand for cement of about 96 lakhs tonnes (FY19)[3] of which only 8.6 lakh tonnes of demand is met by the state and about 90% of the cement is transported from other parts of the country thereby making the town of Walayar, located close to the Asset, an important

[1] https://inspirajournals.com/uploads/Issues/1644969958.pdf

[2] https://invest.kerala.gov.in/?sector=rubber

[3] https://ibm.gov.in/writereaddata/files/07072020143800Cement_2019.pdf

industrial area which houses one large cement plant along with a number of ancillary and supporting units in the vicinity of the Asset.

2.13 Walayar, part of the Palakkad district in Kerala and situated on one end of the Asset is a small industrial town at the border between Kerala and Coimbatore, Tamil Nadu. It is home to the state-owned Malabar Cements Limited which is the one of the state's largest public sector cements production undertakings with a production capacity of 6.6 lakh MT per annum[4] and with future plans to augment the capacity from 0.66 to 0.8 MTA along with an addition of 1 MTA grinding facility and modernisation of the mill at the Walayar plant[5]. Kanjikode, situated in the middle of the Asset is home to the manufacturing base for companies such as Bharat Earth Movers, Pepsico, Marico, United breweries and Empee Distilleries.

2.14 Kochi refinery is one of the major refineries in the State and is responsible for production of domestic markets such as Benzene, Sulphur, White Spirit. Additionally, Fuel Oil is exported to the international markets. A new project, Integrated Refinery Expansion Project, had begun in 2019 which aims to increase the capacity of the refinery and convert it into a world-class refinery with one of the largest refining capacities among all the other public sector refineries of India.

Historical performance of Kochi Port

2.15 Kochi port is a key port near the vicinity of the Asset. The port handled all major categories of cargo including liquid bulk, dry bulk, break and containers. The historical cargo handling performance of the port is presented below:

Table 2.3: Cargo Handled, Kochi Port

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	CAGR (14-20)	CAGR (18-20)
Liquid Bulk	14832	14816	14707	16665	19963	22430	23810	**8.2%**	**9.2%**
Dry Bulk	1092	1487	1544	1467	1420	1417	1480	**5.2%**	**2.1%**
Break Bulk	178	46	62	35	63	59	120	**(6.4%)**	**38.0%**
Containers (TEU)	346204	366377	419550	491087	555812	594592	620061	**10.2%**	**5.6%**
Total ('000 Tonnes)	**20,887**	**21,595**	**22,098**	**25,007**	**29,138**	**32,022**	**34,038**	**8.5%**	**8.1%**
YoY Growth		**3.4%**	**2.3%**	**13.2%**	**16.5%**	**9.9%**	**6.3%**		

Source: https://cochinport.gov.in/sites/default/files/inline-files/Statistics-Cargo%20traffic%2012%20yrs_0.pdf

2.16 The port has grown at a healthy 8.5% CAGR between 2014-2020, with the liquid bulk and container categories garnering the key growth.

PCU factor assumption for reporting

2.17 Please see the PCU factors considered in the table below as per IRC64 1990. Based on the discussion with client, for forecasting purposes, we have referred to the Rigid and Trailer trucks splits in the TVC counts for calculating the effective PCU for MAV trucks, which comes

[4] https://www.malabarcements.co.in/en/history-1

[5] https://www.malabarcements.co.in/en/future-plans-1

out at 3.3. For Rigid trailer trucks we have assumed a PCU factor of 3, whereas for Trailer trucks we have assumed a PCU factor of 4.5.

2.18 The PCU factors considered are given in the table below:

Table 2.4: PCU factors

Vehicle Category	PCU Factor
CJV	1.0
LCV	1.5
Bus	3.0
2A	3.0
3A	3.0
MAV	3.3
OSV	4.5

Source: Steer analysis and IRC64,1990

3 Traffic description

Introduction

3.1 This chapter outlines the current traffic and revenues on the Asset, as well as our analysis of origin-destination (OD) data and traffic count data. This covers data which was collected as a part of this study and previous studies, as well as data provided by the Client.

3.2 Traffic demand data is generally collected and analysed to understand the volume and vehicle composition of traffic currently using the Asset, while OD data is used to obtain a better understanding of travel patterns, trip lengths, trip purposes and areas of influence in the vicinity of the Asset, as well as the commodities being moved by the goods vehicles. This analysis, combined with our understanding of the Asset (based on our site visits), enables us to identify the key drivers of demand on the Asset.

3.3 Actual toll plaza data is used as the basis from which the current/base year annual average daily traffic (AADT) is established. This data is typically provided by the Client and independently analysed and validated by us using traffic volume count (TVC) information.

Historical trends

3.4 The following table presents the historical variation in traffic volume at the toll plaza, in terms of vehicle shares and total AADT. The data was provided for the period of May 2015 to March 2022.

3.5 On the Asset, the major traffic contributor is CJV because they hold a higher share of making multiple local trips and since the asset is located in between two major cities, Walayar and Palakkad, the number of local movements captured at the toll plaza is higher. LCV, Bus share has fallen since FY21 which is due to the rise in spread of COVID-19. Buses are majorly used for inert city, intra city travel, with restrictions and lockdowns in place their usage declined substantially, as shown in the table below:

Table 3.1: Historical evolution in AADT by vehicle class at TP Pampampallam

Class	FY16	FY17	FY18	FY19	FY20	FY21	FY22
CJV	6,284	7,938	9,195	9,748	10,634	6,610	7,971
LCV	1,190	1,365	1,696	2,325	2,363	1,517	1,544
Bus	837	946	961	930	971	269	366
2A	639	622	681	920	964	967	1,231
3A/MAV	1,428	1,670	2,132	2,541	2,631	2,694	2,939
OSV	1	1	2	2	3	2	3
Total	**10,379**	**12,541**	**14,667**	**16,467**	**17,566**	**12,059**	**14,054**
PCU	**17,120**	**20,097**	**23,573**	**27,017**	**28,510**	**21,319**	**24,600**

Source: Steer analysis of the Client data

Table 3.2: Historical YoY growth rates and CAGR by vehicle class at TP Pampampallam

Class	FY17	FY18	FY19	FY20	FY21	FY22	CAGR FY16-FY20	CAGR FY20-FY22	CAGR FY16-FY22
CJV	26%	16%	6%	9%	-40%	25%	14.1%	(13.1%)	4.2%
LCV	15%	24%	37%	2%	-37%	3%	18.7%	(19.3%)	4.4%
Bus	13%	2%	-3%	4%	-75%	53%	3.8%	(39.3%)	(13.2%)
2A	-3%	9%	35%	5%	-3%	32%	10.8%	13.0%	11.5%
MAV	17%	28%	19%	4%	-1%	13%	16.5%	5.4%	12.7%
OSV	0%	100%	0%	50%	-33%	50%	40.8%	1.8%	20.1%
Total	**21%**	**17%**	**12%**	**7%**	**-34%**	**20%**	**14.1%**	**(10.5%)**	**5.2%**
PCU	**17%**	**17%**	**15%**	**6%**	**-28%**	**19%**	**13.6%**	**(7.1%)**	**6.2%**

Source: Steer analysis of the Client data

3.6 CJV traffic has seen a healthy growth profile over the years with a CAGR of 14% between FY16 and FY20. FY21 and FY22 being impacted by COVID19, there has been a delayed recovery of CJV traffic which has resulted in lower CJV volumes in both these years. Once tourism traffic returns to normal it is expected that these volumes will increase. Overall since FY16 CJV has shown a 4% CAGR.

3.7 MAV's have grown at a healthy 5% PCU over FY16-22. This can be explained by the reasons listed below

- NH544 is a key 4 lane entry point into Kerela, therefore a large majority of the trucks movement into the state is driven by this road.
- Also before the GST was implemented in July 2017 (FY18), the limited processing capacity on Octroi barriers forced many truck users to use a local road through Pollachi to enter Kerala. Only high commodity value goods were transported via the Asset. Post the GST implementation, the traffic movement has become significantly smoother, which provided a boost to traffic observed in the growth of commercial vehicles, particularly 3A/MAV trucks, since FY18.

3.8 Due to COVID-19 the bus networks have still not come back to pre-COVID-19 levels, once the impact of COVID-19 related restrictions reduce it is expected that the Bus volumes will return to the levels seen in FY19 and more. Overall the Asset has registered a healthy traffic PCU growth of 6% over six years, despite traffic being impacted due to COVID19 related restrictions.

3.9 The table below presents the reported historical revenue of the Asset.

Table 3.3: Historical revenue evolution (in INR Crore) at TP Pampampallam:

	FY 17	FY 18	FY 19	FY 20	FY 21	FY 22
Annual Revenue (INR Crore)	41.5	51.7	61.6	67.8	55.1	65.7

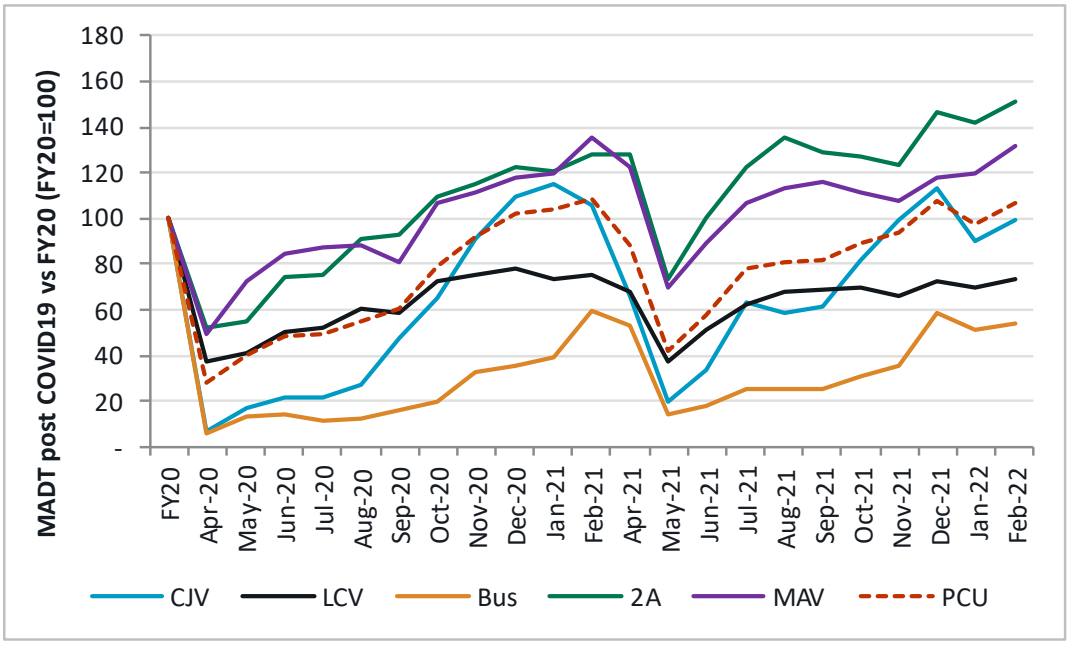
Impact of COVID-19 on traffic and subsequent recovery of traffic volumes

3.10 On 24th March 2020, the Central government announced a nationwide 25-days lockdown which was extended for another three weeks until May 3. As previously mentioned, all toll operations were suspended from 26th March – 19th April 2020. Further extensions until 17th May and again until 31st May featured relaxations in 'green' and 'orange' zones. Starting 8th

June 2020, 'Unlock' phases began. States have also taken their own measures, with Central guidelines being the minimum expected restrictions from States.

3.11 In direct relation to these 'Lockdown' and 'Unlock' phases, traffic on roads across the country dropped significantly in the last week of March 2020 continuing into April and May 2020. While traffic for LCVs/2As and MAVs had a quick recovery in September and October respectively back to FY20 AADT, the other vehicle classes have seen longer recovery trends, as can be seen in the following chart.

Figure 3.4: Month on month recovery VS FY20



Source: Steer analysis of the Client data

3.12 As we can see from the table above, the recovery of traffic to FY20 pre pandemic levels was only achieved in Q4FY21 (not adjusted for Seasonality), signalling a very weak recovery of traffic profile, similar behaviour has not been seen on several other Assets studied by Steer. This can be attributed to the delayed surge in COVID-19 related infections and significant drop in remittances which form the other key contributor to state economy. Similar low traffic recovery is being witnessed in Q3 and Q4 of FY22, post the second wave and third wave. By Q3Fy22 The Asset is yet to achieve FY20 PCU levels, which suggests that the local economy has been badly impacted by reasons such as Covid19, reduced remittances, very slow revival of tourism in the state among others.

Toll Frequencies

3.13 Toll frequency or segmentation is typically the share of each ticket category recorded for a particular vehicle type. Each vehicle category has different segmentation. As a part of historical analysis, we calculate the toll frequency for each vehicle category from the monthly data shared by the client. The most common ticket categories observed on a typical National Highway concession are: Single, Return, Monthly, Local and Exempt. Given the local nature of traffic, some assets offer custom made local passes to attract the local commuters to opt for these category passes instead of evading toll. Brief description of different ticket-types is given in the subsequent table.

3.14 Understanding the toll frequency gives insights into the nature of traffic. CJVs generally have higher shares of return passes or monthly passes, while heavy trucks mostly have single tickets since they travel long distance. However, this trend may vary for each asset and each toll plaza. The asset catering to short distance local traffic generally observes high share of return or other local monthly passes while the asset catering to strategic long-distance traffic generally observes high share of single ticket traffic.

3.15 The following are the types of tickets being sold at the plazas of the Asset.

Table 3.4: Typical ticket types sold at NHAI plazas

Category	Description
Single	Allows the vehicle to cross the toll plaza once
Return	Allows the vehicle to cross the plaza twice in a day at discounted rates.
Monthly Pass	Discounted single ticket pass users issued at toll plaza for users who intend to undertake multiple single trips within a month. 50 trips are given at a discounted rate
Local Personal	Discounted single entry pass only for private cars of residents within 20km radius of toll plaza
Local Commercial	50% discount on single trips for commercial vehicles registered in the local district. This pass allows single entry only
Exemptions	Officially exempted vehicles like ambulance, police cars, key political personnel etc.

Impact of FASTag implementation

3.16 Government of India has introduced (and more recently, mandated) Electronic Toll Collection (ETC) across National Highways in India, collected via "FASTag". The timeline of ETC implementation is presented in the following table.

Table 3.5: Timeline of national ETC implementation

Date	ETC Development
2014	FASTag system set up as a pilot on the Ahmedabad to Mumbai stretch of the Golden Quadrilateral, in November 2014 it was also implemented on the Delhi to Mumbai stretch of the Quadrilateral.
December 2019	FASTag is made mandatory on all National Highways with only one lane on either side keep as a Cash Lane, cash users entering ETC lanes were charged double the toll.
February 2021	FASTag is made mandatory for all vehicles at every toll plaza in the country starting 15th Feb 2021

Source: NHAI.gov.in and Wikipedia

3.17 Generally, over the period the shares of single/return/monthly tickets tend to stabilise within 2-3 years of asset operations. Only in the cases where trip patterns are expected to change significantly due to urban expansion is where we expect these shares to change over the period or due to some external events impacting the trip patterns. During the last one year, two key events impacted the traffic patterns throughout the country: COVID-19 and FASTag implementation.

3.18 With the FASTag implementation in December 2020, it was ensured that only FASTag users benefited from discounted tickets such as return/monthly and cash users were only allowed to

buy single tickets, thus leading to a drastic increase in single ticket users. However, with the increase in proportion in transaction via FASTag, it was observed that traffic patterns have begun to return to their initial segmentation.

3.19 The table below presents the proportion of transactions via FASTag as of March 2022. We can see that commercial vehicle types have attained 99% FASTag penetration and as for CJVs, they have achieved 90% share as of March 2022. These high penetration levels improve the overall service levels of the toll plaza and reduces the transaction time.

Table 3.6: Percentage of Transactions via Fast Tag, Mar 2022 at TP Pampampallam

Toll Plaza	CJV	LCV	Bus	MAV
Pampampallam toll plaza	90%	99%	99%	99%

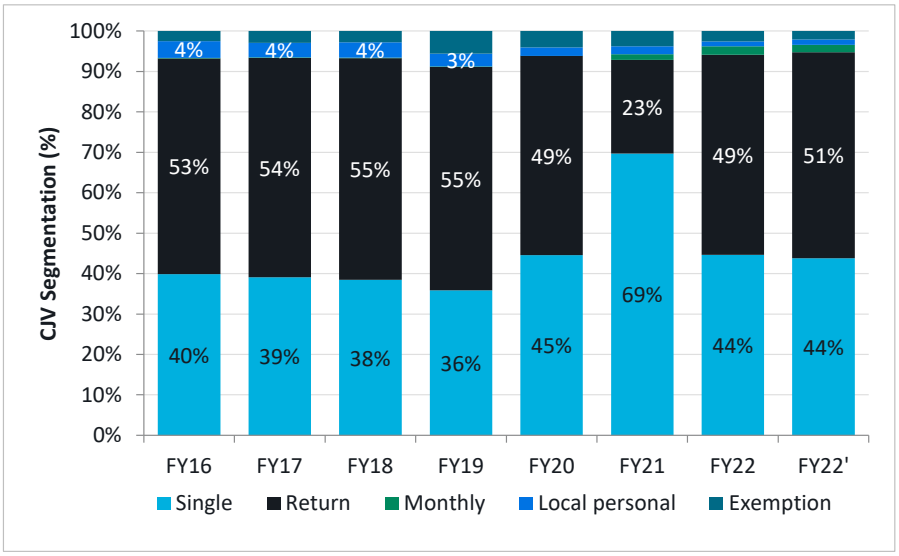
Source: Steer Analysis

Share of traffic by payment type

3.20 The figures below show the ticket segmentation for CJV and MAV categories. In FY16, 39% of CJVs paid for single journeys, with the remainder being largely made up of return journeys, local personal tickets, and exemptions. Local personal tickets are special discount tickets issued to users residing within 20 kilometres of the toll plaza.

3.21 It can be observed that both CJV and MAV tickets are dominated by single journeys in FY21. The single journey proportion increased from a relatively stable average of 38% to 45% in FY20 and 69% in FY21 and return journeys decreased from an average of 54% to 50% in FY20 and 23% in FY21. This shift, from return to single journeys, can be attributed to the gradual implementation of FASTag norms from 2019.

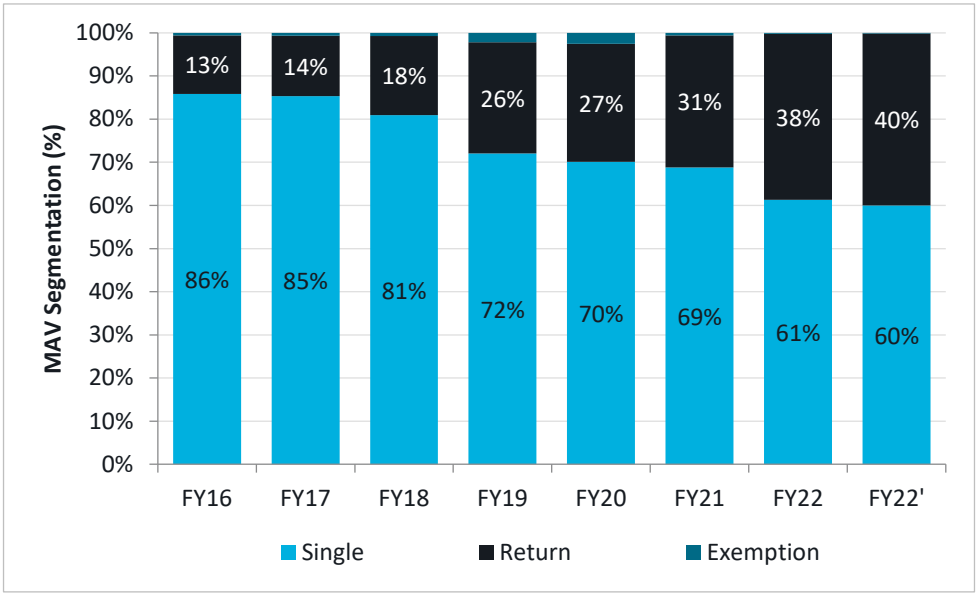
Figure 3.1: Ticket-segmentation for CJV at TP Pampampallam



Source: Steer analysis of the Client data (FY22' is calculated based on Nov21-Mar-22 data)

3.22 In contrast to the above trend, for MAV categories, the single journey tickets decreased from 86% to 69% from FY16 to FY21 whereas the return journey tickets increased from 13% to 39% in the same period. This can be result of overall improving LOS on the network and return trips being more possible for heavy vehicles. Hence the return share has stabilised at 40% in FY22.

Figure 3.2: Ticket-segmentation for MAV at TP Pampampallam



Source: Steer analysis of the Client data (FY22' is calculated based on Nov21-Mar-22 data)

Table 3.7: Historic ticket segmentation at TP Pampampallam

Vehicle Type	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY22'
LCVs								
Single	55%	53%	50%	42%	45%	62%	38%	39%
Return	41%	42%	46%	54%	53%	37%	61%	61%
Exemption	3%	4%	3%	3%	1%	1%	-	-
BUS/2A								
Single	9%	9%	13%	11%	13%	36%	25%	22%
Return	14%	17%	17%	22%	25%	31%	59%	76%
Monthly	7%	6%	4%	1%	0%	2%	2%	2%
Exemptions	69%	68%	65%	66%	61%	28%	4%	-

Source: Steer analysis of the Client data (FY22' is calculated based on Nov21-Mar22 data)

Primary Data Collection

3.23 As mentioned previously, in order to validate and inform various inputs used in our forecasting, we undertook primary data collection on the Assets, comprising the surveys listed in the table below. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas, which Steer also commissioned with a third party. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

Table 3.8: Data collection schedule

7-day videography-based TVC			1-day OD survey	
Start date	**End date**	**Time (hrs)**	**Start date**	**State time**

7-day videography-based TVC			1-day OD survey	
27 Jan 2021	02 Feb 2021	0000-2359	27 Jan 2021	0900 hours

Source: Steer analysis

3.24 It should be noted that, in our experience, traffic on national highways shows variation across the week due to the economic activities surrounding each road. To derive a representative TVC count considering daily variation, three-day to seven-day traffic counts are generally recommended, and hence, in order to fully understand the impact of this weekly fluctuation on the Asset, we collected seven-day counts at the toll plaza.

Key findings of the TVC data analysis

WADT estimates

3.25 Taking an average of the seven-day TVC counts (27th Jan – 2nd Feb 2021, 0000-2359), we obtained the following weekly average daily traffic (WADT) for each toll plaza. This WADT excludes non-tollable vehicles such as tractors, two-wheelers, bullock-carts, etc., but includes officially exempt vehicles such as police cars, ambulances, emergency response vehicles, government vehicles and other vehicle types officially allowed as 'exempted' under the concession agreement.

Table 3.9: WADT at TP Pampampallam

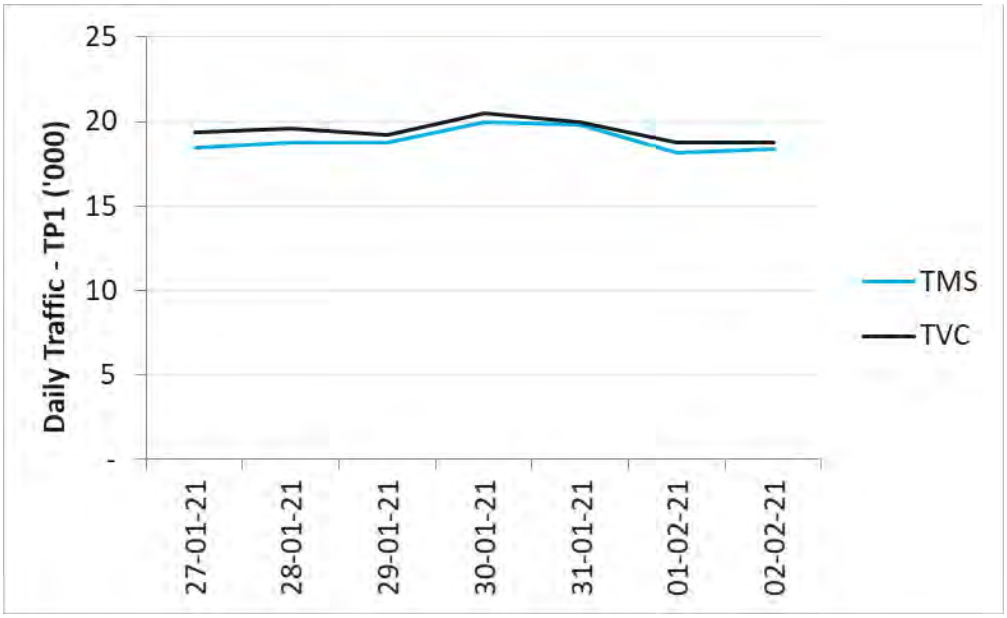
Toll Plaza	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
TP1 Pampampallam	10,360	1,413	2,436	525	1,233	1,026	2,457	2	**19,451**

Source: Steer analysis of TVC data

TVC v/s TMS analysis

3.26 As we use the TMS data to estimate the base year AADT, we have used our TVC data to validate the TMS data on those particular days, as provided by the Client. The following figures show the comparison between the daily traffic observed by TVC and TMS for the toll plaza.

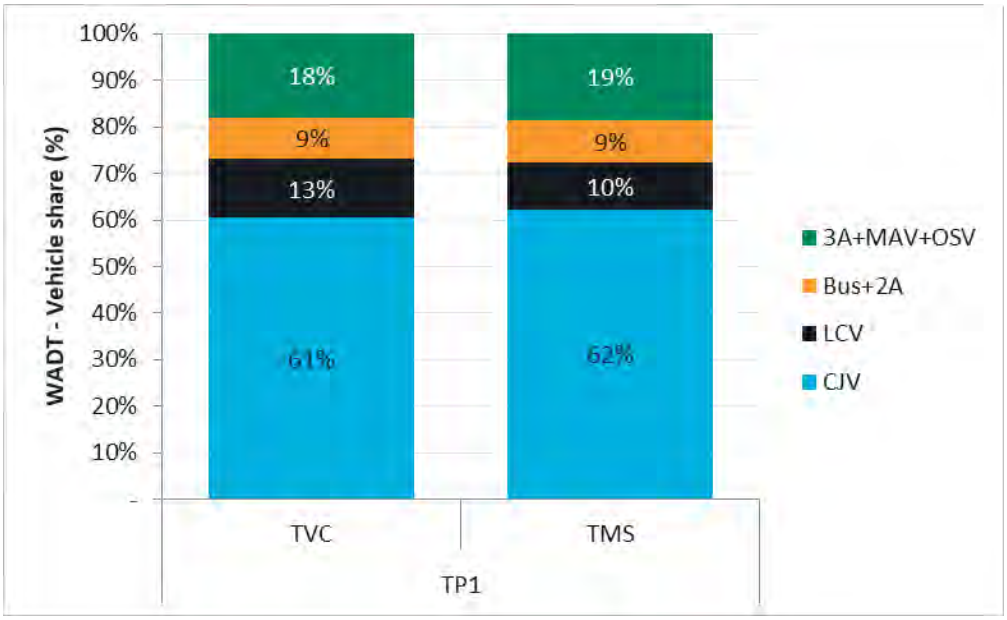
Figure 3.3: Comparison between TVC and TMS daily traffic data on TP Pampampallam



Source: Steer analysis of TVC and Client TMS data

3.27 As can be seen from the figure above, the difference between daily traffic from both sources is minimal. The figure below compares the shares of vehicle types at both toll plazas observed by the TVC and TMS data. In terms of individual vehicle categories as well, the difference is minimal (1%-3%) which could be attributed to common misclassification of vehicle categories.

Figure 3.4: Comparison between vehicle shares from TVC and TMS WADTs



Source: Steer analysis of TVC and Client TMS data

3.28 Considering the smaller variation between the TVC and TMS data for the largest revenue generators-CJV and 3A+MAVs, and an overall good fit in the traffic volumes, TVC-TMS analysis gives us the confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

Key findings of origin-destination analysis

Overview

3.29 Origin-destination (OD) analysis enables the understanding of the nature of traffic movement on the Asset. We have analysed the regional drivers of demand based on the following analysis:

- Zonal influence
- Commodity distribution
- Top OD pairs
- Trip length distribution

3.30 While zonal analysis and the list of top OD pairs help to understand 'where' people and goods travel, commodity distribution sheds light on 'what' goods get transported on this asset. Trip length distribution shows 'how far' vehicles and people travel, and goods get transported. This set of analysis is used to estimate key drivers of traffic and aid in making informed forecasting assumptions related to traffic demand elasticities, growth drivers and exogenous impacts.

Sample rates

3.31 Sample rates help understand the reliability of OD data. They are calculated by dividing OD samples by the TVC count observed on the same date for each vehicle category at the toll plaza. The table below presents the sample rates for key vehicle type aggregations at the toll plaza. We believe that the sample rates of the OD data are reasonable for the analysis required.

Table 3.10: Sample rates for OD data

Vehicle type	TP Pampampallam
Car	29%
Mini Bus + Bus	46%
Mini LCV + LCV	37%
2A	74%
3A	34%
MAV + OSV	60%
Total	38%

Source: Steer analysis of OD data

Zone Categories

3.32 To facilitate better interpretation of key regional drivers of traffic as determined by their OD zones, and influenced by various towns, cities, states, and regions in the vicinity of the Asset, we have aggregated zonal data as described in the table below. The methodology behind this aggregation of zones may vary as per the characteristics displayed by the different Assets being studied.

Table 3.11: Zone aggregations for zonal influence analysis

Aggregate Zone	Description
Local	Local zones are those that fall on or very close to the Asset.

Aggregate Zone	Description
IAOI (Immediate Area of Influence)	IAOI zones are the locations which generate traffic and lie within approximately 75-150 km distance from the Asset.
Rest of State (RoS)	Rest of the cities/Districts in the state that Asset lies in (other than Local/IAOI)
Tamil Nadu	Tamil Nadu
Karnataka	Karnataka
North India	Uttarakhand, Haryana, Punjab, Jammu and Kashmir
Central India	Madhya Pradesh, Chhattisgarh
West India	Gujarat and Maharashtra
Rest of South India	States other than Kerala, Karnataka and Tamil Nadu
East & Northeast India	West Bengal, Orissa, Jharkhand and Northeast Indian states

Source: Steer analysis

Zonal influence

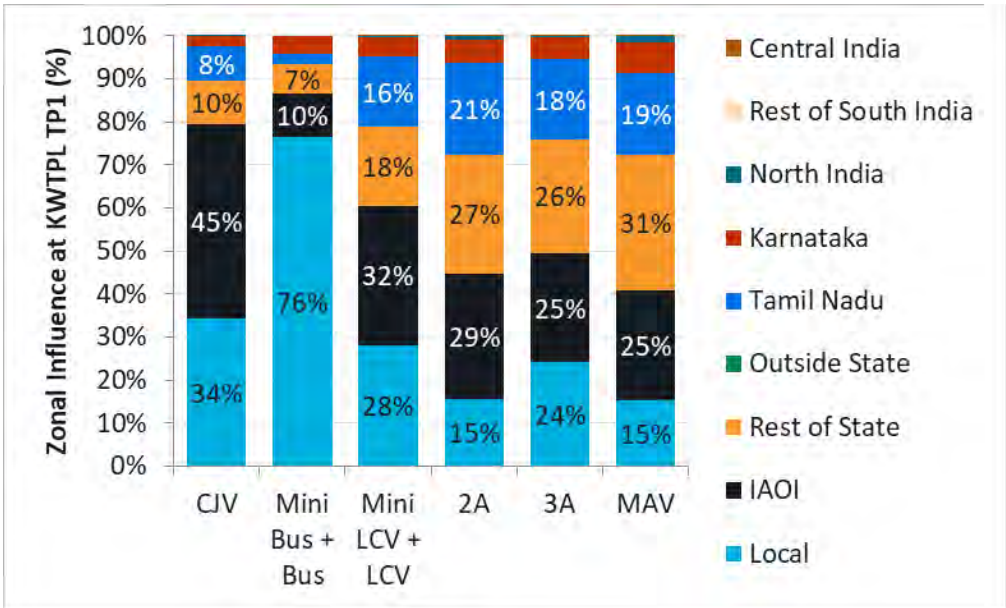
3.33 The zonal influence is the contribution of the zone or the zonal aggregation to trips by a vehicle type. This section presents the zonal influence[6] at the toll plaza for the Asset, based on zonal aggregation listed in the previous sub-section. it should be noted that zonal influence is analysed on trip ends and not trips.

3.34 As can be seen from the figure below, there is a higher share of local trips for the passenger vehicles wherein 36% and 47% of the influence for CJVs is from local and IAOI zones respectively such as Walayar, Coimbatore, Thrissur and other areas in Palakkad district. This analysis is in line with our understanding during the site visit wherein a heavy influence on the passenger traffic from the surrounding local areas was observed. Light goods traffic is significantly influenced by IAOI areas such as Coimbatore, Thrissur and Annur whereas the heavy goods traffic is more influenced by areas in 'Rest of the State' such as Kochi, Kozhikode, Thiruvananthapuram, and Ernakulam.

3.35 Outside Kerala, it is seen that areas in Tamil Nadu such as Salem, Chennai, Thanjavur and Erode contribute to both the light and heavy goods traffic on the Asset, followed by Bangalore in Karnataka. Supporting this analysis, of the top OD pair analysis, as given in the Appendix A, further shows that the majority of the trips originate and end in local and IAOI areas for passenger traffic whereas for the goods traffic, places in rest of the state and outside state such as Ernakulam, Bangalore and Salem feature at the top of the OD pair list.

[6] For example, if out of 100 trips at a toll plaza on an Asset, 10 trips are between Hyderabad and Delhi and 90 trips are between Hyderabad and Chennai, then zonal influence of Hyderabad would be 50% since one end of all trips are at Hyderabad. Likewise, zonal influence of Delhi and Chennai would be 5% and 45%, respectively.

Figure 3.5: Zonal influence at TP Pampampallam



Source: Steer analysis of OD data

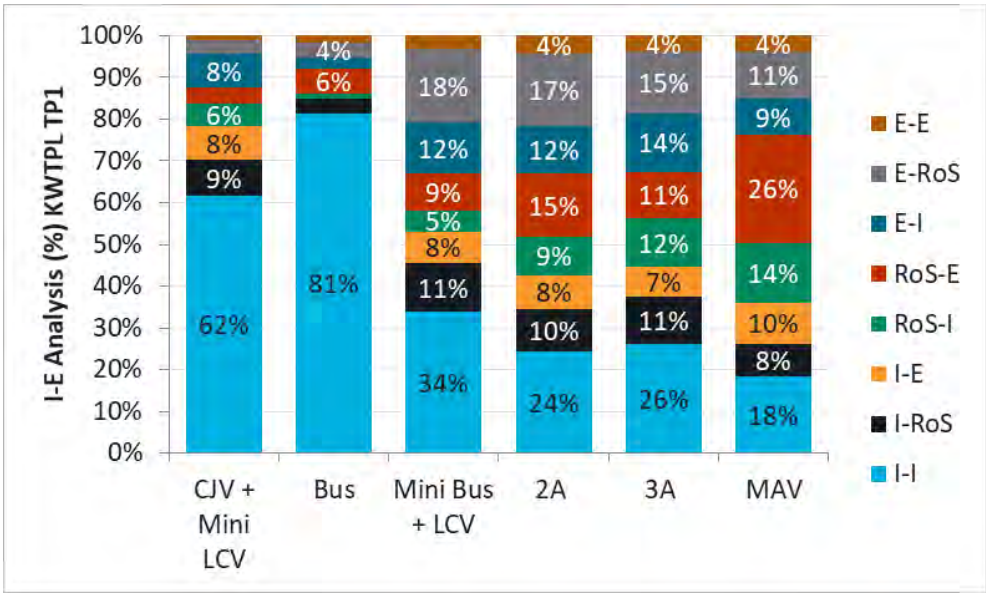
Internal External analysis

3.36 Internal-External analysis helps in identifying the trips which have both an origin and destination on or near the Asset i.e., local/IAOI zones (Internal-Internal or I-I), any one end on the Asset (Internal-External or I-E), or neither end on the Asset i.e., through trips (External-External or E-E). RoS here represents areas within the state which are neither local nor IAOI. 'Internal' zones are those that were analysed as 'local' and 'IAOI' in the zonal influence analysis, i.e., lying on the Asset, while 'External' zones are areas lying outside the state.

3.37 The figure below shows the distribution of trips based on these categories. Understandably, these reflect the observations seen in the zonal influence presented earlier, at a higher level of aggregation. As expected,

- more than 60% of the passenger traffic originates from and is destined to places within the internal areas i.e., local and IAOI zones thereby contributing to the local movement on the Asset.
- Overall, a significant share of the light goods traffic and 3A vehicles originate from external areas and end their trips in Kerala which could be attributed to Kerala's dependency on other states for meeting its consumption demand. However, 25% of the MAV traffic has its origin in areas within the Rest of the State and are destined to places in external areas. A lot of these trips are seen originating from Kochi and therefore it could be inferred that these trips cater to the movement of major commodities imported at the Cochin port such as petroleum oils to the rest of the country.

Figure 3.6: Internal-external distribution at TP Pampampallam



Source: Steer analysis of OD data

Commodity distribution

3.38 We have grouped various commodities into aggregate categories for ease of interpretation, as shown in the table below. The charts in the following sub-section present information in terms of aggregate commodity categories.

Table 3.12: Aggregate commodity categories

Commodity Description	Code	Combined codes used for charts
Agricultural Products / Cash crops (Wheat, Rice, Sugar cane, Maize etc.)	AGR	AGR
Perishable Items (Fruits, vegetables, milk, meat, fish etc.)	PER	
Cattle Food / Livestock (sheep, goat, cow, cattle food etc)	LIV	
Building Material / Construction (Cement, Lime, Brick etc)	CNS	CNS
Container	CTR	CTR
Empty	EMT	EMT
Groceries / Food items (Soap, Salt, Sugar, Pulses, Spices, Biscuits, bread, cool drinks, beer etc.)	GRO	GRO
Machinery / Spare parts	MAC	MAC
Steel / Metal (Iron, steel etc)	STL	MAN
Chemicals / Fertilizers (Acids, Fertilizers etc.)	CHM	
Manufacturing (Electronic items, Medicine, Leather, Wine, Rubber/ Tyre, Plastics, Cloth, Paper etc.)	MAN	
Automobiles (Finished products)	AUT	
Basic / Fabricated Metals (steel, iron)	MET	
Raw Wood, Cork & Wood Products, Fern	WUD	
Mining Minerals (Coal, Gypsum, Cobalt etc.)	MIN	MIN

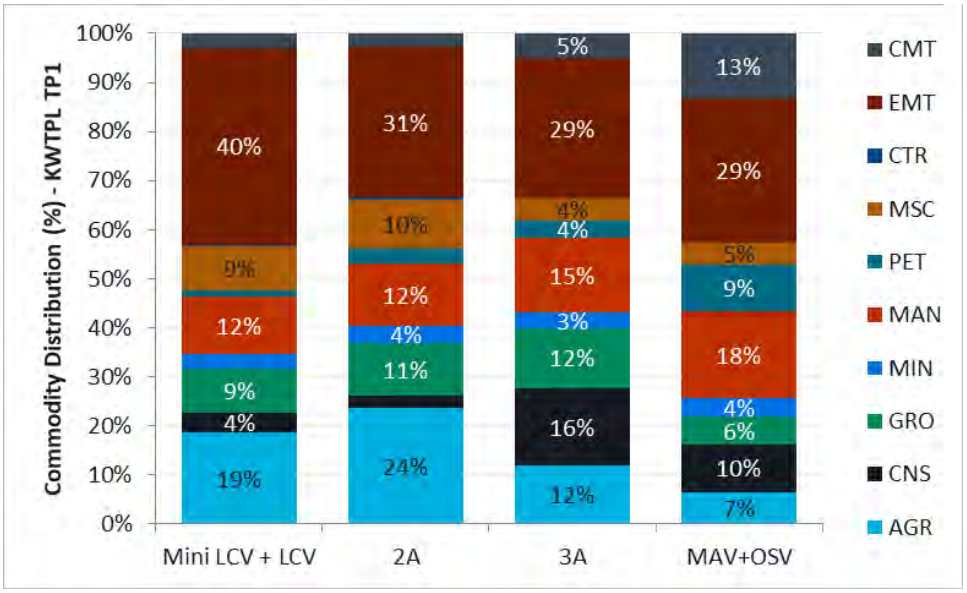
Commodity Description	Code	Combined codes used for charts
Miscellaneous (Parcel, Courier, Household items etc.)	MSC	MSC
Passengers	PAS	
Petroleum Products (Oil, LPG, CNG, etc.)	PET	PET
Sand	SND	SND
Stone (Kota stone, marble, Granite, Aggregate stone etc.)	STN	STN
Cement	CMT	CMT

Source: Steer Analysis

3.39 The following figures present the commodity distribution for goods vehicles at the total level and split by direction, towards Palakkad and towards Coimbatore.

3.40 The dominant commodity moved by 3A and MAVs includes manufacturing items such as rubber and plastic while around 9% of MAVs use the Asset to transport petroleum products. A high proportion of MAVs carried cement on the Asset which could be attributed to the presence of the state-owned Malabar Cement plant at Walayar and various other ancillary units along the Asset. Agricultural and grocery items, largely consisting of household products were the key commodity category moved by light goods vehicle accounting for around 30% of the share followed by manufacturing items.

Figure 3.7: Commodity distribution at TP Pampampallam (Total)

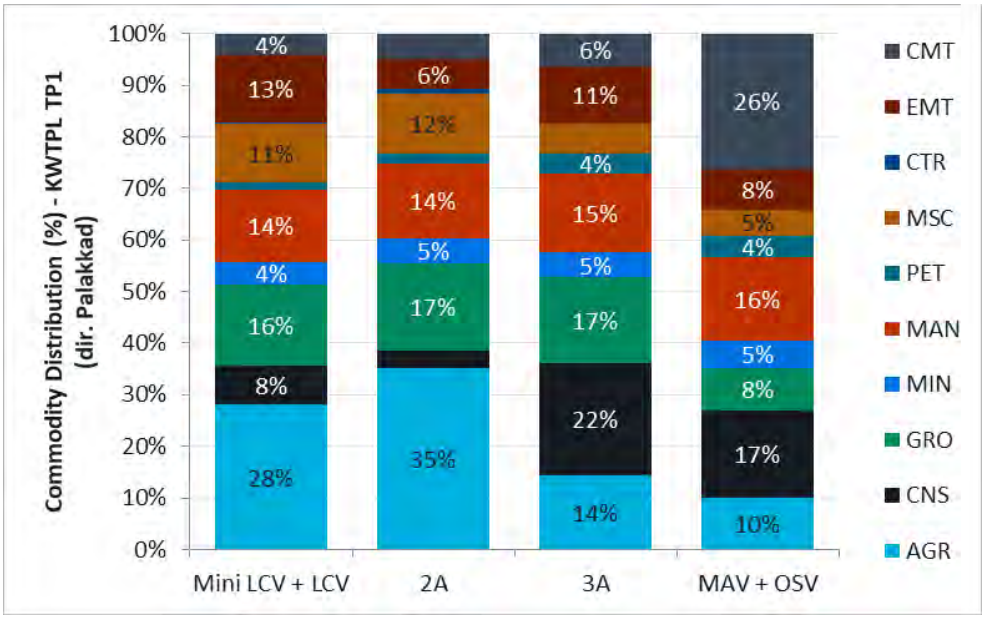


Source: Steer analysis of OD data

3.41 Looking by direction, it is seen that around 40-60% of the goods traffic is empty while travelling towards Coimbatore whereas those going in the direction of Palakkad carry a mixture of commodities with a majority of the light goods vehicles transporting agricultural products while the heavy goods vehicles carried construction material, manufacturing items and cement. This nature of direction-wise commodity distribution could be attributed to Kerala's dependency on other states for meeting its consumption demand including agricultural products and also cement, given that Kerala has a high demand for cement, 90% of which is met from external areas and the commodity distribution shows that 26% of the

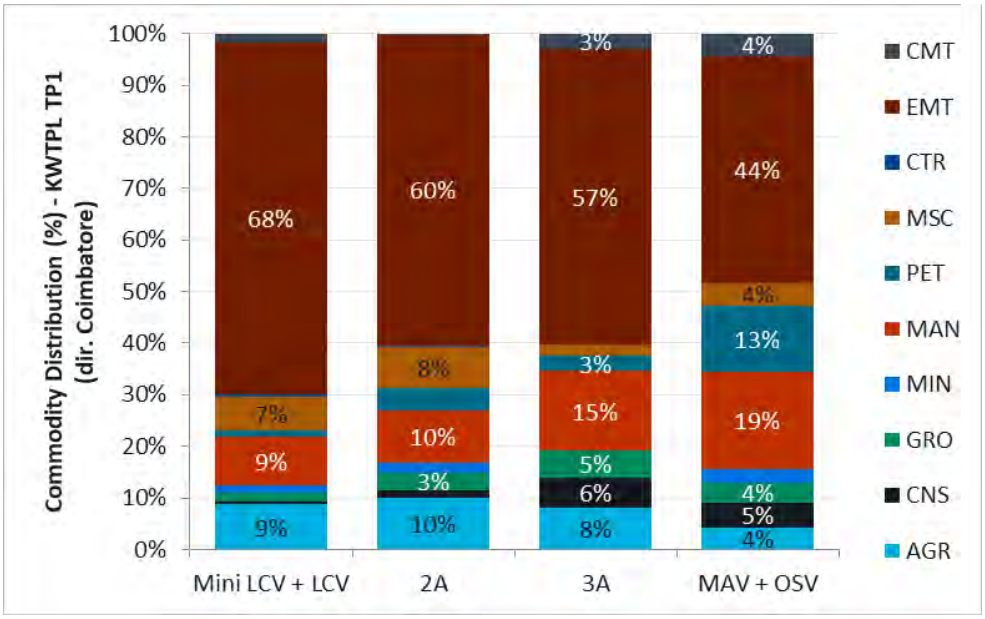
MAV's carry cement in the direction of Palakkad compared to 4% of the MAV's moving towards Coimbatore.

Figure 3.8: Commodity distribution at TP Pampampallam (towards Palakkad)



Source: Steer analysis of OD data

Figure 3.9: Commodity distribution at TP Pampampallam (towards Coimbatore)



Source: Steer analysis of OD data

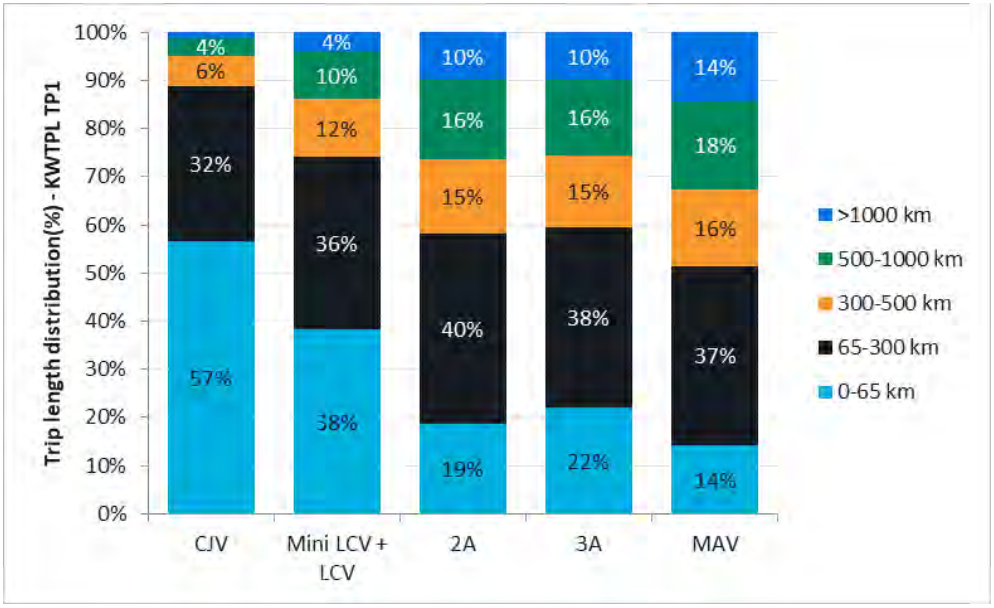
Trip length analysis

3.42 Trip-length distribution provides the distance-based profile of various vehicle categories. This aids in validating assumptions around the share of macro-economic drivers, inputs from zonal influence and toll segmentation. For ease of interpretation, we have categorised distances into 5 groups – local (0-65km), short-distance (65-300 km), medium-distance (300-500 km), long-

distance (500-1000 km) and very-long-distance (+1,000 km). The trip distances were derived as driving distances from Google Distance Matrix Tool based on zonal coordinates for OD pairs.[7]

3.43 Supporting the observations made in the zonal and internal-external analysis in the previous sections, the figure below highlights that the Asset primarily caters to the short and medium distance trips wherein more than 50% of passenger vehicles travel shorter distances up to 65 kms, contributing to the local movements on the Assets and majority of the goods traffic travel cover distances up to 300 kms.

Figure 3.10: Trip length distribution TP Pampampallam



Source: Steer analysis of OD data

Conclusions

3.44 Traffic on the Asset was dominated by CJVs which make up approximately 60% of the total vehicle composition, 3A/MAVs and LCVs contributing to 16% and 12% respectively. The Asset witnessed a significant decline in traffic from March to May 2020, with recovery evident from October 2020 for 2As and MAVs while CJVs came back to their pre-pandemic levels starting December 2020. Traffic in FY22 post 2nd and 3rd wave of COVID-19 has not recovered back to FY21Q4 levels signalling a delayed recovery in traffic volumes.

3.45 CJVs used to predominantly buy return tickets till FY20. However, with the onset of strict FASTag implementation, the share of single journeys increased across the category as the share of return journey tickets decreased post FY20. Later months of FY21 observed an even higher increase in the share of return tickets as the implementation rate of FASTag increased. For MAVs single tickets have remained dominant, holding a share of 81-85% till FY16-18 post which it decreased to 69% in FY21 and is trending at 44% in FY22. The proportion of local

[7] Google Distance API is a tool that is available on a chargeable basis from Google Maps Platform. Link: https://developers.google.com/maps/documentation/distance-matrix/start. Travel distance and time information for driving/transit under various congestion scenarios can be extracted through this tool by using macro-enabled Excel, R, etc.

personal tickets as well as exemptions has remained constant over the years. The Asset observes almost negligible violations.

3.46 Ticket segmentation for buses was dominated by exemptions historically. From FY16-20, average 65% of the total share of buses was exempted from paying toll. This can be attributed to the fact that the state buses are included in the exempted category according to the government norms and hence, are counted as 'Exemptions' on the Pampampallam toll plaza of the Asset. With the introduction of FASTag, better compliance can be observed on the Asset as the exempted passes got converted into monthly passes and hence, the share of exempted buses went down to 28% in FY21 and in FY22 it has reached 4%.

3.47 There has been a significant growth in ETC traffic due to recent government mandate aimed at 100% FASTag penetration. The proportion of vehicles with active FASTag grew by 99% by March-22 for MAVs and around 90% for CJVs.

3.48 The TVC data shows minor variation on the TMS data, where at a total level, the TVC data is approximately 3% higher than the TMS data. However, the difference is negligible (1.4%) for the larger revenue generating categories (2A,3A, MAV, and OSV combined). This gives us confidence that the base year traffic calculated using the Client data forms a reliable base year traffic estimate.

3.49 The OD analysis found that in terms of the zonal influence, local and IAOI areas such as Walayar and Coimbatore highly influence the movement of passenger traffic on the Asset whereas the heavy goods vehicle traffic is significantly influenced by areas in the Rest of the State such as Kochi, Thiruvananthapuram, and Ernakulam. Outside Kerala, states such as Tamil Nadu and Karnataka have a high influence on the movement of both light and heavy goods traffic on the Asset. The internal and external distribution highlights that majority of the passenger traffic originates from and is destined to places within the internal areas i.e., local and IAOI zones thereby contributing to the local movement on the Asset whereas a high proportion of heavy goods vehicle originate from external areas and end their trips in Kerala.

3.50 The key commodities transported on the Asset includes manufacturing items such as rubber and plastic for the heavy goods traffic and grocery/agricultural items by light goods vehicle. It is also observed that a higher share of vehicles across all categories are empty travelling towards Coimbatore whereas given Kerala's high consumption demand, which is met by other states, there is a higher share of traffic carrying a mix of commodities including cement towards Palakkad. This is consistent with the underlying economic trends where Kerala is predominantly a destination for various consumption linked commodities as it has relatively few industries located there.

4 Socio Economic Context

Introduction

4.1 The growth of traffic on existing (brownfield) roads depends on, firstly, how fast the background travel demand grows (background growth); and secondly, how successful the Asset is in attracting that traffic (traffic capture). Background travel demand is driven by the socio-economic conditions of the region where the Asset is located and conditions on a national scale. These include:

- Changes in factors such as population, economic growth (regional and national) and industrial production; and
- Other local factors such as strategic port growth, and growth in local industries near the Assets.

4.2 In turn, the change in the competitive position of the Asset (and thus of the traffic capture it will achieve) derives from how the service offered and the prices charged on the Asset change in comparison to competing roads; and whether any new competing road facilities are available.

4.3 In this chapter, we assess the socio-economic indicators relevant to traffic growth on the Asset.

Population growth

National Level

4.4 The total population in India has grown at a Compound Annual Growth Rate (CAGR) of 1.5% since 2000, decreasing over the years, as shown in the table below. The World Bank forecasts this growth to decrease to 0.6% CAGR by the 2030-45 period.

Table 4.1: CAGR of population in India

Years	CAGR		
	Total Population (m)	Rural Population (m)	Urban Population (m)
1970 - 1985	2.3%	1.9%	3.8%
1985 - 2000	2.0%	1.7%	2.9%
2000 - 2015	1.5%	1.0%	2.6%
2015 – 2030*	1.0%	0.3%	2.3%
2030 – 2045*	0.6%	-0.3%	1.9%

Source: World Bank Data on Health Nutrition and Population Statistics, *forecast population growth

State Level

4.5 The following table shows the evolution of population in the state of Kerala (containing the Asset), compared to that of the country. Overall, as can be seen, the trend observed at the country level is also noticeable at the state level, namely, a move towards urban agglomeration with the growth in rural population being slower than that of urban population. Further, Kerala has grown at a rate lesser than the country average in terms of total population, however its urban population has increased at a much higher rate, in the decade between 2001 and 2011.

Table 4.2: Population Growth in India (2001 – 2011)

State	2001 Population (m)			2011 Population (m)			CAGR (2001 – 2011)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Kerala	31.8	23.57	8.26	33.39	17.45	15.93	0.5%	(3.0%)	6.8%
India	1,028	742	286	1,210	833	377	1.6%	1.2%	2.8%

Source: National Institution for Transforming India (NITI Aayog) – Census Data

4.6 Due to the complexities of patterns of urbanisation, and the very dynamic nature of local population migration (which are very difficult to forecast with accuracy), we do not use population growth as a proxy for understanding future travel demand growth on the Asset. It has been included in this section simply to provide the underlying socio-economic context of the state/trends in the regions in which the Asset is located.

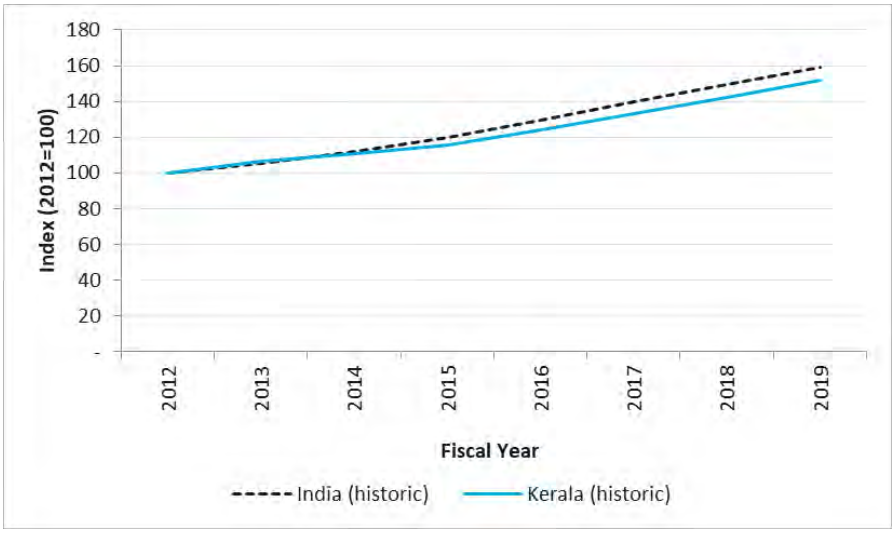
Economic growth

GDP and GSDP Growth

4.7 The Indian economy has grown at a CAGR of 6.9% over the past decade, aided by a strong growth in the services/tertiary sector (9.4% CAGR, FY12-FY19).

4.8 The economic performance of Kerala has been very similar to the country. The state contributes approximately 4% to India's GDP. The following figures illustrates the evolution of India and Kerala GDP.

Figure 4.1: Evolution of Kerala's state GDP and national GDP



Source: Open Government Data (OGD) Platform (State GDPs) and IMF (National GDP)

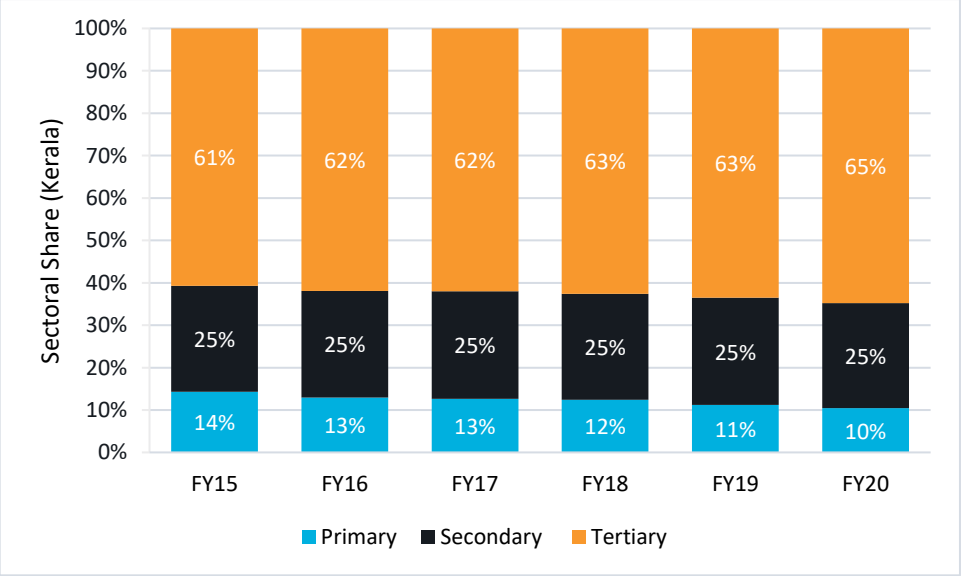
Economic activity in the state[8]

4.9 Kerala is a relatively small state situated in Southern India with an area of 38,863 sq.km and a population of 3.33 crore people. Share of primary sector such as agriculture and allied activity (including fisheries) is declining but it is a leading producer of cash crops such as coconut, rubber, coffee, pepper, cashew, and tea. Other key agricultural products include spices such as cardamom, vanilla, nutmeg, and cinnamon. Contribution of manufacturing sector is 12.5% in 2019-20 and is the second highest employer in the State after agriculture. The state contains a mix of traditional industries such as coir, cashew, and handloom as well as emerging businesses such as chemicals, refined petroleum products, rubber and plastic products, electronics, pharmaceuticals, and medical botanical products.

4.10 Services is a dominant contributor to the State's incomes, with over 60% contribution to GSDP. Leading contributors to this sector include tourism, Ayurveda and medicinal services, pilgrimage, IT services, financial services, and education. Kerala is one of the top destinations for international and domestics tourists in India, and around 1.9 million foreign tourists visited the State in 2019. Kerala has also become a major IT destination with a total turnover of about INR 15,000 cr and providing employment to more than 60,000 people in the State.

4.11 Major containerised traffic is routed through Cochin port and dispatched to final destinations via road. Cochin port handled total traffic of 3.4 MT; tea, coffee, cashew kernels, seafood, coir products and spices are major commodities exported via the port. The port also handles major import items for the State such as fertilisers, raw materials, iron and steel products, machinery and petroleum, oil and lubricants (POL).

Figure 4.2: Sectoral contribution to Kerala's GSDP



Source: Ministry of Statistics and Programme Implementation

[8] https://spb.kerala.gov.in/sites/default/files/2021-01/English-Vol-1_0.pdf

5 Traffic growth analysis

Introduction

5.1 In this chapter, we present our approach, assumptions and results for base (or background) traffic growth for each vehicle category on the Asset.

5.2 Traffic growth is commonly related to a variety of macro-economic and industry- or commodity-specific factors (hereafter referred to as 'traffic growth drivers'). These growth drivers are typically identified from the results of the OD data analysis and the site visits that help us appreciate the nature of traffic movement – 'what' travels 'where' and 'why'.

5.3 To understand the historical traffic trends in relation to these growth drivers, we carry out regression analysis to determine the historical relationship between traffic belonging to each major vehicle category and its macroeconomic growth driver at the toll plaza. The dynamics of traffic demand is the dependent variable while the dynamics of one or more identified growth drivers are the independent or explanatory variables.

5.4 Typically, passenger and light commercial vehicles like cars, buses, LCVs and 2-axle trucks grow in line with the GSDP of the state where the toll road is located. Heavy vehicle traffic like 3-axle trucks and MAVs grow in line with the national GDP. This is because most light vehicles tend to travel shorter distances within the state, whereas a significant proportion of heavy vehicles carry commodities for long-distances across the country. These commodities also tend to be part of industry ecosystems whose demand-supply relationships are scattered across the country and therefore relate more with GDP growth.

Estimation of background elasticities

5.5 Elasticities, in the case of traffic growth are the relationships between traffic and growth drivers. Multiplied with forecasts of growth drivers like GDP or GSDP, they provide the forecasts of background traffic growth rates.

5.6 The table below shows the historical CAGRs on the Asset by each vehicle category. The growth rates have been bucketed to analyse the historical growth under different time periods to arrive at an elasticity estimation.

Table 5.1: Historical vehicle-wise growth and CAGR (%) at TP Pampampallam

Vehicle Type	Growth (%)						CAGR (%) Growth (%)		
	FY17	FY18	FY19	FY20	FY21	FY22	FY16-19	FY16-20	FY20-22
CJV	26.3%	15.8%	6.0%	9.1%	(39.8%)	24.5%	15.8%	14.1%	14.1%
LCV	14.7%	24.3%	37.1%	1.6%	(36.9%)	3.5%	25.0%	18.7%	18.7%
Bus	13.0%	1.6%	(3.2%)	4.4%	(75.3%)	52.4%	3.6%	3.8%	3.8%
2A	(2.6%)	9.4%	35.2%	4.8%	(3.1%)	31.8%		10.8%	

Vehicle Type	Growth (%)						CAGR (%) Growth (%)		
	FY17	FY18	FY19	FY20	FY21	FY22	FY16-19	FY16-20	FY20-22
3A/MAV	16.9%	27.7%	19.2%	3.5%	(1.2%)	13.1%	21.2%	16.5%	16.5%
OSV	51.3%	110.4%	(31.9%)	81.2%	(43.0%)	80.6%		40.8%	
Total AADT	**20.8%**	**16.9%**	**12.3%**	**6.7%**	**(33.6%)**	**20.5%**	**16.6%**	**14.1%**	**14.1%**
PCU	**17.3%**	**18.3%**	**15.1%**	**5.3%**	**(25.0%)**	**18.7%**	**16.9%**	**13.9%**	**13.9%**

Source: Steer analysis of Client TMS data

5.7 Typically, we rely on national GDP as a growth driver for 3A/MAV trucks, given their characteristics of travelling across multiple states and carrying varied types of commodities which contribute to national GDP. However, for this Asset, the movement of trucks is almost entirely dependent on the consumption of the state of Kerala, as previously described in Chapter 2. Therefore, for this Asset we have used the GSDP of Kerala as the growth driver for trucks too. These

5.8 The below table presents the growth drivers identified to model the forecast background traffic growth rates.

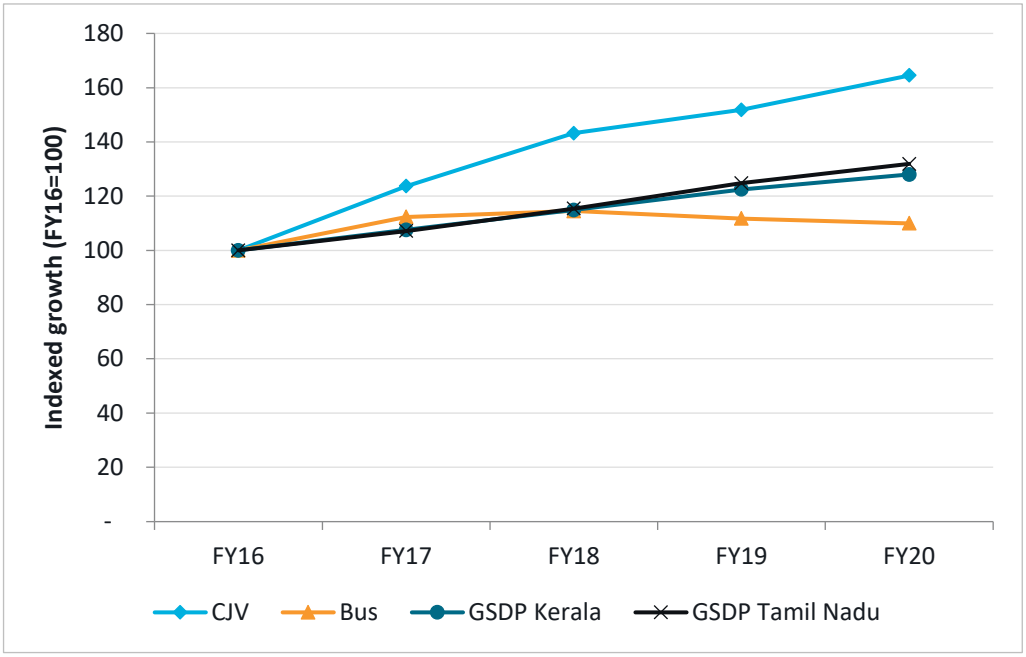
Table 5.2: Identified growth drivers to model traffic growth

Vehicle type	Growth Driver
Car	GSDP Tamil Nadu and Kerala
LCV	GSDP Kerala
Bus	GSDP Tamil Nadu and Kerala
2A	GSDP Kerala
3A	GSDP Kerala
MAV	GSDP Kerala

Source: Steer analysis of Client data

5.9 The traffic on this Asset has shown variable growth trends every year (for the reasons described in Chapter 3), due to which econometric regression analysis does not provide robust enough results of elasticities to growth drivers. We have therefore, analysed trends of each vehicle category and compared with the growth of key drivers, as described below.

Figure 5.1: Relationship between CJV and Bus traffic with GSDP of Kerala and Tamil Nadu



Source: Steer analysis of Client TMS data and publicly available GSDP data

5.10 Further, FY21 and FY22 have been impacted by COVID-19 related restrictions and the traffic volumes on the Asset were significantly impacted during the travel restrictions imposed during the first, second and third wave of COVID-19. Hence, FY21 and FY22 have not been considered while undertaking the regression analysis.

CJV

5.11 As can be seen from the figure above, cars have shown a strong growth on this Asset, driven by the local trips between the urban centres of Walayar, Coimbatore, Thrissur, and other areas in Palakkad district, as well as high contribution of tourism.

5.12 Generally, we would expect that in fast-growing economies with relatively low car ownership levels, car traffic growth rates are often in line with or slightly higher than growth in GSDP/GDP (i.e., suggesting elasticities at or just above 1.0). Further, there is an expected increase in car ownership proportion of overall population as the economy grows.

5.13 Historically, the CJV traffic on the Asset has shown strong growth of ~20% in the FY16-FY18 period, with the growth in this category slightly moderating in the recent years to reach a CAGR of 7% between FY18-FY20.

Nevertheless, the relationship to GSDP suggests that during more stable years, CJVs have grown with a background traffic growth elasticity of 1.2. Taking note of the positive outlook for passenger traffic on the tourism-driven Asset, we have assumed a forecast background elasticity of 1.2 expected to taper down to 1 by FY25. The tapering down has been done since the car growth has shown a big jump given how people's perception has changed post Covid-19, a lot of [people have shifted to personal mobility choices over public mode of transportation. However, such high growth is not a sustainable change and eventually with rise in fuel prices, and inflation the car growth is likely to taper down.

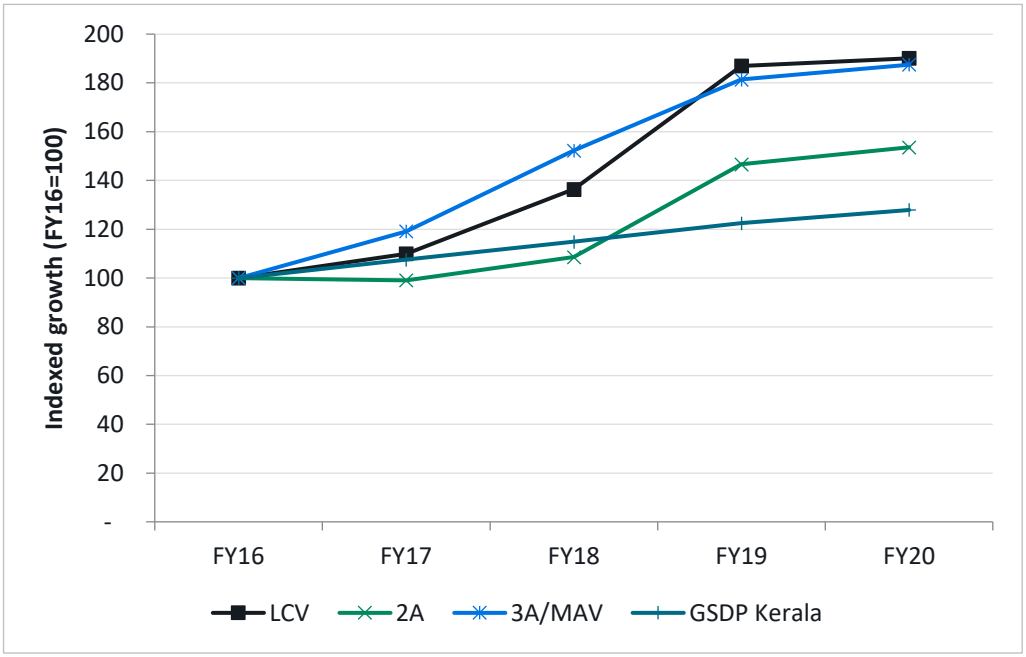
Bus

5.14 Bus growth tends to be largely supply-driven in many parts of the country, with new buses being bought and deployed by the government at intervals of time. Based on our experience

across the country, buses on inter-urban and tourism corridors show elasticities of 0.20 to 0.50 with respect to the GSDP.

5.15 The bus traffic trend on this Asset has shown an average growth till FY18 and thereafter a decline in recent years. We thus expect the buses on this Asset to have an overall stable low growth in the forecast, with a relationship lower than benchmark states, to reflect this slower growth observed in recent years, and have used an elasticity of 0.2 to GSDP.

Figure 5.2: Relationship between commercial traffic with GSDP of Kerala



LCV, 2A

5.16 As described in Chapter 3, the growth of commercial vehicles had a stable low profile in the initial years, due to the inconvenience of Octroi near the state border. However, the traffic growth increased after the GST was implemented in FY18.

5.17 Although LCV and 2A have similar traffic characteristics in terms of types of commodities carried and the distances covered, as seen in the OD data analysis in Chapter 3, LCVs trucks have a higher preference in use. This is seen both from the volume of the categories (LCV ~2,000 and 2A ~1,000) and the growth registered by the categories, shown in Figure 5.2. LCV recorded a growth of 17% over FY16-FY20 while 2A recorded about 2% growth over the same period. These growths can be seen to be stabilising by FY20.

5.18 Therefore, looking forward, we have assumed higher elasticity of 0.50 for LCV and a lower elasticity of 0.20 for 2A with respect to GSDP, which is within the range of benchmarks observed in other parts of the country.

3A/MAV Trucks

5.19 3A and MAV have consistently recorded a high growth: 22% CAGR over FY16-FY18, and 11% CAGR over FY18-FY20, which are influenced by the jump in 3A-MAV volumes in FY18 due to GST implementation. As such, the actual underlying growth rate is not easily separated from the impact of these exogenous events.

5.20 In general, in the country, we have observed that 3As grow slower than MAVs due to a shift between these categories, as there is an increasing preference seen for MAVs instead of 3As across the country. This is because MAVs have higher load capacity which generate economies of scale and therefore lower costs. However, it is unlikely that 3A trucks will disappear from the market completely as there are likely certain commodities or movements which are best served by 3As.

5.21 Based on these trends, we have assumed elasticities of 0.30 and 0.90 for 3A and MAV trucks respectively, with respect to GSDP Kerala, which are in line with benchmarks observed across the country.

Forecasts for background elasticities

5.22 The following table presents a summary of the results of the regression analysis carried out on historical toll plaza data and the macroeconomic (GDP/GDSP) growth, along with the assumed forecast elasticities for background traffic growth.

5.23 The forecast elasticities are assumed to remain constant over the concession period, except for cars, as the logistics sector in still in early stages of development in India (95% of trucks still owned by operators owning less than 5 trucks). Car ownership levels are still around 30-35 per 1000 people, and it is likely to take a few years before the market reaches maturity. These trends are based on a long-term understanding of historical relationships and an overall outlook on the growth of the region and the country.

Table 5.3: Adopted forecast elasticities for background growth

Vehicle type	Growth driver	Forecast	
		Adopted Elasticity	Evolution of elasticity
Car	GSDP Kerala	1.2	Gradual decrease to '1' by FY25
	GSDP Tamil Nadu		
LCV	GSDP Kerala	0.5	Constant
Bus	GSDP Kerala	0.2	Constant
	GSDP Tamil Nadu		
2A	GSDP Kerala	0.2	Constant
3A	GSDP Kerala	0.3	Constant
MAV	GSDP Kerala	0.9	Constant

Source: Steer analysis of Client data

Forecasts for growth drivers

5.24 Following the discussion in Chapter 4 on the nature of economic activity in the state of Kerala, in this section, we describe the assumptions in relation to forecasts of the key macro-economic drivers of traffic growth. Particularly, we have based our forecast on GDP and GSDP projections provided by the Client.

National GDP

5.25 India's GDP and the relevant state GSDPs are the primary macroeconomic variables that have been modelled to drive our traffic growth forecasts. After the last period of economic slowdown in FY11-12, the country has been experiencing an economic downturn since late FY19 with the average forecast for FY20 from independent sources at the time being 4%.

Related events to the economic slowdown include reduced growth rates in automobile sales and production, liquidity crunch, rising number of non-performing assets, lower manufacturing outputs and lower rural consumption.

5.26 Furthermore, the last months of FY20 and FY21 have been affected by COVID-19, with impacts on industry (economic activity) and society (social activity). This bias has been addressed in terms of base traffic estimation (as described in Chapter 6) and we based our forecast on the GDP projections shared by the Client as shown in Figure 5.3.

5.27 Based on that, GDP forecast to grow by 7.0% between FY23 and FY26 and gradually tapering down to 6.0% by FY40, end of concession.

5.28 The GDP growth for India provided by the Client is in line with other independent forecasts available form from reliable sources such as IMF, World Bank and RBI in the short and medium term, while longer term GDP forecasts are considered to be optimistic.

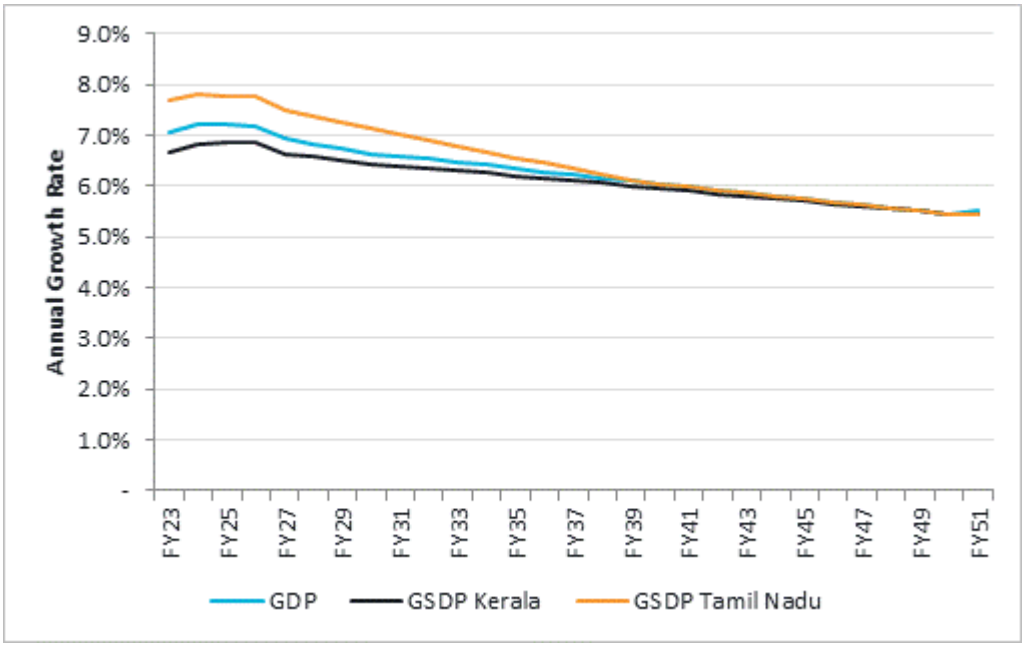
State GSDP

5.29 As per Client projections, Kerala's GSDP assumes to continue growing in line with the national GDP throughout the concession period. We believe this is a realistic position based on the current and future development plans of local and state governments.

5.30 There are significant investments expected to take place in the State across its leading industrial sectors such as food processing including sea food units, spices, rubber, electronics, coir, and other traditional sectors. Service sectors such as IT, Ayurveda and tourism are also expected to grow and contribute to the State's expected GSDP growth if the planned investments are realised.

5.31 The GDP-GSDP lines are expected to converge by FY40. The chart below shows the forecast growth lines for GDP and Kerala GSDP.

Figure 5.3: GDP-GSDP forecast



Source: GDP and GSDP forecast provided by Client

6 Forecasts: Base year AADT and Impacts

Introduction

6.1 Following the discussion on our forecast of base growth rates in the previous chapter, this chapter first covers the forecasting assumptions around base year AADT and potential network impacts on traffic growth on the Asset. Thereafter, we present our assumptions around toll segmentations, trip factors and evolution of toll rates for the concession period which are used to forecast revenues as derived from forecast traffic. In the final section, this chapter summarises traffic growth rates for the forecast years.

6.2 The following table lists key intermediate and final outputs that have presented in previous Chapters and in this chapter.

Table 6.1: Key intermediate and final outputs in the forecast

Forecast	Final outputs	Intermediate outputs	Inputs	Chapter
Traffic	Base year AADT	ADT, SCF estimate for base year	Historical SCF and year-to-date ADT	Chapter 3, 6
	Background traffic growth	Background forecast elasticity	Background historical elasticities with respect to growth drivers	Chapter 5, Appendix C
		Forecasts for growth drivers	Historical performance of growth drivers along with Client's GDP line	Chapter 4, 5, Appendix C
	Impact growth rates and staging	Impacts	Development of Vadakkanchery-Thrissur section of NH 544 and Kuthiran tunnel	Chapters 6
Revenue	Annual/daily revenue forecasts	Forecast toll segmentation: Trip frequencies and trip factors	Historical trip frequencies	Chapter 3, 6
			Historical trip factors	Chapter 6
		Future toll rates	Toll evolution	Chapter 6

Source: Steer

6.3 All traffic is presented as AADT by vehicle category at the toll plaza, for financial years (April-March). All revenue is presented in INR (nominal terms). Though FY38 is the last year of concession, we have developed our forecasts until FY40 for the Client's reference.

Seasonality Correction factors

6.4 Traffic on any Asset varies on a month-on-month level. Such variations maybe due to monsoons (typically Jul to Sept) or due to festivals in the region. For e.g. It is observed that typically the truck traffic during the first half of the financial year (April-September) is generally lower than the annual average, mainly because of peak summer season followed by monsoons affecting the freight movement patterns in large parts of the country in the July-September period. In addition to these there may be other seasonal variations specific to the Asset.

6.5 In order to normalise for these variations across the year to provide an AADT estimate, Seasonality Correction Factors (SCF) are used. SCFs are estimated to convert the monthly traffic numbers to an AADT level while accounting for seasonal variation due to local/national festivals, weather changes and/or temporary external impacts. These are typically estimated using historical data for each plaza and vehicle category over multiple years. An SCF >1 means that the traffic for the month is lower than the annual average and vice-versa.

6.6 To achieve this, we studied the seasonality between monthly average daily traffic (MADT) – We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. This averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.7 We have analysed the seasonality trends between monthly average daily traffic (MADT) and AADT for data during the historical years of tolling (as described in Chapter 3, section 3.19), excluding the years that were impacted by specific events. This averaged seasonality trend is then applied to the monthly traffic to obtain AADT as mentioned in the previous sections.

6.8 The seasonality factors assumed for individual vehicle types for each toll plaza are shown in the table below.

Table 6.2: Seasonality correction factors for TP1 Pampampallam

Vehicle Class	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
CJV	0.93	0.90	1.08	0.96	1.26	1.03	1.08	1.04	0.89	0.94	1.02	1.03
LCV	1.17	1.10	1.31	1.10	1.24	0.98	1.00	0.96	0.82	0.86	0.89	0.89
Bus	1.00	0.99	1.08	1.04	1.14	0.97	1.00	0.92	0.94	1.01	0.90	1.08
2A	1.14	1.14	1.06	0.93	1.04	0.99	1.08	1.07	1.00	0.98	0.87	0.89
MAV	1.11	1.07	1.11	1.07	1.16	0.98	1.00	0.97	0.94	0.97	0.90	0.86

Source: Steer analysis of Client historical TMS data

FY22 AADT estimates

6.9 As discussed earlier in chapter 1 and 3, The second wave of COVID-19 infections peaked in the in the country in the months of April and May 2021. Therefore, the traffic volumes on the Asset were impacted during Q1FY22. The period starting October 2021 up until March 2022 is devoid of any significant event, except Jan 2022 when the third wave of COVID-19 affected traffic volumes.

6.10 However, the impact was short lived and primarily impacted CJV volumes and hence Jan 2022 has not been considered in the AADT estimation (for CJV and Buses). We believe that the

traffic levels observed during the November 2021 - March 2022 period when seasonally adjusted, were representative of normalised traffic on the asset and not a result of temporary shifts or impacts, despite the slow recovery to normal in Kerela as a state in general.

6.11 The FY22 adopted is based on average of AADT for Nov-21 to Mar-22 for all the vehicle types except CJV and Bus category. In the case of CJV and Buses Jan 2022 is impacted by the third wave of COVID-19 related restrictions, hence the month has been excluded from the analysis. The adopted AADT for FY22 is presented below, further MADT for each of the months from Pct-21 upto Mar-22 are also provided:

Table 6.3: Adopted AADT for FY22 (Oct-March, MADT)

Vehicle category	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	FY22 Adopted
CJV	8,744	10,556	12,087	9,607	10,599	11,778	11,204
LCV	1,649	1,565	1,714	1,656	1,742	1,809	1,499
Bus	301	350	569	501	528	577	488
2A	1,229	1,190	1,412	1,371	1,459	1,475	1,321
MAV	2,943	2,841	3,104	3,154	3,485	3,514	2,978
Total	**14,867**	**16,502**	**18,885**	**16,289**	**17,813**	**19,153**	**17,491**
PCU	**25,332**	**26,717**	**30,642**	**27,913**	**30,448**	**32,019**	**28,518**

Source: Steer analysis

Analysis of potential impacts

Tourism revival

6.12 Once COVID-19 related restrictions are relaxed and the economy revives in Kerela it is expected that tourism traffic will return to the state and in turn on the Asset, therefore it is expected that CJV and bus traffic will be impacted positively on the Asset. Bus volumes are expected to revive and reach close to pre-Covid19 levels, whereas CJV's tourism movement is also expected to commence as the state restriction and interstate travel between Tamil Nadu and Kerala resumes. The revival is expected to commence starting FY23.

Table 6.4: Estimated impact of tourism revival on the Asset

	CJV	Bus	2A	3A	MAV
Impact %	5.0%	10.0%	-	-	-

Source: Steer analysis

Revenue forecasting assumptions

6.13 To forecast the revenues for a particular financial year, the traffic forecast for each vehicle type is converted into tickets sold, which is then multiplied with the corresponding toll rate, which grows over the years as defined in the Concession Agreement. While "trip factors" provide the conversion factor to the former, i.e., traffic (trips) to tickets sold, "toll segmentation" provides the latter i.e., the breakup of trips paying each ticket type. This section discusses assumptions related to trip factors, toll segmentation and toll rates for the forecast period.

Trip factors

6.14 Trip factors are used to calculate the revenue for the trips made on passes such as return, local personal, monthly passes. The trip factors assumed are based on the latest FY21 data available and listed in the table below:

Table 6.5: Trip factors for the forecast years

Ticket category	CJV	LCV	Bus	2A	3A	MAV	OSV
Single	1	1	1	1	1	1	1
Return	2	2	2	2	2	2	2
Monthly	1,213	45	41	53	39	39	1
Local Commercial	1	1	1	1	1	1	1
Local Personal	13	1	1	1	1	1	1
Exemptions	1	1	1	1	1	1	1

Source: Steer analysis of Client TMS data (*Trip factors are based on data provided by the vendor, and it indicates a large number of CJV Monthly trips are not converting to revenue)

Toll segmentation

6.15 As discussed in Chapter 3, segmentation trends have largely been stabilising over the years, with FY21 (shown in the following tables) due to FASTag implementation and penetration. Overall, the Asset is well managed with a minimal proportion of exemptions and violations across vehicle categories. Buses comprise majority of exemptions as they are primarily local. This has also led to an increase in the share of Single tickets compared to FY19 levels in CJVs, LCVs and buses. For 2A and 3A/MAV, the return category has increased with normalisation of the network.

Table 6.6: Forecast toll segmentation, FY22 onwards

Ticket type	CJV	Bus	LCV	2A	3A/MAV	OSV
Single	44%	22%	39%	54%	60%	59%
Return	51%	76%	61%	46%	40%	34%
Monthly	2%	2%	-	1%	-	-
Local personal	1%	-	-	-	-	-
Exemptions	2%	-	-	-	-	-

Source: Steer analysis of Client TMS data

Toll evolution

6.16 Based on the concession agreement and the gazetted toll notification, we understand that base toll rates increase every year (revision month is April) based on WPI-linked inflation. These are rounded up to the nearest five to estimate the final toll rate charged to users.

6.17 We have used actual toll rates from the FY19 and FY21 toll notifications to validate the modelling of future toll evolution. Increase in WPI was calculated based on the Client's WPI

forecasts, as shown in the table below. The upward trend in inflation is expected to continue in the medium term, before gradually tapering to 4.0% in the long term.

Table 6.7: WPI growth forecast assumptions

Financial year	WPI growth (%)
FY23	14.3%
FY24	5.6%
FY25	5.4%
FY26	5.5%
FY27	5.3%
FY28	4.9%
FY29	4.4%
FY30	4.2%
FY31	4.1%
FY32	4.1%
FY33	4.0%
FY34	4.0%
FY35 onwards	4.0%

Source: WPI forecasts shared by client, *FY23 WPI growth is for Dec-21, as per the latest March 2022 publication released by RBI

Revenue reconciliation

6.18 As part of validating the data provided by the Client, as well as our assumptions around toll calculations, we have reconciled the actual reported revenue against the modelled revenue. For the Asset we have reconciled reported revenue for the month of Feb 2022 with the modelled revenue based on Feb 2022 MADT and forecast assumptions on toll segmentation, trip factors and toll rates.

6.19 The comparison, as shown in the table below, shows that modelled revenue overall is within a variation of 0.5% from the reported revenue. This gives us confidence that the revenues estimated using the traffic data in our forecasts are accurately representing the revenues being reported from the Asset.

Table 6.8: Revenue reconciliation summary for March 2022

TP#	Steer modelled revenue (INR lakhs)	Reported revenue (INR lakhs)	Difference (%)
TP1 Pampampallam	22.87	22.98	(0.5%)

Source: Steer comparison between modelled and reported revenue

Traffic and Revenue forecasts

6.20 Based on the traffic and revenue-related forecast assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Asset. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Asset. Further, Appendix B presents the AADT and revenues for the forecast period.

Table 6.9: Forecast (background plus impacts) AADT for TP1 Pampampallam

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
CJV	11,204	12,675	16,819	23,375	33,813	50,479
LCV	1,499	1,549	1,770	2,075	2,491	3,048
Bus	488	545	577	617	666	722
2A	1,321	1,339	1,413	1,507	1,622	1,760
3A	877	895	970	1,068	1,192	1,346
MAV	2,101	2,226	2,823	3,745	5,180	7,419
OSV	1	1	1	2	2	4
AADT	**17,492**	**19,229**	**24,373**	**32,388**	**44,966**	**64,777**
PCU's	**28,522**	**30,761**	**37,773**	**48,556**	**65,273**	**91,289**

Source: Steer analysis

Table 6.10: Forecast (background plus impacts) AADT CAGR (%) TP1 Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	13.1%	7.3%	6.8%	6.3%	6.8%
LCV	3.3%	3.4%	3.2%	3.1%	3.2%
Bus	11.6%	1.5%	1.4%	1.3%	1.3%
2A	1.3%	1.4%	1.3%	1.2%	1.3%
3A	2.0%	2.0%	1.9%	1.9%	1.9%
MAV	6.0%	6.1%	5.8%	5.6%	5.8%
OSV	6.0%	6.1%	5.8%	5.6%	5.8%
AADT	9.9%	6.1%	5.9%	5.6%	5.8%
PCU's	7.8%	5.3%	5.2%	5.1%	5.1%

Source: Steer analysis

Table 6.11: Forecast (background plus impacts) revenue (INR crores) forecast for TP1 Pampampallam

Vehicle Type	FY22	FY27	FY32	FY38	FY45
CJV	22.1	28.2	45.4	80.3	150.6
Bus	4.9	5.6	7.9	11.8	18.4
LCV	3.2	3.9	5.1	6.9	9.7
2A	9.5	10.6	13.8	18.7	26.1

Vehicle Type	FY22	FY27	FY32	FY38	FY45
3A	10.1	11.3	15.1	21.0	30.6
MAV	24.1	28.1	44.0	73.8	133.1
OSV	0.0	0.0	0.0	0.0	0.1
Total Revenue	**73.9**	**87.8**	**131.3**	**212.6**	**368.5**

Source: Steer analysis

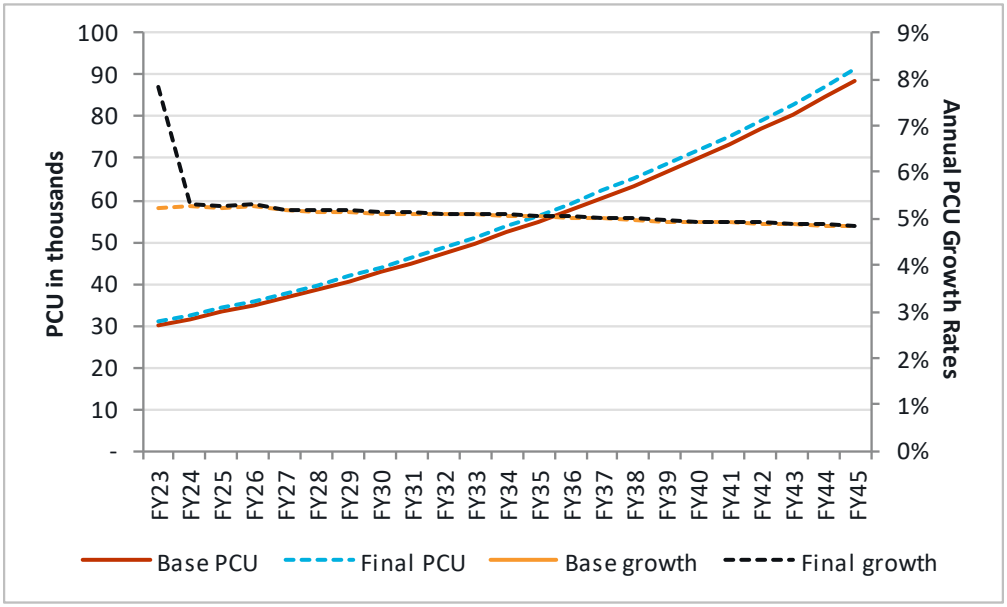
Table 6.12: Forecast (background plus impacts) revenue CAGR (%) for TP1 Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	27.6%	12.6%	12.1%	11.0%	11.8%
LCV	15.3%	8.6%	8.5%	7.7%	8.2%
Bus	22.7%	6.9%	6.3%	5.8%	6.2%
2A	11.0%	6.9%	6.2%	5.7%	6.2%
3A	12.4%	7.5%	6.8%	6.5%	6.9%
MAV	16.7%	11.8%	10.9%	10.3%	10.9%
OSV	17.1%	11.8%	10.9%	10.3%	10.9%
Total revenue	**18.8%**	**10.6%**	**10.1%**	**9.6%**	**10.0%**

Source: Steer analysis

6.21 As presented in the table above, CAGRs (FY22-FY38) in terms of PCUs for the final (background plus impacts) growth rates is 10% for the period of the concession.

Figure 6.1: Traffic and growth rates for forecast PCUs - Background and final, TP1 Pampampallam



Source: Steer analysis

Upside and Downside Cases

6.22 We have developed our base case scenario considering a balanced view on the risks associated with input assumptions around GDP growth and traffic growth elasticities. There is always a risk that the outturn values of these inputs will vary as compared to the assumptions taken due to exogenous impacts, e.g. GDP growth could be influenced both positively and negatively by the impact of monsoons, export-import balances, political changes etc.

6.23 Similarly, traffic growth elasticities could be influenced by increased efficiencies achieved by technology, large shifts in commodity prices globally, changes in local manufacturing practices. However, at this stage we consider that the base case represents a central case scenario given the risks of variation of input assumptions.

6.24 To account for the possible variations in the growth drivers, we are also presenting the forecasts for an Upside (optimistic) and a Downside (pessimistic) scenario. These scenarios are defined by the following variations from the base assumptions

Table 6.13: Summary of Macro Assumptions for upside and downside cases

Asset	Input	Upside	Downside
Macro Assumptions			
KWTPL	GDP/GSDP	+1% every year	-1% every year
KWTPL	WPI	+1% every year	-1% every year
KWTPL	Elasticities	+ 10%	- 10%

Source: Steer analysis

6.25 The traffic forecast and growth, and revenue incorporating the upside and downside assumptions are presented in the following sections.

Traffic and Revenue Forecasts-Upside case

6.26 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Upside case.

6.27 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.14: Traffic forecast (With Upside Impacts) for TP1: Pampampallam

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
CJV	11,204	12,906	18,333	27,675	44,117	73,578
Bus	1,499	1,562	1,848	2,259	2,850	3,692
LCV	488	547	587	639	704	782
2A	1,321	1,343	1,438	1,560	1,714	1,903
3A	877	899	996	1,124	1,294	1,513
MAV	2,101	2,260	3,042	4,344	6,558	10,380
OSV	1	1	1	2	3	5
AADT	**17,492**	**19,518**	**26,245**	**37,605**	**57,239**	**91,853**
PCU's	**28,522**	**31,157**	**40,317**	**55,529**	**81,406**	**126,343**

Source: Steer analysis

Table 6.15: Traffic growth AADT (With Upside Impacts) CAGR (%) for TP1: Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	15.2%	9.2%	8.6%	8.1%	8.5%
Bus	4.2%	4.3%	4.1%	3.9%	4.1%
LCV	12.0%	1.8%	1.7%	1.6%	1.7%
2A	1.7%	1.7%	1.6%	1.6%	1.6%
3A	2.5%	2.6%	2.5%	2.4%	2.5%
MAV	7.6%	7.7%	7.4%	7.1%	7.4%
OSV	7.6%	7.7%	7.4%	7.1%	7.4%
AADT	**11.6%**	**7.7%**	**7.5%**	**7.3%**	**7.4%**
PCU's	**9.2%**	**6.7%**	**6.6%**	**6.6%**	**6.6%**

Source: Steer analysis

Table 6.16: Revenue forecast (With Upside Impacts) for TP1: Pampampallam (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
CJV	22.1	28.7	51.8	99.9	219.5	533.4
Bus	4.9	5.8	8.5	13.7	23.7	44.4
LCV	3.2	4.0	5.4	7.7	11.6	18.7
2A	9.5	10.8	14.5	20.6	31.1	50.2
3A	10.2	11.5	16.1	23.8	37.5	63.7
MAV	24.4	28.9	49.2	92.1	189.9	436.9
OSV	0.0	0.0	0.0	0.0	0.1	0.2
Total Revenue	**74.3**	**89.7**	**145.7**	**257.8**	**513.3**	**1,147.2**

Source: Steer analysis

Table 6.17: Revenue growth (With Upside Impacts) CAGR (%) for TP1: Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	30.0%	15.9%	14.0%	14.0%	14.5%
Bus	18.1%	10.3%	9.9%	9.6%	9.9%
LCV	25.1%	7.8%	7.3%	7.1%	7.4%
2A	13.3%	7.7%	7.2%	7.1%	7.3%
3A	12.8%	8.8%	8.1%	7.8%	8.2%
MAV	18.4%	14.3%	13.3%	12.8%	13.4%
OSV	19.0%	14.2%	13.4%	12.8%	13.4%
Total Revenue	**20.7%**	**12.9%**	**12.1%**	**12.2%**	**12.3%**

Source: Steer analysis

Traffic and Revenue Forecasts-Downside case

6.28 Based on the Upside assumptions discussed above, we have modelled the traffic and revenue forecasts for the forecast period for the Assets. The table below presents the MADT/PCU and revenue forecast growth rates and CAGRs on this Assets for Downside case.

6.29 Please note that below tables present the normalised traffic for FY22 (FY22*) as detailed above.

Table 6.18: Traffic forecast (With Downside Impacts) for TP1: Pampampallam

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
CJV	11,204	12,469	15,556	20,067	26,603	35,966
Bus	1,499	1,537	1,704	1,924	2,209	2,569
LCV	488	543	568	598	633	673
2A	1,321	1,335	1,391	1,461	1,545	1,641
3A	877	891	948	1,020	1,108	1,214
MAV	2,101	2,197	2,639	3,277	4,192	5,490
OSV	1	1	1	2	2	3
AADT	**17,492**	**18,973**	**22,807**	**28,347**	**36,292**	**47,556**
PCU's	**28,522**	**30,410**	**35,638**	**43,121**	**53,762**	**68,723**

Source: Steer analysis

Table 6.19: Traffic growth AADT (With Downside Impacts) CAGR (%) for TP1: Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	11.3%	5.7%	5.2%	4.8%	5.2%
Bus	2.5%	2.6%	2.5%	2.3%	2.4%
LCV	11.2%	1.1%	1.0%	1.0%	1.0%
2A	1.0%	1.0%	1.0%	0.9%	1.0%
3A	1.5%	1.6%	1.5%	1.4%	1.5%
MAV	4.6%	4.7%	4.4%	4.2%	4.4%
OSV	4.6%	4.7%	4.4%	4.2%	4.4%
AADT	**8.5%**	**4.7%**	**4.4%**	**4.2%**	**4.4%**
PCU's	**6.6%**	**4.0%**	**3.9%**	**3.7%**	**3.9%**

Source: Steer analysis

Table 6.20: Revenue forecast (With Downside Impacts) for TP1: Pampampallam (In Cr)

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
CJV	22.1	26.8	40.0	63.9	103.8	183.5
Bus	4.9	5.5	7.4	10.1	14.4	21.7
LCV	3.2	3.9	4.9	6.3	8.2	11.3
2A	9.5	10.5	13.2	16.8	22.1	30.4
3A	10.1	11.1	14.3	18.7	25.2	35.7
MAV	24.1	27.4	39.7	60.2	95.5	161.6
OSV	0.0	0.0	0.0	0.0	0.1	0.1

Vehicle Type	FY22	FY23	FY27	FY32	FY38	FY45
Total Revenue	**73.9**	**85.2**	**119.5**	**176.0**	**269.3**	**444.2**

Source: Steer analysis

Table 6.21: Revenue growth (With Downside Impacts) CAGR (%) for TP1: Pampampallam

Vehicle Type	FY22-FY23	FY23-FY27	FY27-FY32	FY32-FY38	FY23-FY38
CJV	21.1%	10.6%	9.8%	8.4%	9.5%
Bus	12.2%	7.6%	6.6%	6.1%	6.6%
LCV	21.2%	6.0%	5.1%	4.7%	5.2%
2A	10.0%	5.9%	4.9%	4.7%	5.1%
3A	10.5%	6.5%	5.6%	5.1%	5.6%
MAV	13.9%	9.7%	8.7%	8.0%	8.7%
OSV	14.7%	9.6%	8.6%	8.1%	8.7%
Total Revenue	**15.3%**	**8.8%**	**8.1%**	**7.3%**	**8.0%**

Source: Steer analysis

Target traffic and extension in concession period

6.30 As per the Concession Agreement (Article 29), the Authority and the Concessionaire refer to a precise traffic volume, 'Target Traffic' in PCUs per day, on a specific month and year, 'Target Date', to determine variations on the concession period.

6.31 The concession period is renegotiated in the event that the Actual Traffic falls short of the Target Traffic by more than 2.5% thereof or exceeds the Target Traffic by more than 2.5% thereof.

6.32 As per the concession agreement, for every 1% shortfall as compared to target traffic, the concession period shall be increased by 1.5% with a capping of maximum 20% of the concession period.

6.33 The Target Date for the Asset was January 1, 2021, and the Target traffic was 35,772 PCUs. The actual traffic in the month was around ~25,000 PCUs.

Summary outlook

6.34 Overall, passenger traffic on the Asset is primarily driven by tourism and leisure travel from nearby states such as Tamil Nadu and Karnataka. Given the health safety concerns plus restrictions on tourism and hospitality industry, the Asset has seen slow recovery of passenger vehicles.

6.35 Kerala is largely a consumption driven economy, which is the primary reason for revival of traffic to pre-pandemic levels from Q3FY21. The State has significant cement demand carried in commercial vehicles due to large scale construction activities undertaken in the State. Given the presence of Cochin international port, POL items move between Coimbatore (Tamil Nadu) and Kochi (Kerala) which are also observed during site visit and OD analysis.

6.36 Goods traffic is driven by agro-based commodities such as rubber as well as movement of cement both within the state of Kerala and imports from other states into Kerala.

6.37 Post implementation of GST in FY18, the commercial traffic on this Asset has grown significantly, due to quicker inter-state movement. The traffic is further expected to benefit from the improvement in the neighbouring section of Vadakcherry-Thrissur and the Kuthiran tunnel.

6.38 Our findings and estimates in this report are based on our understanding from the site visit, analysis of primary data available both from surveys and the toll management system (both historical and current), macroeconomic assumptions prescribed by Client, feedback from Client meetings and secondary publicly available data. There can be risks associated with assumptions and the forecasts using them as summarised below.

Appendices

A Top 10 OD Pairs

A.1 Further to the OD analysis presented in Chapter 3 this appendix presents the top 10 OD pairs at each toll plaza. Please see this data for both CJVs and MAVs and OSVs combined below.

Table A.1: CJV, Bus and Mini Bus top 10 OD pair shares at TP1 Pampampallam

	OD Pair	Share
1.	Palakkad_Coimbatore	39%
2.	Palakkad_walayar	10%
3.	Thrissur_Coimbatore	9%
4.	Ernakulam_Coimbatore	6%
5.	Malappuram_Coimbatore	3%
6.	Kanjikode_Coimbatore	2%
7.	Kozhikode_Coimbatore	2%
8.	Palakkad_Tamil Nadu	2%
9.	Bengaluru_Ernakulam	1%
10.	Palakkad_Tamil Nadu	1%

Source: Steer analysis

Table A.2: MAV and OSV top 10 OD pair shares at TP1 Pampampallam

	OD Pair	Share
1.	Ernakulam_Coimbatore	15%
2.	Palakkad_Coimbatore	9%
3.	Bengaluru_Ernakulam	4%
4.	Salem_Ernakulam	4%
5.	Thrissur_Coimbatore	4%
6.	Chennai_Ernakulam	3%
7.	Palakkad_walayar	3%
8.	Ernakulam_Andhra Pradesh	2%
9.	Ernakulam_Tamil Nadu	2%
10.	Ernakulam_Tamil Nadu	2%

Source: Steer analysis

B Detailed forecasts

B.1 Further to the summary of forecasts presented in Chapter 6, this appendix presents detailed forecasts.

Traffic forecasts

B.2 This section presents the detailed traffic forecasts for the forecast period until FY38, year of expected close of the concession. The following two tables show the traffic growth rates and AADT, respectively.

Table B.1: Forecasts for (background + impacts) AADT at TP1 Pampampallam

Vehicle Category	CJV	LCV	Bus	2A	3A	MAV	Total	PCU
FY23	12,675	1,549	545	1,339	895	2,226	**19,229**	**30,761**
FY24	13,638	1,602	553	1,357	913	2,363	**20,427**	**32,393**
FY25	14,637	1,657	561	1,376	932	2,509	**21,672**	**34,097**
FY26	15,708	1,713	569	1,395	951	2,664	**23,001**	**35,909**
FY27	16,819	1,770	577	1,413	970	2,823	**24,373**	**37,773**
FY28	17,993	1,829	585	1,432	989	2,990	**25,819**	**39,730**
FY29	19,235	1,888	593	1,450	1,009	3,166	**27,343**	**41,786**
FY30	20,542	1,949	601	1,469	1,028	3,349	**28,940**	**43,935**
FY31	21,921	2,011	609	1,488	1,048	3,542	**30,621**	**46,191**
FY32	23,375	2,075	617	1,507	1,068	3,745	**32,388**	**48,556**
FY33	24,906	2,141	625	1,526	1,088	3,957	**34,244**	**51,036**
FY34	26,517	2,208	633	1,545	1,108	4,179	**36,193**	**53,633**
FY35	28,211	2,276	641	1,564	1,129	4,413	**38,236**	**56,351**
FY36	29,990	2,346	649	1,583	1,150	4,657	**40,378**	**59,195**
FY37	31,856	2,418	658	1,603	1,171	4,913	**42,620**	**62,167**
FY38	33,813	2,491	666	1,622	1,192	5,180	**44,966**	**65,273**

Source: Steer analysis

Table B.2: Forecasts for (background +impacts) AADT growth rates (%) at TP1 Pampampallam

Vehicle type	CJV	LCV	Buses	2A	3A	MAV	Total	PCU
FY23	13.1%	3.3%	11.6%	1.3%	2.0%	6.0%	9.9%	7.8%
FY24	7.6%	3.4%	1.5%	1.4%	2.0%	6.1%	6.2%	5.3%

Vehicle type	CJV	LCV	Buses	2A	3A	MAV	Total	PCU
FY25	7.3%	3.4%	1.5%	1.4%	2.1%	6.2%	6.1%	5.3%
FY26	7.3%	3.4%	1.5%	1.4%	2.1%	6.2%	6.1%	5.3%
FY27	7.1%	3.3%	1.4%	1.3%	2.0%	6.0%	6.0%	5.2%
FY28	7.0%	3.3%	1.4%	1.3%	2.0%	5.9%	5.9%	5.2%
FY29	6.9%	3.3%	1.4%	1.3%	2.0%	5.9%	5.9%	5.2%
FY30	6.8%	3.2%	1.4%	1.3%	1.9%	5.8%	5.8%	5.1%
FY31	6.7%	3.2%	1.3%	1.3%	1.9%	5.8%	5.8%	5.1%
FY32	6.6%	3.2%	1.3%	1.3%	1.9%	5.7%	5.8%	5.1%
FY33	6.6%	3.1%	1.3%	1.3%	1.9%	5.7%	5.7%	5.1%
FY34	6.5%	3.1%	1.3%	1.3%	1.9%	5.6%	5.7%	5.1%
FY35	6.4%	3.1%	1.3%	1.2%	1.9%	5.6%	5.6%	5.1%
FY36	6.3%	3.1%	1.3%	1.2%	1.8%	5.5%	5.6%	5.0%
FY37	6.2%	3.1%	1.2%	1.2%	1.8%	5.5%	5.6%	5.0%
FY38	6.1%	3.0%	1.2%	1.2%	1.8%	5.4%	5.5%	5.0%

Source: Steer analysis

Revenue forecasts

B.3 The following table presents the year-wise annual revenue forecasts for the forecast period until FY38.

Table B.3: Forecasts for (background +impacts) revenue INR Lakhs at TP1 Pampampallam

Vehicle Category	CJV	LCV	Buses	2A	3A	MAV	OSV	Total
FY23	2,823	564	392	1,058	1,130	2,811	2	**8,779**
FY24	3,110	614	421	1,138	1,216	3,146	2	**9,648**
FY25	3,514	664	449	1,214	1,312	3,532	2	**10,687**
FY26	4,044	730	482	1,301	1,405	3,934	2	**11,898**
FY27	4,542	786	512	1,384	1,510	4,395	2	**13,133**
FY28	5,102	858	549	1,478	1,624	4,908	3	**14,521**
FY29	5,772	931	579	1,560	1,732	5,436	3	**16,013**
FY30	6,425	997	615	1,654	1,851	6,031	3	**17,576**
FY31	7,134	1,079	652	1,750	1,971	6,662	4	**19,252**
FY32	8,034	1,181	694	1,868	2,103	7,376	4	**21,261**
FY33	8,853	1,254	731	1,963	2,240	8,148	4	**23,193**
FY34	9,886	1,361	773	2,081	2,379	8,971	5	**25,455**
FY35	11,006	1,473	818	2,192	2,534	9,905	5	**27,933**
FY36	12,254	1,582	869	2,327	2,701	10,941	6	**30,679**

Vehicle Category	CJV	LCV	Buses	2A	3A	MAV	OSV	Total
FY37	13,385	1,700	918	2,468	2,875	12,064	7	**33,417**
FY38	15,063	1,842	973	2,609	3,062	13,305	7	**36,862**

Source: Steer analysis

C Data collection exercise

C.1 To validate and inform various inputs used in our forecasting, we undertook primary data collection on the Asset. OD survey data was collected on behalf of the Client, TVC surveys were commissioned by Steer with a third party. OD data collection typically involves manual data entry by enumerators based on oral surveys with road users crossing toll plazas. TVC data collection involves video-graphic capture of traffic passing crossing the toll plazas, followed by manual counting.

7 days TVC count

Table C.1: 7-day TVC counts at TP1 Pampampallam

Date	Source	CJV	Mini LCV	LCV	Bus	2 Axle	3 Axle	MAV	OSV	Total
27-01-2021	TVC	10,289	1,514	2,559	532	1,148	999	2,323	1	19,365
28-01-2021	TVC	9,697	1,533	2,611	519	1,334	1,114	2,752	-	19,560
29-01-2021	TVC	9,215	1,543	2,695	506	1,377	1,186	2,705	2	19,229
30-01-2021	TVC	11,125	1,544	2,481	532	1,268	1,083	2,499	-	20,532
31-01-2021	TVC	12,535	956	1,841	483	1,000	879	2,294	-	19,988
01-02-2021	TVC	10,394	1,351	2,465	553	1,182	880	1,923	-	18,748
02-02-2021	TVC	9,263	1,451	2,399	549	1,321	1,041	2,701	8	18,733

Source: Steer analysis

Table C.2: 7-WADT TVC vs TMS

	Source	CJV +Mini LCV	LCV	Bus	2A	3A+ MAV	OSV	Total
TP1	TVC	11,773	2,436	525	1,233	3,483	2	19,451
	TMS	11,766	1,871	459	1,282	3,500	-	18,878

Source: Steer analysis

Zone list

Table C.3: Zone list used for OD analysis

Zone No	Zone Name	State
101	Alathur	Kerala
102	Erimayur	Kerala
103	Kunissery	Kerala
104	Vadakacherry	Kerala
105	Puthucode	Kerala

Zone No	Zone Name	State
106	Chittlamcherry	Kerala
107	kavaserri	Kerala
108	Tarur	Kerala
109	Kuzhalmannam	Kerala
110	Vilayannur	Kerala
111	Kottai	Kerala
112	Nenmara	Kerala
113	Parali	Kerala
114	Pirayiri	Kerala
115	Palakkad	Kerala
116	Thenkurissi	Kerala
117	kannadi	Kerala
118	mathur	Kerala
119	mampad	Kerala
120	Kannambara	Kerala
121	Kuthiran	Kerala
122	Pallatheri	Kerala
123	Kanjikode	Kerala
124	Kava	Kerala
125	Elapully	Kerala
126	pampampallam	Kerala
127	attapalam	Kerala
128	pampubara	Kerala
129	kozhiparra	Kerala
130	elippara	Kerala
131	walayar	Kerala
132	pichanur	Tamil Nadu
133	solakarai	Tamil Nadu
134	ettimadal	Tamil Nadu
135	boluvampatti	Tamil Nadu
136	mundur	Kerala
137	chittur	Kerala
138	kollengode	Kerala
139	pazhayannur	Kerala
140	chelakkara	Kerala
141	pattikad	Kerala
142	pallasana	Kerala
143	Krishnagiri	Tamil Nadu

Zone No	Zone Name	State
144	Mysuru	Karnataka
145	Bengaluru	Karnataka
146	Erode	Tamil Nadu
147	Salem	Tamil Nadu
148	Chennai	Tamil Nadu
149	South Karnataka	Karnataka
150	North Karnataka	Karnataka
151	Alappuzha	Kerala
152	Ernakulam	Kerala
153	Idukki	Kerala
154	Kannur	Kerala
155	Kasaragod	Kerala
156	Kollam	Kerala
157	Kottayam	Kerala
158	Kozhikode	Kerala
159	Malappuram	Kerala
160	Pathanamthitta	Kerala
161	Thiruvananthapuram	Kerala
162	Thrissur	Kerala
163	Wayanad	Kerala
164	Meghalaya	Meghalaya
165	Manipur	Manipur
166	West Bengal	Manipur
167	Tripura	West Bengal
168	Madhya Pradesh	Tripura
169	Mizoram	Madhya Pradesh
170	Uttar Pradesh	Mizoram
171	Haryana	Uttar Pradesh
172	Odisha	Haryana
173	Bihar	Odisha
174	Telangana	Bihar
175	Maharashtra	Telangana
176	Punjab	Maharashtra
177	Sikkim	Punjab
178	Uttarakhand	Sikkim
179	Kerala	Uttarakhand
180	Andhra Pradesh	Kerala
181	Nagaland	Andhra Pradesh

Zone No	Zone Name	State
182	Jharkhand	Nagaland
183	Rajasthan	Jharkhand
184	Gujarat	Rajasthan
185	Delhi	Gujarat
186	Chhattisgarh	Delhi
187	Himachal Pradesh	Chhattisgarh
188	Goa	Himachal Pradesh
189	Assam	Goa
190	Jammu and Kashmir	Assam
191	Arunachal Pradesh	Jammu and Kashmir
192	Ladakh	Arunachal Pradesh
193	Puducherry	Ladakh
194	Daman and Diu	Puducherry
195	Mangaluru	Karnataka
196	Coimbatore	Tamil Nadu
197	Lakshadweep	Lakshadweep
198	Mumbai	Maharashtara
199	Thanjavur	Tamil Nadu
200	Dindigul	Tamil Nadu
201	Tiruchirapalli	Tamil Nadu
202	Dadra and Nagar Haveli	Dadara & Nagar Havelli
203	Nagercoil	Tamil Nadu
204	Andaman and Nicobar Islands	Andaman and Nicobar Islands
205	South Tamil nadu	Tamil Nadu
206	North tamil nadu	Tamil Nadu

Source: OD data

Direction-wise commodity distribution

Table C.4: Commodity distribution towards Coimbatore at TP1 Pampampallam

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	9%	10%	8%	4%
Construction	1%	1%	6%	5%
Groceries	2%	3%	5%	4%
Minerals	2%	2%	-	3%
Manufacturing	9%	10%	15%	19%
Petroleum	1%	4%	3%	13%
Miscellaneous	7%	8%	2%	4%
Container	0%	0%	-	-

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Empty	68%	60%	57%	44%
Cement	2%	0%	3%	4%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Table C.5: Commodity distribution towards Palakkad at TP1 Pampampallam

Commodities	Mini LCV + LCV	2A	3A	MAV + OSV
Agriculture	28%	35%	14%	10%
Construction	8%	3%	22%	17%
Groceries	16%	17%	17%	8%
Minerals	4%	5%	5%	5%
Manufacturing	14%	14%	15%	16%
Petroleum	1%	2%	4%	4%
Miscellaneous	11%	12%	6%	5%
Container	0%	1%	-	-
Empty	13%	6%	11%	8%
Cement	4%	5%	6%	26%
Total	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Trip length distribution

Table C.6: Trip length frequency for TP1 Pampampallam

Distance range	CJV	Minibus+ Bus	Mini LCV+LCV	2A	3A	MAV
0-65 km	57%	90%	38%	19%	22%	14%
65-300 km	32%	7%	36%	40%	38%	37%
300-500 km	6%	-	12%	15%	15%	16%
500-1000 km	4%	3%	10%	16%	16%	18%
>1000 km	1%	1%	4%	10%	10%	14%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Steer analysis

Control Information

Prepared by

Steer
Suite No. S3, Vatika Business Centre,
Vatika Triangle, MG Road,
Gurgaon, Haryana, 122002, India
+91 124 441 8650
www.steergroup.com

Prepared for

Cube Highways Fund Advisors Private Limited
1901, Tower B, 19th Floor, World Trade Tower, Plot No. C - 1,
Sector 16, Noida- 201301 (UP, India)

Steer project/proposal number

23741304

Client contract/project number

Transit

Author/originator

Anshika Saxena

Reviewer/approver

Samhita Indurkar

Other contributors

Vaibhav Gupta

Distribution

Client:

Steer:

Version control/issue number

V1.0

Date

April 2022

steer

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com